



Appendix to the Report of the 3rd Groundfish Assessment Review Meeting (GARM III)

*Assessment of 19 Northeast Groundfish Stocks through 2007
Northeast Fisheries Science Center, Woods Hole, Massachusetts,
August 4-8, 2008*

by the Northeast Fisheries Science Center

NOAA's National Marine Fisheries Serv., 166 Water St., Woods Hole MA 02543-1026

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Appendix A. Georges Bank Atlantic cod

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Appendix A. Table A1a. USA Western GB commercial landings at age (thousands of fish; metric tons) and mean weight (kg) and mean length (cm) at age of Atlantic cod, 1978-2007.

Year	Age																Total
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	
USA Western Georges Bank Commercial Landings in Numbers (000's) at Age																	
1978	0	2420	44757	12479	4832	119	1085	0	167	0	0	0	0	0	0	0	65858
1979	446	11762	3927	29906	6053	2600	795	2389	0	199	76	0	0	0	0	0	58153
1980	991	27575	40830	2202	15313	6194	3112	463	1016	0	0	0	0	0	0	0	97696
1981	280	22100	26729	12750	725	6858	2012	349	1004	208	69	0	0	0	0	0	73083
1982	4189	60994	22453	13481	8064	861	2730	425	301	168	175	41	6	11	0	0	113899
1983	811	30197	44466	9118	5905	4651	548	964	220	115	71	82	65	13	0	0	97227
1984	610	11025	25222	18232	2683	1921	1814	177	865	127	92	126	56	7	0	0	62957
1985	1218	33734	11473	7479	8751	1904	1216	899	71	371	62	24	20	8	0	0	67231
1986	1300	9266	22568	2697	1852	1713	256	243	274	25	75	26	15	5	0	0	40315
1987	187	37643	5653	9809	1365	1111	940	182	122	112	4	11	4	0	0	0	57144
1988	0	16050	39917	3542	6069	803	422	367	82	86	51	0	0	0	0	0	67388
1989	0	14326	21689	22508	1635	1812	282	147	58	0	0	0	0	0	0	0	62457
1990	0	43914	23420	9495	8676	697	627	105	60	29	0	13	0	0	0	0	87035
1991	376	9564	24991	12324	5115	2981	273	222	71	13	6	7	0	0	0	0	55943
1992	0	16627	8835	5993	6030	1481	793	120	88	5	7	0	8	0	0	0	39986
1993	0	5878	24097	3255	1822	1725	482	482	99	4	0	0	0	0	0	0	37844
1994	0	2022	9831	11956	1598	522	855	238	107	0	29	0	0	0	0	0	27158
1995	0	3231	9293	5353	2604	212	166	174	38	6	6	0	0	0	0	0	21083
1996	0	1986	6884	8310	1675	1148	53	81	88	0	0	0	0	0	0	0	20225
1997	0	3849	5120	6328	4922	601	511	79	55	17	5	0	0	0	0	0	21488
1998	81	6770	9287	3094	2122	1449	186	41	8	0	0	0	0	0	0	0	23037
1999	0	2369	15126	4815	1600	581	842	85	9	0	0	0	0	0	0	0	25427
2000	88	7013	5831	7303	1530	449	221	251	16	0	0	0	0	0	0	0	22702
2001	5	4961	20580	5200	2809	702	214	74	73	4	1	0	0	0	0	0	34623
2002	0	290	9032	9958	2432	2059	517	90	51	26	8	1	0	0	0	0	24464
2003	0	723	2186	5058	4635	671	480	82	24	12	1	0	0	0	0	0	13872
2004	0	284	2383	834	1469	1003	178	156	42	13	5	4	2	0	0	0	6374
2005	0	223	943	3425	866	714	442	66	36	11	9	1	0	0	0	0	6735
2006	0	117	4343	1232	1679	216	121	112	13	11	3	1	0	1	0	0	7850
2007	0	1289	1652	7207	410	484	50	33	22	2	4	0	0	0	0	0	11152

Appendix A. Table A1a.continued. USA Western GB commercial landings at age (thousands of fish; metric tons) and mean weight (kg) and mean length (cm) at age of Atlantic cod, 1978-2007.

Age																	
Year	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	Total
<u>USA Western Georges Bank Commercial Landings in Weight (Tons) at Age</u>																	
1978	0	313	11740	4838	1968	71	817	0	210	0	0	0	0	0	0		19954
1979	38	1686	926	13959	3141	1928	781	2508	0	287	83	0	0	0	0		25348
1980	82	4174	10210	895	8980	4309	2676	431	897	0	0	0	0	0	0		32610
1981	31	3448	6843	4830	434	5130	1795	374	1513	403	155	0	0	0	0		24937
1982	277	8798	6338	5152	4514	563	2811	451	421	245	253	62	15	25	0		29878
1983	87	4420	10967	3343	3023	3102	504	1068	256	165	128	139	139	27	0		27362
1984	61	1762	6358	7000	1486	1410	1655	199	953	149	139	200	100	15	0		21486
1985	114	4802	2593	3154	4745	1274	1002	967	99	485	105	38	41	20	0		19454
1986	123	1387	5382	1072	1172	1339	253	262	374	34	108	42	35	12	0		11579
1987	16	5334	1465	4070	806	913	806	192	152	171	9	24	9	0	0		13961
1988	0	2432	9522	1358	3353	615	394	381	110	127	100	0	0	0	0		18388
1989	0	2403	4958	8808	889	1323	273	136	75	0	0	0	0	0	0		18873
1990	0	6731	5755	3545	4416	448	551	130	72	39	0	20	0	0	0		21696
1991	44	1471	6203	4777	2849	1960	215	209	95	24	13	17	0	0	0		17867
1992	0	2489	2122	2465	2861	1001	626	120	102	8	14	0	18	0	0		11819
1993	0	909	5347	1242	1068	1055	392	454	92	12	0	0	0	0	0		10563
1994	0	273	2070	4155	811	387	598	221	110	0	55	0	0	0	0		8668
1995	0	487	1862	2035	1395	190	152	217	49	9	15	0	0	0	0		6406
1996	0	303	1687	2690	810	773	63	84	99	0	0	0	0	0	0		6508
1997	0	609	1212	2269	1939	355	392	64	62	20	7	0	0	0	0		6926
1998	4	998	2105	1117	1052	829	154	32	13	0	0	0	0	0	0		6300
1999	0	369	3260	1624	780	360	593	86	13	0	0	0	0	0	0		7083
2000	10	1198	1450	2663	778	281	183	218	14	0	0	0	0	0	0		6788
2001	0	766	4769	1577	1368	414	153	67	72	5	3	0	0	0	0		9191
2002	0	55	1980	3028	969	1112	343	72	55	33	10	1	0	0	0		7652
2003	0	149	535	1553	1945	357	311	62	23	14	2	0	0	0	0		4951
2004	0	58	677	310	631	520	112	124	38	15	8	5	3	0	0		2500
2005	0	40	243	1182	366	365	265	56	36	12	13	1	0	0	0		2580
2006	0	24	1097	448	691	113	76	82	12	12	3	1	1	1	0		2559
2007	0	262	418	2330	166	219	26	23	15	2	3	0	0	0	0		3462

Appendix A. Table A1a.continued. USA Western GB commercial landings at age (thousands of fish; metric tons) and mean weight (kg) and mean length (cm) at age of Atlantic cod, 1978-2007.

Age																	
Year	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	Average
USA Western Georges Bank Commercial Landings Mean Weight (kg) at Age																	
1978	0	1.296	2.623	3.877	4.071	5.998	7.533	0	12.614	0	0	0	0	0	0	0	3.03
1979	0.861	1.434	2.357	4.668	5.19	7.416	9.823	10.498	0	14.414	10.939	0	0	0	0	0	4.359
1980	0.824	1.514	2.501	4.068	5.864	6.956	8.601	9.295	8.827	0	0	0	0	0	0	0	3.338
1981	1.091	1.56	2.56	3.788	5.988	7.481	8.925	10.718	15.072	19.393	22.4	0	0	0	0	0	3.412
1982	0.661	1.442	2.823	3.821	5.598	6.535	10.299	10.607	14.013	14.641	14.449	15.268	24.028	22.4	0	0	2.623
1983	1.069	1.464	2.466	3.666	5.119	6.669	9.207	11.076	11.668	14.33	17.884	17.004	21.173	20.494	0	0	2.814
1984	1.003	1.598	2.521	3.839	5.54	7.339	9.122	11.287	11.019	11.737	15.143	15.831	17.803	22.4	0	0	3.413
1985	0.935	1.423	2.26	4.216	5.423	6.689	8.244	10.755	13.879	13.065	17.14	15.654	20.181	23.879	0	0	2.894
1986	0.946	1.497	2.385	3.974	6.325	7.816	9.893	10.785	13.615	13.844	14.34	15.939	24.183	23.344	0	0	2.872
1987	0.857	1.417	2.591	4.15	5.91	8.217	8.58	10.528	12.424	15.203	22.4	21.887	20.847	0	0	0	2.443
1988	0	1.515	2.385	3.835	5.524	7.661	9.332	10.398	13.492	14.734	19.77	0	0	0	0	0	2.729
1989	0	1.677	2.286	3.913	5.438	7.3	9.669	9.271	12.956	0	0	0	0	0	0	0	3.022
1990	0	1.533	2.457	3.733	5.09	6.431	8.785	12.371	12.173	13.391	0	15.36	0	0	0	0	2.493
1991	1.158	1.538	2.482	3.876	5.569	6.573	7.868	9.418	13.346	18.597	22.4	24.028	0	0	0	0	3.194
1992	0	1.497	2.402	4.113	4.745	6.758	7.9	9.999	11.612	15.398	19.272	0	22.191	0	0	0	2.956
1993	0	1.546	2.219	3.816	5.861	6.117	8.127	9.417	9.302	31.885	0	0	0	0	0	0	2.791
1994	0	1.351	2.105	3.475	5.071	7.425	7.001	9.28	10.207	0	18.723	0	0	0	0	0	3.192
1995	0	1.507	2.004	3.802	5.358	8.96	9.132	12.483	12.777	14.233	24.154	0	0	0	0	0	3.039
1996	0	1.524	2.45	3.237	4.836	6.735	11.876	10.313	11.241	0	0	0	0	0	0	0	3.218
1997	0	1.583	2.366	3.586	3.939	5.901	7.667	8.026	11.301	11.277	15.43	0	0	0	0	0	3.223
1998	0.536	1.475	2.266	3.611	4.96	5.721	8.285	7.8	15.398	0	0	0	0	0	0	0	2.735
1999	0	1.558	2.155	3.373	4.874	6.188	7.04	10.056	14.816	0	0	0	0	0	0	0	2.786
2000	1.177	1.708	2.486	3.646	5.088	6.265	8.27	8.684	8.457	0	0	0	0	0	0	0	2.99
2001	0.727	1.544	2.317	3.032	4.869	5.891	7.187	9.126	9.854	12.176	17.917	0	0	0	0	0	2.655
2002	0	1.883	2.192	3.04	3.982	5.403	6.632	7.948	10.68	12.768	12.144	13.129	0	0	0	0	3.128
2003	0	2.057	2.449	3.07	4.197	5.325	6.485	7.527	9.576	11.72	15.108	0	0	0	0	0	3.569
2004	0	2.034	2.842	3.713	4.292	5.187	6.298	7.952	9.23	11.451	14.713	11.8	16.086	0	0	0	3.922
2005	0	1.811	2.58	3.453	4.224	5.107	5.993	8.586	9.902	11.798	13.905	19.274	0	0	0	0	3.832
2006	0	2.08	2.527	3.638	4.119	5.21	6.319	7.303	8.931	10.118	8.935	10.505	16.568	18.822	0	0	3.259
2007	0	2.035	2.532	3.233	4.046	4.521	5.312	7.001	6.802	11.497	7.057	0	0	0	0	0	3.104

Appendix A. Table A1a.continued. USA Western GB commercial landings at age (thousands of fish; metric tons) and mean weight (kg) and mean length (cm) at age of Atlantic cod, 1978-2007.

Age																	
Year	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	Average
USA Western Georges Bank Commercial Landings Mean Length (cm) at Age																	
1978	0.0	50.2	62.7	71.0	71.2	79.8	89.4	0.0	106.5	0.0	0.0	0.0	0.0	0.0	0.0		65.0
1979	44.2	52.0	60.4	75.7	78.6	88.7	98.2	100.3	0.0	110.9	102.0	0.0	0.0	0.0	0.0		72.0
1980	43.3	52.8	61.7	72.9	82.2	87.3	93.2	94.0	94.2	0.0	0.0	0.0	0.0	0.0	0.0		65.6
1981	47.6	53.1	62.4	70.9	83.1	89.3	95.1	100.6	113.2	123.0	129.0	0.0	0.0	0.0	0.0		65.8
1982	39.7	52.0	64.2	70.5	80.6	84.6	99.3	100.0	110.0	111.7	110.5	111.7	132.0	129.0	0.0		60.1
1983	47.5	52.4	61.5	69.5	78.3	85.6	95.7	101.6	102.8	110.8	119.2	117.4	126.1	124.5	0.0		62.4
1984	46.5	53.6	62.0	71.3	80.3	88.9	95.2	102.4	101.6	103.4	112.0	114.7	118.4	129.0	0.0		66.6
1985	45.5	51.8	59.5	73.8	80.1	85.9	92.0	100.8	109.6	107.3	117.9	114.2	124.5	131.6	0.0		62.0
1986	45.6	52.5	61.0	72.1	84.6	90.8	98.3	101.1	108.8	109.8	110.8	115.2	132.0	130.2	0.0		62.6
1987	44.2	51.8	62.6	73.3	82.6	92.5	93.2	99.9	105.8	113.2	129.0	127.8	126.0	0.0	0.0		59.1
1988	0.0	53.1	61.0	70.9	80.2	90.1	95.8	99.5	108.4	112.0	123.8	0.0	0.0	0.0	0.0		62.3
1989	0.0	54.8	60.3	71.7	80.0	88.2	97.5	96.3	107.5	0.0	0.0	0.0	0.0	0.0	0.0		64.8
1990	0.0	53.3	61.5	70.3	78.0	84.2	93.6	105.7	105.1	108.7	0.0	114.0	0.0	0.0	0.0		60.5
1991	48.8	53.2	61.8	71.1	80.5	84.9	89.7	93.2	108.6	121.4	129.0	132.0	0.0	0.0	0.0		65.6
1992	0.0	52.7	61.4	73.4	76.9	85.6	92.2	98.2	104.9	117.0	120.0	0.0	132.0	0.0	0.0		63.7
1993	0.0	53.1	59.9	71.7	82.7	83.5	93.5	98.0	97.8	141.0	0.0	0.0	0.0	0.0	0.0		63.1
1994	0.0	51.3	58.8	69.4	79.4	89.9	89.1	98.1	101.1	0.0	122.8	0.0	0.0	0.0	0.0		66.2
1995	0.0	52.8	57.9	71.1	81.3	95.1	97.1	106.9	108.6	114.0	129.0	0.0	0.0	0.0	0.0		64.6
1996	0.0	53.2	61.7	67.7	77.2	88.0	102.6	101.5	103.3	0.0	0.0	0.0	0.0	0.0	0.0		66.6
1997	0.0	53.6	61.2	70.0	72.1	84.2	92.0	93.1	104.8	105.3	117.0	0.0	0.0	0.0	0.0		66.6
1998	38.1	52.4	60.4	71.1	79.4	83.5	94.8	93.1	117.0	0.0	0.0	0.0	0.0	0.0	0.0		63.0
1999	0.0	53.5	59.6	69.4	79.1	85.4	89.6	100.5	115.5	0.0	0.0	0.0	0.0	0.0	0.0		63.9
2000	48.9	54.9	62.4	71.1	79.3	85.6	94.1	96.4	96.0	0.0	0.0	0.0	0.0	0.0	0.0		65.1
2001	42.0	53.2	60.8	66.5	78.3	83.7	90.0	96.7	100.2	107.5	123.0	0.0	0.0	0.0	0.0		62.8
2002	0.0	56.9	59.6	66.8	72.8	80.8	86.8	91.7	101.8	109.2	107.0	111.0	0.0	0.0	0.0		66.4
2003	0.0	58.3	61.8	66.8	74.4	80.4	86.6	90.8	97.9	106.0	111.0	0.0	0.0	0.0	0.0		69.7
2004	0.0	58.2	64.7	71.1	75.2	80.3	85.8	93.1	97.5	105.5	114.5	106.1	118.3	0.0	0.0		71.8
2005	0.0	56.1	63.1	69.7	75.3	80.1	84.3	95.8	99.9	104.9	112.9	126.0	0.0	0.0	0.0		71.6
2006	0.0	58.7	62.3	70.9	74.2	80.2	85.8	90.2	94.2	100.6	96.8	99.3	119.0	125.0	0.0		67.5
2007	0.0	58.2	62.8	68.1	73.1	75.8	80.0	87.6	86.6	104.8	85.3	0.0	0.0	0.0	0.0		66.8

Appendix A. Table A1b. USA Eastern GB commercial landings at age (thousands of fish; metric tons) and mean weight (kg) and mean length (cm) at age of Atlantic cod, 1978-2007.

Year	Age																Total
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	
<u>USA Eastern Georges Bank Commercial Landings in Numbers (000's) at Age</u>																	
1978	0.34	367	12834	4446	1752	862	685	102	121	24	7	2	0	0.47	2		21204
1979	21	3231	2011	7127	2723	1238	581	480	87	18	9	5	0	4	0		17536
1980	0	2596	5626	1002	4639	2179	656	117	201	34	7	0	0	0	0		17056
1981	96	5731	9602	6916	942	1937	869	533	308	114	20	10	0	0	0		27077
1982	0	13029	5110	3644	3953	415	1642	503	191	63	48	31	25	5	0		28659
1983	50	3650	10674	4323	2709	1786	279	549	325	136	161	100	14	35	6		24797
1984	75	2041	6661	9655	2877	2188	1830	205	542	231	100	41	21	9	0	4	26481
1985	10	6670	4425	2544	4294	1143	638	596	80	176	24	29	8	5	0		20640
1986	23	2021	9006	1918	1852	2147	301	256	165	15	61	12	0	0	0		17777
1987	0	10379	2367	3787	641	496	577	154	81	41	6	4	0	0	0		18533
1988	0	574	14450	3337	4418	672	447	525	91	60	29	5	1	0	1		24609
1989	0	2151	4624	10375	906	1709	209	133	169	24	8	1	0	0	0		20310
1990	0	2573	9722	3301	5338	564	591	51	28	37	0	3	0	0	0		22208
1991	53	2080	3437	6090	3186	2638	377	199	54	20	3	8	0	0	3		18148
1992	13	6451	4502	1618	3361	1084	977	66	65	5	9	0	0	0	0		18150
1993	3	1812	7087	2825	1055	1107	349	232	58	20	4	0	0	0	0		14553
1994	0	224	1184	1411	396	61	100	46	32	3	3	0	1	0	0		3461
1995	0	140	663	288	461	60	20	14	15	1	1	0	0	0	0		1664
1996	0	99	567	1056	219	211	24	10	12	2	0	0	0	0	0		2201
1997	0	100	220	348	687	141	82	26	5	3	3	0	0	0	0		1615
1998	0	100	424	364	441	433	55	34	10	2	0	0	0	0	0		1864
1999	0	175	1428	1222	497	275	278	60	11	2	0	0	0	0	0		3948
2000	0	165	410	1307	516	129	78	40	6	0	0	0	0	0	0	0	2652
2001	0	80	2270	915	1730	398	123	76	34	4	1	1	0	0	0		5633
2002	0	29	793	2740	615	735	146	37	32	11	3	2	0	0	0		5143
2003	0	14	574	1379	2368	485	456	90	18	5	1	0	0	0	0		5390
2004	0	18	339	700	815	579	166	101	23	3	2	0	0	0	0		2746
2005	0	0	13	152	130	52	104	14	8	3	0	0	0	0	0		475
2006	0	0	58	59	170	78	24	15	4	0	0	1	0	0	0		409
2007	0	3	29	509	28	133	5	6	3	1	0	0	0	0	0		718

Appendix A. Table A1b continued. USA Eastern GB commercial landings at age (thousands of fish; metric tons) and mean weight (kg) and mean length (cm) at age of Atlantic cod, 1978-2007.

Age																	
Year	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	Total
USA Eastern Georges Bank Commercial Landings in Weight (Tons) at Age																	
1978	0	48	2484	1250	718	452	360	72	82	22	11	3	0	1	3		5502
1979	2	454	301	2342	1282	877	554	450	86	26	11	9	0	7	0		6408
1980	0	324	1168	311	2399	1375	490	122	188	43	10	0	0	0	0		6418
1981	10	731	1833	2032	392	1243	699	497	398	165	38	20	0	0	0		8092
1982	0	1591	1095	1251	1948	283	1396	488	231	91	73	61	47	11	0		8565
1983	5	586	2502	1344	1194	1086	202	563	375	182	260	163	31	70	17		8572
1984	9	332	1509	3159	1324	1338	1537	186	618	282	128	68	39	20	0	7	10550
1985	1	888	783	782	1968	678	516	591	89	223	38	44	16	8	0		6641
1986	2	231	1859	516	841	1425	249	242	213	23	72	21	0	0	0		5696
1987	0	1415	520	1405	324	358	484	141	85	43	8	7	0	0	0		4793
1988	0	75	3105	931	2148	396	332	461	89	71	33	10	2	0	2		7645
1989	0	345	898	3120	398	950	133	125	166	25	10	2	0	0	0		6182
1990	0	359	1886	945	2310	334	462	45	29	41	1	3	0	0	0		6414
1991	7	329	790	1841	1399	1454	283	174	43	20	4	8	0	0	3		6353
1992	1	936	973	498	1343	571	625	53	63	7	12	0	0	0	0		5080
1993	0	263	1441	778	458	571	246	175	58	22	10	0	0	0	0		4019
1994	0	31	223	411	149	37	68	39	30	3	5	0	3	0	0		997
1995	0	18	121	94	215	39	21	14	16	1	1	0	0	0	0		540
1996	0	14	115	300	91	118	15	9	13	2	0	0	0	0	0		674
1997	0	13	36	87	259	70	51	19	6	3	3	0	0	0	0		549
1998	0	14	80	113	178	222	36	25	10	2	0	0	0	0	0		678
1999	0	23	249	362	203	141	162	40	8	2	0	0	0	0	0		1193
2000	0	22	78	354	194	57	41	23	4	0	0	0	0	0	0	0	771
2001	0	10	391	220	527	181	65	50	28	3	1	1	0	0	0		1479
2002	0	4	148	749	235	346	89	31	24	11	5	2	0	0	0		1641
2003	0	2	121	373	811	207	243	60	13	4	1	0	0	0	0		1838
2004	0	3	67	198	291	271	83	73	18	2	2	0	0	0	0		1007
2005	0	0	2	43	44	21	48	9	5	2	0	0	0	0	0		174
2006	0	0	13	16	57	26	12	7	2	0	0	0	0	0	0		134
2007	0	1	5	141	9	50	3	4	2	1	0	0	0	0	0		216

Appendix A. Table A1b continued. USA Eastern GB commercial landings at age (thousands of fish; metric tons) and mean weight (kg) and mean length (cm) at age of Atlantic cod, 1978-2007.

Age																	
Year	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	Average
<u>USA Eastern Georges Bank Commercial Landings Mean Weight (kg) at Age</u>																	
1978	0.582	1.307	1.935	2.812	4.099	5.239	5.255	7.086	6.723	9.172	15.742	15.59	0	11.95	16.63		2.595
1979	1.025	1.406	1.496	3.286	4.71	7.083	9.537	9.377	9.874	13.923	11.951	16.28	0	20.11	0		3.654
1980	0	1.25	2.076	3.102	5.171	6.314	7.466	10.394	9.379	12.696	14.159	0	0	0	0		3.763
1981	1.013	1.276	1.909	2.938	4.166	6.418	8.052	9.333	12.944	14.483	19.369	20.85	0	0	0		2.988
1982	0	1.221	2.143	3.432	4.928	6.808	8.504	9.686	12.057	14.48	15.121	19.32	18.76	24.36	0		2.989
1983	1.015	1.605	2.344	3.109	4.406	6.08	7.243	10.243	11.531	13.35	16.085	16.25	22.4	20.22	27.52		3.457
1984	1.217	1.628	2.265	3.272	4.604	6.118	8.399	9.074	11.406	12.172	12.865	16.45	18.57	22.23	0	20.85	3.984
1985	0.9	1.331	1.771	3.075	4.585	5.935	8.087	9.923	11.199	12.656	15.774	15.3	20.85	17.96	0		3.218
1986	0.877	1.146	2.064	2.689	4.542	6.636	8.277	9.448	12.903	15.224	11.914	17.28	0	0	0		3.204
1987	0	1.364	2.196	3.71	5.047	7.221	8.389	9.131	10.535	10.628	12.888	17.3	0	0	0		2.586
1988	0	1.315	2.149	2.791	4.861	5.888	7.422	8.79	9.783	11.822	11.209	18.78	20.11	0	14.16		3.107
1989	0	1.606	1.943	3.007	4.396	5.556	6.358	9.434	9.845	10.329	11.891	13.75	0	0	0		3.044
1990	0	1.396	1.94	2.863	4.327	5.914	7.821	8.956	10.205	11.078	13.024	11.24	0	0	0		2.888
1991	1.29	1.583	2.298	3.024	4.39	5.509	7.521	8.702	7.928	10.382	12.344	9.503	0	0	11.23		3.5
1992	1.016	1.451	2.162	3.077	3.995	5.265	6.396	8.094	9.742	13.175	13.74	0	0	0	0		2.799
1993	0.866	1.45	2.034	2.755	4.338	5.156	7.042	7.558	10.156	10.633	22.191	0	0	0	0		2.762
1994	0	1.382	1.88	2.909	3.754	6.037	6.832	8.623	9.188	13.136	14.95	0	22.19	0	0		2.881
1995	0	1.306	1.831	3.242	4.657	6.409	10.4	10.069	10.57	16.626	20.698	0	0	0	0		3.248
1996	0.902	1.377	2.023	2.839	4.137	5.576	6.078	8.978	10.182	9.283	12.702	0	0	0	0		3.062
1997	0	1.34	1.656	2.488	3.776	4.983	6.261	7.34	10.579	9.804	12.635	16.63	0	0	0		3.398
1998	0	1.35	1.894	3.105	4.026	5.113	6.529	7.33	9.97	10.299	11.095	10.16	0	0	0		3.637
1999	0	1.323	1.743	2.966	4.079	5.139	5.826	6.778	7.499	10.671	0	0	0	0	0		3.023
2000	0	1.329	1.894	2.708	3.768	4.42	5.273	5.681	6.378	0	7.682	0	0	0	0	0	2.908
2001	0	1.252	1.721	2.402	3.046	4.552	5.248	6.479	8.218	9.063	7.824	9.283	0	0	0		2.625
2002	0	1.349	1.863	2.732	3.816	4.711	6.079	8.387	7.426	10.332	13.567	11.94	0	0	0		3.19
2003	0	1.591	2.108	2.704	3.427	4.263	5.34	6.671	7.55	8.41	11.08	0	0	0	0		3.41
2004	0	1.801	1.986	2.821	3.576	4.671	5.003	7.195	7.641	7.686	9.057	11.1	0	0	0		3.665
2005	0	1.327	1.781	2.807	3.412	4.024	4.648	6.229	5.981	6.681	0	0	8.457	0	0		3.661
2006	0	0	2.298	2.667	3.35	3.31	5.172	5.069	5.029	6.277	9.283	5.911	0	0	0		3.275
2007	0	1.48	1.744	2.765	3.259	3.773	6.481	6.189	6.067	7.865	8.457	0	0	0	0		3.011

Appendix A. Table A1b continued. USA Eastern GB commercial landings at age (thousands of fish; metric tons) and mean weight (kg) and mean length (cm) at age of Atlantic cod, 1978-2007.

Age																	
Year	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	Average
USA Eastern Georges Bank Commercial Landings Mean Length (cm) at Age																	
1978	39.0	50.4	57.4	64.1	72.7	78.6	78.8	87.7	85.6	94.0	114.8	114.3	0.0	105.0	117.0		61.8
1979	46.9	51.7	52.6	67.9	76.3	87.2	97.2	96.5	98.5	110.3	105.0	116.1	0.0	124.5	0.0		67.8
1980	0.0	49.8	58.4	66.5	78.9	84.5	89.0	99.5	96.3	107.0	111.0	0.0	0.0	0.0	0.0		68.5
1981	46.7	49.6	56.5	65.5	73.6	85.1	91.6	96.2	106.8	110.8	123.0	126.0	0.0	0.0	0.0		62.7
1982	0.0	49.5	58.8	68.8	77.7	86.8	93.3	97.2	104.6	111.4	113.0	122.5	120.9	132.0	0.0		62.1
1983	46.7	54.0	60.8	66.7	74.6	83.2	88.1	98.7	103.1	108.3	115.6	115.4	129.0	124.6	138.0		66.6
1984	49.6	54.2	60.3	67.8	75.9	83.5	92.8	95.4	102.7	104.9	105.8	115.5	120.7	127.9	0.0	126.0	70.3
1985	45.0	50.9	55.7	66.6	75.8	82.7	91.5	97.9	102.0	106.1	114.5	113.7	126.0	120.0	0.0		64.3
1986	44.5	48.3	58.3	62.4	74.6	85.8	92.2	96.3	106.9	113.3	104.2	118.0	0.0	0.0	0.0		64.4
1987	0.0	51.2	59.4	70.5	78.6	88.6	93.0	95.6	99.8	100.2	106.7	118.5	0.0	0.0	0.0		60.2
1988	0.0	50.7	59.2	63.8	77.2	82.2	89.2	94.3	97.8	103.8	101.0	121.3	124.5	0.0	111.0		65.1
1989	0.0	54.1	57.5	66.0	74.2	79.9	82.8	96.8	98.3	99.8	104.8	109.9	0.0	0.0	0.0		65.0
1990	0.0	51.6	57.2	64.8	73.9	81.8	90.0	95.1	99.4	102.3	108.0	102.9	0.0	0.0	0.0		63.4
1991	50.5	53.9	60.6	65.7	74.3	79.8	89.4	93.4	90.5	99.9	105.8	97.0	0.0	0.0	102.7		67.8
1992	46.8	52.7	60.0	67.2	73.1	80.6	85.8	92.9	99.9	111.0	112.5	0.0	0.0	0.0	0.0		63.4
1993	45.0	52.8	58.9	64.9	75.2	79.8	89.3	90.9	99.7	102.5	132.0	0.0	0.0	0.0	0.0		63.6
1994	0.0	51.5	57.5	65.7	71.1	83.6	87.9	94.6	96.4	110.4	115.1	0.0	132.0	0.0	0.0		64.3
1995	0.0	51.3	57.1	68.7	78.1	86.9	102.3	101.2	102.2	120.0	129.0	0.0	0.0	0.0	0.0		66.9
1996	45.0	51.9	58.7	65.8	74.5	83.0	84.3	96.7	100.9	99.0	105.0	0.0	0.0	0.0	0.0		66.4
1997	0.0	51.7	55.5	63.0	72.7	79.7	86.2	90.7	102.9	99.5	109.2	120.0	0.0	0.0	0.0		68.8
1998	0.0	52.1	57.8	67.9	74.2	80.6	87.1	90.7	100.4	102.3	105.0	102.0	0.0	0.0	0.0		70.4
1999	0.0	51.9	56.4	67.0	74.2	80.4	84.3	88.8	91.9	103.6	0.0	0.0	0.0	0.0	0.0		66.0
2000	0.0	52.0	57.9	64.9	72.5	76.5	81.5	83.5	87.4	0.0	93.0	0.0	0.0	0.0	0.0	0.0	65.9
2001	0.0	50.2	56.1	62.3	67.2	76.8	80.1	87.1	94.5	97.9	92.4	99.0	0.0	0.0	0.0		63.1
2002	0.0	52.1	57.6	65.0	72.5	77.8	84.7	94.6	90.9	101.4	111.9	107.1	0.0	0.0	0.0		67.6
2003	0.0	54.6	60.2	65.4	70.5	75.5	81.3	87.5	90.9	94.6	104.8	0.0	0.0	0.0	0.0		69.8
2004	0.0	57.4	59.1	66.2	71.4	78.0	79.8	90.3	91.8	92.6	97.7	105.0	0.0	0.0	0.0		71.3
2005	0.0	52.1	57.3	66.3	70.5	74.1	77.9	85.2	83.1	88.3	0.0	0.0	96.0	0.0	0.0		71.5
2006	0.0	0.0	62.1	65.1	69.9	69.6	81.1	79.6	79.8	87.0	99.0	85.3	0.0	0.0	0.0		69.2
2007	0.0	54.0	57.0	65.9	68.6	72.6	87.6	85.8	85.1	93.3	96.0	0.0	0.0	0.0	0.0		67.3

Appendix A. Table A2. BASE MODEL VPA output and diagnostics for GB cod.

VPA Version 2.7.1

Model ID: Georges Bank Cod - spr 2008 Assessment TY 2007

Input File:

C:\LOB\GBCOD\ASSESS_2008\VPA\TY07\10_PLUS_SVSWEPT\10P_SVSWEPT_CORR_DF02004_AUG1

Date of Run: 01-AUG-2008

Time of Run: 11:40

Levenburg-Marquardt Algorithm Completed 7 Iterations
Residual Sum of Squares = 383.740

Number of Residuals = 595
Number of Parameters = 8
Degrees of Freedom = 587
Mean Squared Residual = 0.653730
Standard Deviation = 0.808536

Number of Years = 30
Number of Ages = 10
First Year = 1978
Youngest Age = 1
Oldest True Age = 9

Number of Survey Indices Available = 30
Number of Survey Indices Used in Estimate = 30

VPA Classic Method - Auto Estimated Q's

Stock Numbers Predicted in Terminal Year Plus One (2008)
Age Stock Predicted Std. Error CV

1	5158.350	0.246246E+04	0.477374E+00
2	5777.533	0.195206E+04	0.337870E+00
3	4312.780	0.134212E+04	0.311197E+00
4	1201.636	0.348563E+03	0.290074E+00
5	4150.462	0.112909E+04	0.272039E+00
6	348.414	0.977986E+02	0.280697E+00
7	566.199	0.170298E+03	0.300775E+00
8	218.540	0.684464E+02	0.313198E+00

Catchability Values for Each Survey Used in Estimate
INDEX Catchability Std. Error CV

1	0.219439E-01	0.434391E-02	0.197955E+00
2	0.919973E-01	0.727614E-02	0.790908E-01
3	0.186189E+00	0.193080E-01	0.103701E+00
4	0.316089E+00	0.450858E-01	0.142637E+00

5	0.402164E+00	0.624872E-01	0.155377E+00
6	0.408966E+00	0.614000E-01	0.150135E+00
7	0.427224E+00	0.771050E-01	0.180479E+00
8	0.517786E+00	0.835569E-01	0.161374E+00
9	0.141338E-01	0.106855E-01	0.756029E+00
10	0.899870E-01	0.208708E-01	0.231931E+00
11	0.198731E+00	0.467107E-01	0.235044E+00
12	0.177261E+00	0.223604E-01	0.126144E+00
13	0.216299E+00	0.540535E-01	0.249901E+00
14	0.207689E+00	0.355707E-01	0.171269E+00
15	0.300243E+00	0.112587E+00	0.374986E+00
16	0.291472E+00	0.165071E+00	0.566335E+00
17	0.209249E-01	0.562393E-02	0.268767E+00
18	0.981470E-01	0.209510E-01	0.213466E+00
19	0.327191E+00	0.335557E-01	0.102557E+00
20	0.615292E+00	0.779107E-01	0.126624E+00
21	0.949463E+00	0.112662E+00	0.118658E+00
22	0.112928E+01	0.189453E+00	0.167763E+00
23	0.121718E+01	0.235660E+00	0.193612E+00
24	0.128152E+01	0.264935E+00	0.206735E+00
25	0.172164E-01	0.366082E-02	0.212636E+00
26	0.746671E-01	0.874968E-02	0.117182E+00
27	0.131211E+00	0.152631E-01	0.116325E+00
28	0.158575E+00	0.229384E-01	0.144654E+00
29	0.122922E+00	0.223467E-01	0.181795E+00
30	0.143092E+00	0.233551E-01	0.163218E+00

-- Non-Linear Least Squares Fit --

Default Tolerances Used

Scaled Gradient Tolerance	=	6.055454E-06
Scaled Step Tolerance	=	3.666853E-11
Relative Function Tolerance	=	3.666853E-11
Absolute Function Tolerance	=	4.930381E-32

VPA Method Options

- Catchability Values Estimated as an Analytic Function of N
- Catch Equation Used in Cohort Solution
- Plus Group Backward Calculation Method Used
- Rivard Weights Used for JAN-1 Biomass
- Rivard Weights Used for SSB Biomass
- Rivard Weights Calculation Used 5 Years for Terminal Year Plus One

- Heincke Rule Used in F-Oldest Calculation
- F-Oldest Calculation in Years Prior to Terminal Year
Uses Stock Sizes in Ages 5 to 8
- Calculation of Population of Age 1 In Year 2008
= Stock Estimate

Stock Estimates

Age	1
Age	2

Age 3
 Age 4
 Age 5
 Age 6
 Age 7
 Age 8

Full F in Terminal Year = 0.1407

F in Oldest True Age in Terminal Year = 0.1407

Full F Calculated Using Classic Method

Age	Input Partial Recruitment	Calc Partial Recruitment	Fishing Mortality	Used In Full F	Comments
1	0.010	0.006	0.0017	NO	Stock Estimate in
T+1					
2	0.110	0.403	0.1044	NO	Stock Estimate in
T+1					
3	0.390	1.000	0.2591	NO	Stock Estimate in
T+1					
4	0.730	0.876	0.2271	NO	Stock Estimate in
T+1					
5	1.000	0.658	0.1705	YES	Stock Estimate in
T+1					
6	1.000	0.721	0.1869	YES	Stock Estimate in
T+1					
7	1.000	0.250	0.0647	YES	Stock Estimate in
T+1					
8	1.000	0.543	0.1407	NO	Input PR * Full F
9	1.000	0.543	0.1407		Input PR * Full F

Catch At Age - Input Data

AGE	1978	1979	1980	1981	1982
1	151.6	279.2	339.9	1219.2	775.4
2	416.8	2242.7	4238.7	3910.7	10457.1
3	8109.1	953.6	5955.4	4738.2	4434.4
4	2429.6	4585.0	544.9	2685.5	2988.0
5	896.8	1206.9	2464.6	317.9	2039.8
6	178.4	449.8	983.0	1406.0	297.1
7	240.8	159.5	418.1	417.0	707.2
8	22.6	304.1	70.4	162.9	198.6
9	42.1	12.9	138.7	155.5	74.6
10	10.7	35.0	14.2	66.4	84.6
AGE	1983	1984	1985	1986	1987
1	626.2	280.9	176.0	768.3	103.8
2	5181.7	1547.7	7443.7	1594.1	7956.1
3	8753.3	3485.7	2942.2	4576.3	1515.5
4	2680.4	3328.4	1690.1	860.2	2170.1
5	1155.3	923.9	2097.7	525.3	299.7
6	746.4	560.2	496.5	615.4	249.9
7	94.6	450.3	267.2	85.5	277.3
8	175.0	58.9	196.8	70.4	56.1
9	67.7	167.0	27.7	56.0	36.2
10	112.6	124.9	89.7	27.8	26.0
AGE	1988	1989	1990	1991	1992
1	324.9	891.5	71.8	278.7	191.7
2	2352.1	2608.6	5561.1	1963.0	4808.4
3	8368.3	3032.8	5373.4	3491.4	2286.3
4	1074.1	4254.4	1964.0	3160.5	1070.7
5	1575.6	383.5	2272.1	1442.1	1500.0
6	223.8	534.2	230.6	1088.0	448.1
7	150.3	81.4	229.4	141.3	356.0
8	218.0	51.2	24.6	89.7	44.1
9	46.5	60.2	23.2	27.5	36.4
10	52.5	21.3	40.4	26.0	10.4

Catch At Age - Input Data

AGE	1993	1994	1995	1996	1997
1	299.2	94.4	32.3	64.9	126.9
2	1534.9	614.6	652.8	287.3	685.2
3	4429.4	1543.4	1429.0	986.6	749.6
4	1224.8	1987.7	669.9	1269.8	1020.7
5	475.3	425.6	382.3	256.3	882.9
6	535.6	97.6	41.2	183.8	147.7
7	178.0	146.2	21.4	17.9	94.4
8	141.0	51.2	20.0	11.6	18.9
9	43.1	30.5	6.4	11.3	10.1
10	21.2	5.6	1.4	0.3	3.9
AGE	1998	1999	2000	2001	2002
1	63.3	47.7	113.5	11.7	33.6
2	918.9	356.3	943.2	719.8	113.0
3	1310.3	2021.8	741.1	2667.3	1182.7
4	494.3	852.6	1156.4	751.6	1516.2
5	385.6	286.6	315.8	698.7	365.4
6	285.2	125.8	88.0	180.4	371.5
7	40.2	143.8	46.3	54.8	84.7
8	16.0	22.2	38.8	25.8	18.7
9	5.6	5.0	4.2	14.8	10.6
10	2.9	3.4	1.0	1.3	6.5
AGE	2003	2004	2005	2006	2007
1	17.0	50.5	12.3	32.8	10.6
2	201.3	69.4	364.1	69.7	526.1
3	404.4	434.3	201.8	842.8	395.2
4	800.7	260.1	578.4	208.3	1175.8
5	910.4	313.6	144.5	366.1	71.9
6	156.0	253.0	106.0	70.8	129.2
7	142.4	58.2	85.3	31.2	16.2
8	28.2	49.2	18.0	28.5	10.4
9	6.5	11.8	8.9	3.8	8.6
10	2.9	5.0	3.7	3.4	1.1

Weight At Age - Input Data

AGE	1978	1979	1980	1981	1982
1	0.5787	0.6942	0.6438	0.5873	0.6430
2	1.2513	1.3643	1.4133	1.4411	1.3928
3	2.4408	1.8920	2.4308	2.3815	2.5397
4	3.4074	4.2804	3.5465	3.5294	3.7201
5	4.0144	4.9312	5.5826	5.0546	5.2823
6	5.6957	7.1757	6.7481	7.3032	6.5758
7	6.6453	9.6642	8.3051	8.7797	9.4656
8	8.7084	10.3497	9.9256	9.7997	9.7448
9	9.9364	10.4378	9.2950	14.0178	12.9721
10	13.8870	13.6108	14.8999	16.7990	15.6229
AGE	1983	1984	1985	1986	1987
1	0.6763	0.5405	0.8055	0.6738	0.5817
2	1.4363	1.4991	1.3855	1.3568	1.4684
3	2.3895	2.4762	2.0750	2.4477	2.4763
4	3.3518	3.6676	3.7198	3.6106	4.1715
5	4.7839	4.9374	4.9774	5.4941	5.7677
6	6.4468	6.5544	6.4394	7.1726	7.7772
7	8.4913	8.7376	8.2465	8.8770	8.9078
8	10.6665	10.3090	10.2787	9.9439	10.3361
9	11.6989	11.0933	11.7651	12.9472	12.0274
10	16.3190	14.6426	14.0475	14.5623	15.6415
AGE	1988	1989	1990	1991	1992
1	0.4918	0.4347	0.5311	0.6581	0.8296
2	1.3794	1.4362	1.4893	1.5196	1.4349
3	2.3728	2.2041	2.4630	2.4992	2.4077
4	3.5065	3.7324	3.5732	3.5198	3.7982
5	5.4118	5.1806	4.9668	4.8089	4.5200
6	6.7808	6.5629	6.4025	5.8249	6.0428
7	8.7219	7.9373	8.4042	7.3177	7.0854
8	10.4333	9.9761	11.1911	9.3877	9.4720
9	11.5348	11.2867	12.4247	9.6151	11.8412
10	14.9262	14.6514	14.5119	14.6490	18.8362

Weight At Age - Input Data

AGE	1993	1994	1995	1996	1997
1	0.2837	0.4771	0.3963	0.4867	0.5385
2	1.3063	1.1976	1.3467	1.4419	1.4631
3	2.2082	2.1531	1.9769	2.3910	2.3278
4	3.2271	3.5435	3.7206	3.2180	3.4446
5	4.9843	4.7869	5.2487	4.8754	4.0326
6	5.8198	7.0741	7.4302	6.4963	5.7339
7	7.3782	7.1760	9.3273	8.1007	7.7343
8	8.9218	9.1163	12.1972	9.6991	8.0901
9	11.1348	9.0029	11.8414	10.9742	11.4196
10	12.2279	15.7618	19.1176	8.6207	12.0867
AGE	1998	1999	2000	2001	2002
1	0.6185	0.5340	0.3879	0.6008	0.4900
2	1.4324	1.4313	1.5286	1.3651	1.3165
3	2.2614	2.1372	2.3862	2.2118	2.1052
4	3.4254	3.3549	3.3875	2.9372	2.9569
5	4.5713	4.5433	4.5495	4.1007	3.9493
6	5.5756	5.8669	5.4719	5.2650	5.1562
7	7.3994	6.6406	6.9962	5.9799	6.4745
8	7.7535	8.4061	8.0125	7.6805	8.0004
9	11.8255	9.5624	8.0492	9.0431	9.2479
10	12.3102	13.2010	12.5970	9.7372	11.7081
AGE	2003	2004	2005	2006	2007
1	0.6020	0.3318	0.4309	0.3791	0.4225
2	1.4576	1.5332	1.0351	1.0785	1.4203
3	2.2536	2.3640	2.1015	2.0931	1.9169
4	2.9071	3.0802	3.0681	3.1067	2.8988
5	3.8660	3.8831	4.0035	3.6792	3.6265
6	4.7097	4.8244	4.9245	4.5349	4.1726
7	5.7888	5.6511	5.4675	6.4617	5.9316
8	6.9183	7.3709	7.4969	6.3936	6.9569
9	8.2509	8.5524	8.7863	7.5189	6.9220
10	10.4481	11.1003	11.3704	9.0737	9.0701

JAN-1 Weights at Age - Input Data

AGE	1978	1979	1980	1981	1982
1	0.3769	0.4865	0.4303	0.3814	0.4302
2	1.0176	0.8885	0.9905	0.9632	0.9044
3	1.8431	1.5387	1.8211	1.8346	1.9131
4	2.8324	3.2323	2.5904	2.9290	2.9765
5	3.0026	4.0991	4.8883	4.2339	4.3178
6	4.3726	5.3671	5.7686	6.3852	5.7652
7	5.3249	7.4192	7.7198	7.6972	8.3144
8	7.9543	8.2932	9.7940	9.0215	9.2497
9	9.3022	9.5340	9.8082	11.7956	11.2749
10	13.8870	13.6108	14.8999	16.7990	15.6229
AGE	1983	1984	1985	1986	1987
1	0.4542	0.3376	0.6206	0.4564	0.3777
2	0.9610	1.0069	0.8654	1.0454	0.9947
3	1.8243	1.8859	1.7637	1.8415	1.8330
4	2.9176	2.9604	3.0350	2.7372	3.1954
5	4.2186	4.0681	4.2726	4.5207	4.5634
6	5.8356	5.5996	5.6386	5.9750	6.5367
7	7.4724	7.5053	7.3519	7.5606	7.9933
8	10.0481	9.3561	9.4769	9.0555	9.5788
9	10.6772	10.8778	11.0130	11.5361	10.9362
10	16.3190	14.6426	14.0475	14.5623	15.6415
AGE	1988	1989	1990	1991	1992
1	0.2878	0.2349	0.3140	0.4457	0.6611
2	0.8958	0.8404	0.8046	0.8984	0.9718
3	1.8666	1.7437	1.8808	1.9293	1.9128
4	2.9467	2.9759	2.8064	2.9444	3.0810
5	4.7514	4.2621	4.3056	4.1453	3.9887
6	6.2538	5.9596	5.7592	5.3788	5.3907
7	8.2360	7.3363	7.4267	6.8448	6.4243
8	9.6404	9.3279	9.4248	8.8823	8.3255
9	10.9190	10.8516	11.1333	10.3732	10.5433
10	14.9262	14.6514	14.5119	14.6490	18.8362

JAN-1 Weights at Age - Input Data

AGE	1993	1994	1995	1996	1997
1	0.1381	0.2840	0.2078	0.2807	0.3302
2	1.0410	0.5829	0.8016	0.7559	0.8439
3	1.7800	1.6771	1.5387	1.7944	1.8321
4	2.7875	2.7973	2.8303	2.5222	2.8699
5	4.3510	3.9304	4.3126	4.2590	3.6023
6	5.1289	5.9380	5.9639	5.8393	5.2873
7	6.6772	6.4624	8.1229	7.7582	7.0883
8	7.9508	8.2013	9.3556	9.5114	8.0954
9	10.2698	8.9623	10.3899	11.5696	10.5243
10	12.2279	15.7618	19.1176	8.6207	12.0867
AGE	1998	1999	2000	2001	2002
1	0.4066	0.3156	0.2068	0.4059	0.2841
2	0.8783	0.9409	0.9035	0.7277	0.8894
3	1.8190	1.7497	1.8481	1.8387	1.6952
4	2.8238	2.7544	2.6907	2.6474	2.5574
5	3.9682	3.9449	3.9068	3.7271	3.4059
6	4.7417	5.1787	4.9860	4.8942	4.5983
7	6.5136	6.0848	6.4067	5.7203	5.8385
8	7.7439	7.8867	7.2944	7.3304	6.9168
9	9.7811	8.6106	8.2257	8.5122	8.4278
10	12.3102	13.2010	12.5970	9.7372	11.7081
AGE	2003	2004	2005	2006	2007
1	0.3772	0.1879	0.2724	0.1959	0.2433
2	0.8451	0.9607	0.5860	0.6817	0.7338
3	1.7225	1.8563	1.7950	1.4719	1.4378
4	2.4739	2.6347	2.6931	2.5551	2.4632
5	3.3810	3.3598	3.5116	3.3598	3.3566
6	4.3128	4.3187	4.3729	4.2609	3.9181
7	5.4634	5.1590	5.1359	5.6410	5.1864
8	6.6927	6.5321	6.5089	5.9124	6.7047
9	8.1247	7.6921	8.0475	7.5079	6.6526
10	10.4481	11.1003	11.3704	9.0737	9.0701

JAN-1 Weights at Age - Input Data

AGE	2008
1	0.2553
2	0.7615
3	1.6567
4	2.5640
5	3.3938
6	4.2367
7	5.3171
8	6.4702
9	7.6050
10	10.2125

SSB Weight At Age - Input Data

AGE	1978	1979	1980	1981	1982
1	0.3769	0.4865	0.4303	0.3814	0.4302
2	1.0176	0.8885	0.9905	0.9632	0.9044
3	1.8431	1.5387	1.8211	1.8346	1.9131
4	2.8324	3.2323	2.5904	2.9290	2.9765
5	3.0026	4.0991	4.8883	4.2339	4.3178
6	4.3726	5.3671	5.7686	6.3852	5.7652
7	5.3249	7.4192	7.7198	7.6972	8.3144
8	7.9543	8.2932	9.7940	9.0215	9.2497
9	9.3022	9.5340	9.8082	11.7956	11.2749
10	13.8870	13.6108	14.8999	16.7990	15.6229
AGE	1983	1984	1985	1986	1987
1	0.4542	0.3376	0.6206	0.4564	0.3777
2	0.9610	1.0069	0.8654	1.0454	0.9947
3	1.8243	1.8859	1.7637	1.8415	1.8330
4	2.9176	2.9604	3.0350	2.7372	3.1954
5	4.2186	4.0681	4.2726	4.5207	4.5634
6	5.8356	5.5996	5.6386	5.9750	6.5367
7	7.4724	7.5053	7.3519	7.5606	7.9933
8	10.0481	9.3561	9.4769	9.0555	9.5788
9	10.6772	10.8778	11.0130	11.5361	10.9362
10	16.3190	14.6426	14.0475	14.5623	15.6415
AGE	1988	1989	1990	1991	1992
1	0.2878	0.2349	0.3140	0.4457	0.6611
2	0.8958	0.8404	0.8046	0.8984	0.9718
3	1.8666	1.7437	1.8808	1.9293	1.9128
4	2.9467	2.9759	2.8064	2.9444	3.0810

5	4.7514	4.2621	4.3056	4.1453	3.9887
6	6.2538	5.9596	5.7592	5.3788	5.3907
7	8.2360	7.3363	7.4267	6.8448	6.4243
8	9.6404	9.3279	9.4248	8.8823	8.3255
9	10.9190	10.8516	11.1333	10.3732	10.5433
10	14.9262	14.6514	14.5119	14.6490	18.8362

SSB Weight At Age - Input Data

AGE	1993	1994	1995	1996	1997
1	0.1381	0.2840	0.2078	0.2807	0.3302
2	1.0410	0.5829	0.8016	0.7559	0.8439
3	1.7800	1.6771	1.5387	1.7944	1.8321
4	2.7875	2.7973	2.8303	2.5222	2.8699
5	4.3510	3.9304	4.3126	4.2590	3.6023
6	5.1289	5.9380	5.9639	5.8393	5.2873
7	6.6772	6.4624	8.1229	7.7582	7.0883
8	7.9508	8.2013	9.3556	9.5114	8.0954
9	10.2698	8.9623	10.3899	11.5696	10.5243
10	12.2279	15.7618	19.1176	8.6207	12.0867
AGE	1998	1999	2000	2001	2002
1	0.4066	0.3156	0.2068	0.4059	0.2841
2	0.8783	0.9409	0.9035	0.7277	0.8894
3	1.8190	1.7497	1.8481	1.8387	1.6952
4	2.8238	2.7544	2.6907	2.6474	2.5574
5	3.9682	3.9449	3.9068	3.7271	3.4059
6	4.7417	5.1787	4.9860	4.8942	4.5983
7	6.5136	6.0848	6.4067	5.7203	5.8385
8	7.7439	7.8867	7.2944	7.3304	6.9168
9	9.7811	8.6106	8.2257	8.5122	8.4278
10	12.3102	13.2010	12.5970	9.7372	11.7081
AGE	2003	2004	2005	2006	2007
1	0.3772	0.1879	0.2724	0.1959	0.2433
2	0.8451	0.9607	0.5860	0.6817	0.7338
3	1.7225	1.8563	1.7950	1.4719	1.4378
4	2.4739	2.6347	2.6931	2.5551	2.4632
5	3.3810	3.3598	3.5116	3.3598	3.3566
6	4.3128	4.3187	4.3729	4.2609	3.9181
7	5.4634	5.1590	5.1359	5.6410	5.1864
8	6.6927	6.5321	6.5089	5.9124	6.7047
9	8.1247	7.6921	8.0475	7.5079	6.6526
10	10.4481	11.1003	11.3704	9.0737	9.0701

Natural Mortality - Input Data

AGE	1978	1979	1980	1981	1982
1	0.2000	0.2000	0.2000	0.2000	0.2000
2	0.2000	0.2000	0.2000	0.2000	0.2000
3	0.2000	0.2000	0.2000	0.2000	0.2000
4	0.2000	0.2000	0.2000	0.2000	0.2000
5	0.2000	0.2000	0.2000	0.2000	0.2000
6	0.2000	0.2000	0.2000	0.2000	0.2000
7	0.2000	0.2000	0.2000	0.2000	0.2000
8	0.2000	0.2000	0.2000	0.2000	0.2000
9	0.2000	0.2000	0.2000	0.2000	0.2000
10	0.2000	0.2000	0.2000	0.2000	0.2000
AGE	1983	1984	1985	1986	1987
1	0.2000	0.2000	0.2000	0.2000	0.2000
2	0.2000	0.2000	0.2000	0.2000	0.2000
3	0.2000	0.2000	0.2000	0.2000	0.2000
4	0.2000	0.2000	0.2000	0.2000	0.2000
5	0.2000	0.2000	0.2000	0.2000	0.2000
6	0.2000	0.2000	0.2000	0.2000	0.2000
7	0.2000	0.2000	0.2000	0.2000	0.2000
8	0.2000	0.2000	0.2000	0.2000	0.2000
9	0.2000	0.2000	0.2000	0.2000	0.2000
10	0.2000	0.2000	0.2000	0.2000	0.2000
AGE	1988	1989	1990	1991	1992
1	0.2000	0.2000	0.2000	0.2000	0.2000
2	0.2000	0.2000	0.2000	0.2000	0.2000
3	0.2000	0.2000	0.2000	0.2000	0.2000
4	0.2000	0.2000	0.2000	0.2000	0.2000
5	0.2000	0.2000	0.2000	0.2000	0.2000
6	0.2000	0.2000	0.2000	0.2000	0.2000
7	0.2000	0.2000	0.2000	0.2000	0.2000
8	0.2000	0.2000	0.2000	0.2000	0.2000
9	0.2000	0.2000	0.2000	0.2000	0.2000
10	0.2000	0.2000	0.2000	0.2000	0.2000

Natural Mortality - Input Data

AGE	1993	1994	1995	1996	1997
1	0.2000	0.2000	0.2000	0.2000	0.2000
2	0.2000	0.2000	0.2000	0.2000	0.2000
3	0.2000	0.2000	0.2000	0.2000	0.2000
4	0.2000	0.2000	0.2000	0.2000	0.2000
5	0.2000	0.2000	0.2000	0.2000	0.2000
6	0.2000	0.2000	0.2000	0.2000	0.2000
7	0.2000	0.2000	0.2000	0.2000	0.2000
8	0.2000	0.2000	0.2000	0.2000	0.2000
9	0.2000	0.2000	0.2000	0.2000	0.2000
10	0.2000	0.2000	0.2000	0.2000	0.2000
AGE	1998	1999	2000	2001	2002
1	0.2000	0.2000	0.2000	0.2000	0.2000
2	0.2000	0.2000	0.2000	0.2000	0.2000
3	0.2000	0.2000	0.2000	0.2000	0.2000
4	0.2000	0.2000	0.2000	0.2000	0.2000
5	0.2000	0.2000	0.2000	0.2000	0.2000
6	0.2000	0.2000	0.2000	0.2000	0.2000
7	0.2000	0.2000	0.2000	0.2000	0.2000
8	0.2000	0.2000	0.2000	0.2000	0.2000
9	0.2000	0.2000	0.2000	0.2000	0.2000
10	0.2000	0.2000	0.2000	0.2000	0.2000
AGE	2003	2004	2005	2006	2007
1	0.2000	0.2000	0.2000	0.2000	0.2000
2	0.2000	0.2000	0.2000	0.2000	0.2000
3	0.2000	0.2000	0.2000	0.2000	0.2000
4	0.2000	0.2000	0.2000	0.2000	0.2000
5	0.2000	0.2000	0.2000	0.2000	0.2000
6	0.2000	0.2000	0.2000	0.2000	0.2000
7	0.2000	0.2000	0.2000	0.2000	0.2000
8	0.2000	0.2000	0.2000	0.2000	0.2000
9	0.2000	0.2000	0.2000	0.2000	0.2000
10	0.2000	0.2000	0.2000	0.2000	0.2000

Proportion of Natural Mortality Before Spawning = 0.1667
Proportion of Fishing Mortality Before Spawning = 0.1667

Maturity - Input Data

AGE	1978	1979	1980	1981	1982
1	0.0800	0.0700	0.0900	0.0900	0.0800
2	0.3300	0.3400	0.3800	0.3800	0.3600
3	0.7500	0.7800	0.7900	0.7900	0.7900
4	0.9500	0.9600	0.9600	0.9600	0.9600
5	0.9900	0.9900	0.9900	0.9900	0.9900
6	1.0000	1.0000	1.0000	1.0000	1.0000
7	1.0000	1.0000	1.0000	1.0000	1.0000
8	1.0000	1.0000	1.0000	1.0000	1.0000
9	1.0000	1.0000	1.0000	1.0000	1.0000
10	1.0000	1.0000	1.0000	1.0000	1.0000
AGE	1983	1984	1985	1986	1987
1	0.0800	0.1300	0.1800	0.1600	0.2000
2	0.4100	0.4900	0.5900	0.5800	0.5900
3	0.8500	0.8700	0.9100	0.9100	0.8900
4	0.9800	0.9800	0.9900	0.9900	0.9800
5	1.0000	1.0000	1.0000	1.0000	1.0000
6	1.0000	1.0000	1.0000	1.0000	1.0000
7	1.0000	1.0000	1.0000	1.0000	1.0000
8	1.0000	1.0000	1.0000	1.0000	1.0000
9	1.0000	1.0000	1.0000	1.0000	1.0000
10	1.0000	1.0000	1.0000	1.0000	1.0000
AGE	1988	1989	1990	1991	1992
1	0.2500	0.2000	0.1200	0.1300	0.0900
2	0.6400	0.6100	0.4600	0.5300	0.4700
3	0.9000	0.9100	0.8500	0.8900	0.8900
4	0.9800	0.9800	0.9700	0.9800	0.9900
5	1.0000	1.0000	1.0000	1.0000	1.0000
6	1.0000	1.0000	1.0000	1.0000	1.0000
7	1.0000	1.0000	1.0000	1.0000	1.0000
8	1.0000	1.0000	1.0000	1.0000	1.0000
9	1.0000	1.0000	1.0000	1.0000	1.0000
10	1.0000	1.0000	1.0000	1.0000	1.0000

Maturity - Input Data

AGE	1993	1994	1995	1996	1997
1	0.0400	0.0400	0.0400	0.0500	0.1000
2	0.4300	0.4100	0.5000	0.4800	0.5700
3	0.9300	0.9200	0.9600	0.9500	0.9400
4	1.0000	1.0000	1.0000	1.0000	0.9900
5	1.0000	1.0000	1.0000	1.0000	1.0000
6	1.0000	1.0000	1.0000	1.0000	1.0000
7	1.0000	1.0000	1.0000	1.0000	1.0000
8	1.0000	1.0000	1.0000	1.0000	1.0000
9	1.0000	1.0000	1.0000	1.0000	1.0000
10	1.0000	1.0000	1.0000	1.0000	1.0000
AGE	1998	1999	2000	2001	2002
1	0.0900	0.0700	0.0700	0.0800	0.0700
2	0.5600	0.5100	0.5100	0.5000	0.4300
3	0.9400	0.9300	0.9400	0.9300	0.8800
4	1.0000	0.9900	1.0000	0.9900	0.9900
5	1.0000	1.0000	1.0000	1.0000	1.0000
6	1.0000	1.0000	1.0000	1.0000	1.0000
7	1.0000	1.0000	1.0000	1.0000	1.0000
8	1.0000	1.0000	1.0000	1.0000	1.0000
9	1.0000	1.0000	1.0000	1.0000	1.0000
10	1.0000	1.0000	1.0000	1.0000	1.0000
AGE	2003	2004	2005	2006	2007
1	0.0400	0.0700	0.0600	0.0500	0.0400
2	0.3300	0.3800	0.3600	0.3500	0.3700
3	0.8400	0.8300	0.8300	0.8400	0.8900
4	0.9800	0.9800	0.9800	0.9800	0.9900
5	1.0000	1.0000	1.0000	1.0000	1.0000
6	1.0000	1.0000	1.0000	1.0000	1.0000
7	1.0000	1.0000	1.0000	1.0000	1.0000
8	1.0000	1.0000	1.0000	1.0000	1.0000
9	1.0000	1.0000	1.0000	1.0000	1.0000
10	1.0000	1.0000	1.0000	1.0000	1.0000

Input Partial Recruitment

AGE

1	0.0100
2	0.1100
3	0.3900
4	0.7300
5	1.0000
6	1.0000
7	1.0000
8	1.0000
9	1.0000

Input F-Plus Ratio

YEAR

1978	1.0000
1979	1.0000
1980	1.0000
1981	1.0000
1982	1.0000
1983	1.0000
1984	1.0000
1985	1.0000
1986	1.0000
1987	1.0000
1988	1.0000
1989	1.0000
1990	1.0000
1991	1.0000
1992	1.0000
1993	1.0000
1994	1.0000
1995	1.0000
1996	1.0000
1997	1.0000
1998	1.0000
1999	1.0000
2000	1.0000
2001	1.0000
2002	1.0000
2003	1.0000
2004	1.0000
2005	1.0000
2006	1.0000
2007	1.0000

SURVEY - INPUT DATA

INDEX	1	2	3	4	5
SURVEY TAG	spr_36	spr_36	spr_36	spr_36	spr_36
AGE	1	2	3	4	5
TIME	JAN-1	JAN-1	JAN-1	JAN-1	JAN-1
TYPE	NUMBERS	NUMBERS	NUMBERS	NUMBERS	NUMBERS
RETRO FLAG	1	1	1	1	1
1978	0.0000	0.0000	0.0000	0.0000	0.0000
1979	0.0000	0.0000	0.0000	0.0000	0.0000
1980	0.0000	0.0000	0.0000	0.0000	0.0000
1981	0.0000	0.0000	0.0000	0.0000	0.0000
1982	693.8277	7425.1446	12980.2741	11371.7250	8480.5714
1983	452.8527	2666.2982	4121.4375	1087.6661	952.1518
1984	549.4339	588.7768	1039.1705	1691.4696	576.8920
1985	151.7705	3624.3241	906.1152	1516.7491	1929.3027
1986	1190.5313	558.7232	2519.5821	498.8893	737.6786
1987	26.9116	2202.7902	516.9214	1042.7223	84.8330
1988	983.8446	831.6643	4302.5786	558.4500	879.0670
1989	424.0286	1926.7071	910.3500	2162.6277	321.1634
1990	236.8768	1258.8348	2373.0027	921.0054	1245.7205
1991	1402.4089	721.0125	940.8134	1268.9438	654.0750
1992	167.6170	1710.8679	639.5946	229.6366	372.8009
1993	11.6116	544.7893	1784.2259	280.4545	122.2634
1994	170.4857	372.1179	273.2143	295.7545	45.3536
1995	67.6205	521.4295	1166.4884	729.4821	818.2768
1996	99.7232	292.2027	1005.7018	1703.7643	237.9696
1997	397.2536	597.1098	232.5054	667.4625	576.8920
1998	152.0438	908.7107	1773.1607	1158.1554	1031.2473
1999	290.0170	397.3902	831.9375	696.2866	325.3982
2000	301.4920	1101.8732	1133.5661	1558.8241	505.8563
2001	82.9205	320.4804	1084.2509	218.8446	522.7955
2002	88.3848	126.9080	523.6152	1356.5089	327.0375
2003	22.4036	290.7000	370.4786	850.3795	951.3321
2004	870.0509	79.2321	790.8188	1921.3795	1849.5241
2005	16.2563	660.9054	188.2446	861.9911	374.8500
2006	243.9804	315.5625	1783.9527	453.3991	988.2161
2007	170.8955	872.7830	513.0964	2450.3223	247.1223
2008	864.1768	1136.0250	790.2723	479.9009	1312.2482

SURVEY - INPUT DATA

INDEX	6	7	8	9	10
SURVEY TAG	spr_36	spr_36	spr_36	spr_41	spr_41
AGE	6	7	8	1	2
TIME	JAN-1	JAN-1	JAN-1	JAN-1	JAN-1
TYPE	NUMBERS	NUMBERS	NUMBERS	NUMBERS	NUMBERS
RETRO FLAG	1	1	1	1	1
1978	0.0000	0.0000	0.0000	477.9000	246.6000
1979	0.0000	0.0000	0.0000	550.6714	1668.4714
1980	0.0000	0.0000	0.0000	40.1143	2850.4286
1981	0.0000	0.0000	0.0000	2959.9714	2381.4000
1982	400.1223	2548.6795	503.3973	0.0000	0.0000
1983	605.3063	37.1571	298.6232	0.0000	0.0000
1984	546.9750	285.2357	0.0000	0.0000	0.0000
1985	362.5554	262.1491	245.7563	0.0000	0.0000
1986	844.0955	84.2866	170.8955	0.0000	0.0000
1987	245.0732	185.1027	44.8071	0.0000	0.0000
1988	87.4286	50.5446	67.2107	0.0000	0.0000
1989	479.6277	68.9866	53.9598	0.0000	0.0000
1990	178.1357	195.4848	17.6223	0.0000	0.0000
1991	448.2080	73.9045	55.4625	0.0000	0.0000
1992	194.5286	216.7955	26.7750	0.0000	0.0000
1993	188.7911	40.0259	46.9929	0.0000	0.0000
1994	7.7866	60.2438	0.0000	0.0000	0.0000
1995	145.7598	319.1143	38.2500	0.0000	0.0000
1996	284.8259	37.8402	24.7259	0.0000	0.0000
1997	68.0304	182.9170	27.4580	0.0000	0.0000
1998	727.5696	138.7929	42.2116	0.0000	0.0000
1999	162.9723	86.8821	41.6652	0.0000	0.0000
2000	139.8857	34.8348	27.4580	0.0000	0.0000
2001	241.2482	31.5563	24.1795	0.0000	0.0000
2002	306.9563	53.2768	0.0000	0.0000	0.0000
2003	87.5652	108.6027	16.8027	0.0000	0.0000
2004	1219.2188	243.9804	356.8179	0.0000	0.0000
2005	280.4545	174.0375	40.7089	0.0000	0.0000
2006	290.7000	165.7045	73.6313	0.0000	0.0000
2007	285.7821	42.2116	24.7259	0.0000	0.0000
2008	51.6375	61.4732	0.0000	0.0000	0.0000

SURVEY - INPUT DATA

INDEX	11	12	13	14	15
SURVEY TAG	spr_41	spr_41	spr_41	spr_41	spr_41
AGE	3	4	5	6	7
TIME	JAN-1	JAN-1	JAN-1	JAN-1	JAN-1
TYPE	NUMBERS	NUMBERS	NUMBERS	NUMBERS	NUMBERS
RETRO FLAG	1	1	1	1	1
1978	7111.1571	1249.0714	999.7714	182.0571	915.8143
1979	353.7000	2380.5000	702.7714	302.7857	107.4857
1980	3458.0571	272.9571	2192.1429	480.4714	238.5000
1981	3613.8857	2166.3000	136.1571	1129.6286	331.9714
1982	0.0000	0.0000	0.0000	0.0000	0.0000
1983	0.0000	0.0000	0.0000	0.0000	0.0000
1984	0.0000	0.0000	0.0000	0.0000	0.0000
1985	0.0000	0.0000	0.0000	0.0000	0.0000
1986	0.0000	0.0000	0.0000	0.0000	0.0000
1987	0.0000	0.0000	0.0000	0.0000	0.0000
1988	0.0000	0.0000	0.0000	0.0000	0.0000
1989	0.0000	0.0000	0.0000	0.0000	0.0000
1990	0.0000	0.0000	0.0000	0.0000	0.0000
1991	0.0000	0.0000	0.0000	0.0000	0.0000
1992	0.0000	0.0000	0.0000	0.0000	0.0000
1993	0.0000	0.0000	0.0000	0.0000	0.0000
1994	0.0000	0.0000	0.0000	0.0000	0.0000
1995	0.0000	0.0000	0.0000	0.0000	0.0000
1996	0.0000	0.0000	0.0000	0.0000	0.0000
1997	0.0000	0.0000	0.0000	0.0000	0.0000
1998	0.0000	0.0000	0.0000	0.0000	0.0000
1999	0.0000	0.0000	0.0000	0.0000	0.0000
2000	0.0000	0.0000	0.0000	0.0000	0.0000
2001	0.0000	0.0000	0.0000	0.0000	0.0000
2002	0.0000	0.0000	0.0000	0.0000	0.0000
2003	0.0000	0.0000	0.0000	0.0000	0.0000
2004	0.0000	0.0000	0.0000	0.0000	0.0000
2005	0.0000	0.0000	0.0000	0.0000	0.0000
2006	0.0000	0.0000	0.0000	0.0000	0.0000
2007	0.0000	0.0000	0.0000	0.0000	0.0000
2008	0.0000	0.0000	0.0000	0.0000	0.0000

SURVEY - INPUT DATA

INDEX	16	17	18	19	20
SURVEY TAG	spr_41	sp_can	sp_can	sp_can	sp_can
AGE	8	1	2	3	4
TIME	JAN-1	JAN-1	JAN-1	JAN-1	JAN-1
TYPE	NUMBERS	NUMBERS	NUMBERS	NUMBERS	NUMBERS
RETRO FLAG	1	1	1	1	1
1978	83.7000	0.0000	0.0000	0.0000	0.0000
1979	178.2000	0.0000	0.0000	0.0000	0.0000
1980	39.8571	0.0000	0.0000	0.0000	0.0000
1981	169.8429	0.0000	0.0000	0.0000	0.0000
1982	0.0000	0.0000	0.0000	0.0000	0.0000
1983	0.0000	0.0000	0.0000	0.0000	0.0000
1984	0.0000	0.0000	0.0000	0.0000	0.0000
1985	0.0000	0.0000	0.0000	0.0000	0.0000
1986	0.0000	844.4316	3194.7662	3954.7547	520.7328
1987	0.0000	351.8465	2997.7322	1308.8690	1534.0507
1988	0.0000	394.0681	1421.4599	6558.4188	816.2839
1989	0.0000	2294.0392	3912.5331	1942.1927	4011.0501
1990	0.0000	591.1021	3434.0218	5319.9191	2927.3629
1991	0.0000	1660.7155	1632.5678	2589.5902	3025.8799
1992	0.0000	154.8125	4025.1240	2491.0732	1125.9088
1993	0.0000	0.0000	0.0000	0.0000	0.0000
1994	0.0000	0.0000	0.0000	0.0000	0.0000
1995	0.0000	98.5170	942.9486	2111.0790	1210.3520
1996	0.0000	197.0340	689.6191	3251.0617	5657.6917
1997	0.0000	450.3635	745.9146	774.0623	1759.2325
1998	0.0000	14.0739	942.9486	1337.0167	492.5851
1999	0.0000	464.4374	450.3635	2097.0051	1534.0507
2000	0.0000	140.7386	619.2498	1477.7553	5516.9531
2001	0.0000	0.0000	84.4432	900.7270	591.1021
2002	0.0000	12.8934	121.7457	805.6169	2887.0783
2003	0.0000	0.0000	31.3603	419.1448	912.1602
2004	0.0000	753.7760	134.4987	551.7156	595.5775
2005	0.0000	34.4185	1880.0260	661.9957	4092.5096
2006	0.0000	0.0000	52.7756	1978.5841	925.6215
2007	0.0000	193.3181	730.7096	1329.3200	4136.1066
2008	0.0000	12.2714	454.9284	1259.8226	835.7757

SURVEY - INPUT DATA

INDEX	21	22	23	24	25
SURVEY TAG	sp_can	sp_can	sp_can	sp_can	us0aut
AGE	5	6	7	8	1
TIME	JAN-1	JAN-1	JAN-1	JAN-1	JAN-1
TYPE	NUMBERS	NUMBERS	NUMBERS	NUMBERS	NUMBERS
RETRO FLAG	1	1	1	1	1
1978	0.0000	0.0000	0.0000	0.0000	207.0964
1979	0.0000	0.0000	0.0000	0.0000	540.0080
1980	0.0000	0.0000	0.0000	0.0000	156.4152
1981	0.0000	0.0000	0.0000	0.0000	382.0902
1982	0.0000	0.0000	0.0000	0.0000	356.5446
1983	0.0000	0.0000	0.0000	0.0000	494.5179
1984	0.0000	0.0000	0.0000	0.0000	1752.5330
1985	0.0000	0.0000	0.0000	0.0000	244.6634
1986	914.8009	619.2498	365.9204	56.2954	1368.6670
1987	478.5112	168.8863	309.6249	112.5909	103.9580
1988	1435.5337	182.9602	112.5909	239.2556	278.2688
1989	506.6590	591.1021	70.3693	140.7386	750.6563
1990	5446.5838	591.1021	1308.8690	168.8863	342.6107
1991	1477.7553	1843.6757	225.1818	309.6249	214.6098
1992	1379.2383	844.4316	605.1760	168.8863	55.3259
1993	0.0000	0.0000	0.0000	0.0000	47.9491
1994	0.0000	0.0000	0.0000	0.0000	243.7071
1995	844.4316	267.4033	56.2954	70.3693	91.2536
1996	1534.0507	1111.8349	464.4374	112.5909	218.4348
1997	1731.0848	379.9942	84.4432	42.2216	29.5071
1998	492.5851	394.0681	98.5170	28.1477	8.7429
1999	577.0283	365.9204	211.1079	14.0739	95.7616
2000	2406.6301	1097.7611	562.9544	337.7726	95.7616
2001	1562.1985	731.8407	365.9204	239.2556	26.6384
2002	961.5430	1718.1603	563.8122	232.3755	38.7964
2003	1706.7639	447.1511	474.4035	227.5985	319.6607
2004	634.6213	545.4536	103.8278	165.3542	446.5688
2005	1591.4896	721.6604	583.5206	18.8549	2302.2402
2006	2297.1633	982.6574	283.5685	260.2498	71.1723
2007	545.8412	851.2446	135.4739	106.6092	135.7875
2008	3069.2880	196.4960	396.5004	41.2168	102.3188

SURVEY - INPUT DATA

INDEX	26	27	28	29	30
SURVEY TAG	us1aut	us2aut	us3aut	us4aut	us5aut
AGE	2	3	4	5	6
TIME	JAN-1	JAN-1	JAN-1	JAN-1	JAN-1
TYPE	NUMBERS	NUMBERS	NUMBERS	NUMBERS	NUMBERS
RETRO FLAG	1	1	1	1	1
1978	323.4857	4690.4063	943.6821	345.3429	236.4670
1979	2520.9482	534.4071	5543.1080	1316.3464	458.3170
1980	2220.0027	2290.9018	221.4402	2303.8795	437.9625
1981	1120.0420	769.9179	1057.2027	71.7188	361.7357
1982	4815.4018	3073.6607	2129.7054	804.6161	73.7679
1983	788.6330	2608.5134	330.3161	92.6196	157.3714
1984	1160.4777	1488.0616	1011.1661	94.3955	44.8071
1985	2607.9670	931.3875	1268.6705	1127.1455	33.0589
1986	247.6688	1151.0518	91.1170	144.1205	104.6411
1987	3113.1402	175.5402	449.4375	11.2018	66.5277
1988	565.1438	1848.0214	147.5357	273.6241	38.2500
1989	1194.9027	596.9732	1234.6554	81.9643	264.6080
1990	3822.8143	1429.4571	220.0741	692.7348	74.7241
1991	496.7036	2219.0464	2478.1902	563.3679	390.0134
1992	556.8107	239.3357	374.5768	41.6652	39.6161
1993	563.3679	1296.2652	238.1063	136.6071	59.6973
1994	1324.9527	726.2036	522.6589	22.5402	34.5616
1995	554.0786	907.4813	592.0554	209.5554	92.7563
1996	334.2777	2473.4089	1705.5402	119.1214	73.9045
1997	327.7205	267.4768	566.1000	195.3482	81.5545
1998	322.6661	438.3723	149.3116	176.4964	66.3911
1999	458.3170	1401.8625	480.5839	56.1455	48.3589
2000	190.8402	210.6482	422.9357	348.2116	118.9848
2001	780.0268	734.6732	96.3080	107.6464	41.8018
2002	64.3420	520.2000	627.0268	81.1446	74.5875
2003	652.9821	965.8125	1907.0357	2222.5982	161.1964
2004	227.1777	422.3893	273.8973	212.5607	112.5643
2005	1017.4500	185.5125	970.0473	344.2500	439.1920
2006	75.5438	791.5018	176.0866	239.8821	35.3813
2007	590.8259	221.0304	702.4339	46.1732	170.4857
2008	156.6884	282.5036	68.8500	177.9991	8.7429

Additional Output Files

Population File

C:\LOB\GBCOD\ASSESS_2008\VPA\TY07\10_PLUS_SVSWEPT\10P_SVSWEPT_CO

Auxilliary File

C:\LOB\GBCOD\ASSESS_2008\VPA\TY07\10_PLUS_SVSWEPT\10P_SVSWEPT_CO

Covariance File

C:\LOB\GBCOD\ASSESS_2008\VPA\TY07\10_PLUS_SVSWEPT\10P_SVSWEPT_CO

Residuals File

C:\LOB\GBCOD\ASSESS_2008\VPA\TY07\10_PLUS_SVSWEPT\10P_SVSWEPT_CO

Log File

C:\LOB\GBCOD\ASSESS_2008\VPA\TY07\10_PLUS_SVSWEPT\10P_SVSWEPT_CO

Bootstrap Files

Bootstrap Stock Numbers

C:\LOB\GBCOD\ASSESS_2008\VPA\TY07\10_PLUS_SVSWEPT\10P_SVSWEPT_CO

Bootstrap Fishing Mortality

C:\LOB\GBCOD\ASSESS_2008\VPA\TY07\10_PLUS_SVSWEPT\10P_SVSWEPT_CO

Bootstrap Biomass

C:\LOB\GBCOD\ASSESS_2008\VPA\TY07\10_PLUS_SVSWEPT\10P_SVSWEPT_CO

Bootstrap Catchability

C:\LOB\GBCOD\ASSESS_2008\VPA\TY07\10_PLUS_SVSWEPT\10P_SVSWEPT_CO

Estimation Results

JAN-1 Population Numbers

AGE	1978	1979	1980	1981	1982
1	28705.	25943.	22914.	45891.	19863.
2	4707.	23365.	20988.	18453.	36471.
3	25333.	3478.	17107.	13370.	11591.
4	7660.	13468.	1991.	8669.	6701.
5	2967.	4093.	6916.	1141.	4688.
6	1264.	1624.	2267.	3454.	649.
7	1212.	874.	926.	978.	1570.
8	82.	776.	572.	385.	428.
9	174.	47.	363.	405.	169.
10	44.	127.	37.	173.	192.
Total	72148.	73793.	74082.	92919.	82323.
AGE	1983	1984	1985	1986	1987
1	11305.	29021.	9615.	44505.	17898.
2	15562.	8691.	23506.	7713.	35744.
3	20473.	8096.	5723.	12569.	4881.
4	5520.	8936.	3512.	2063.	6191.
5	2817.	2128.	4336.	1367.	920.
6	2015.	1273.	916.	1678.	649.
7	266.	982.	541.	308.	823.
8	654.	133.	402.	205.	176.
9	173.	378.	56.	153.	105.
10	288.	283.	182.	76.	75.
Total	59073.	59920.	48789.	70638.	67462.
AGE	1988	1989	1990	1991	1992
1	24854.	17849.	10204.	19796.	7470.

2	14560.	20056.	13809.	8290.	15956.
3	22111.	9803.	14070.	6330.	5023.
4	2637.	10610.	5305.	6709.	2076.
5	3124.	1198.	4880.	2584.	2671.
6	484.	1153.	637.	1967.	833.
7	308.	197.	467.	315.	642.
8	425.	118.	88.	178.	132.
9	93.	154.	51.	50.	66.
10	105.	54.	88.	47.	19.
=====					
Total	68702.	61191.	49599.	46266.	34887.

JAN-1 Population Numbers

AGE	1993	1994	1995	1996	1997
1	9873.	6318.	3928.	6690.	10672.
2	5943.	7814.	5088.	3187.	5419.
3	8749.	3487.	5843.	3577.	2350.
4	2070.	3214.	1476.	3500.	2043.
5	745.	607.	868.	610.	1728.
6	853.	189.	121.	369.	270.
7	283.	223.	68.	62.	138.
8	209.	74.	53.	36.	35.
9	68.	46.	15.	26.	19.
10	34.	9.	3.	1.	7.
=====					
Total	28827.	21980.	17463.	18057.	22681.

AGE	1998	1999	2000	2001	2002
1	4976.	12399.	6159.	2858.	5338.
2	8623.	4017.	10108.	4940.	2330.
3	3819.	6231.	2967.	7425.	3396.
4	1252.	1952.	3289.	1764.	3690.
5	762.	582.	836.	1656.	772.
6	628.	280.	221.	402.	731.
7	90.	259.	117.	102.	168.
8	30.	37.	84.	54.	35.
9	12.	10.	11.	34.	22.
10	6.	7.	3.	3.	13.
=====					
Total	20196.	25776.	23796.	19240.	16495.

AGE	2003	2004	2005	2006	2007
1	1983.	13523.	2945.	7178.	7068.
2	4340.	1608.	11026.	2400.	5847.
3	1805.	3372.	1254.	8698.	1902.
4	1721.	1115.	2369.	845.	6362.

5	1665.	694.	679.	1420.	505.
6	306.	553.	288.	426.	834.
7	268.	111.	226.	141.	285.
8	62.	92.	39.	109.	87.
9	12.	26.	32.	16.	64.
10	5.	11.	13.	14.	9.
=====					
Total	12167.	21104.	18871.	21247.	22962.

JAN-1 Population Numbers

AGE	2008
1	5158.
2	5778.
3	4313.
4	1202.
5	4150.
6	348.
7	566.
8	219.
9	62.
10	52.
=====	
Total	21848.

Fishing Mortality Calculated

AGE	1978	1979	1980	1981	1982
1	0.0058	0.0119	0.0165	0.0297	0.0440
2	0.1026	0.1117	0.2509	0.2650	0.3774
3	0.4318	0.3577	0.4797	0.4908	0.5419
4	0.4269	0.4664	0.3569	0.4147	0.6667
5	0.4024	0.3905	0.4942	0.3647	0.6443
6	0.1688	0.3620	0.6411	0.5883	0.6924
7	0.2463	0.2239	0.6785	0.6268	0.6760
8	0.3601	0.5597	0.1456	0.6208	0.7059
9	0.3083	0.3598	0.5414	0.5446	0.6558
10	0.3083	0.3598	0.5414	0.5446	0.6558
AGE	1983	1984	1985	1986	1987
1	0.0630	0.0107	0.0204	0.0192	0.0064
2	0.4535	0.2179	0.4261	0.2575	0.2803
3	0.6290	0.6351	0.8203	0.5081	0.4158
4	0.7533	0.5232	0.7433	0.6078	0.4840
5	0.5944	0.6425	0.7493	0.5448	0.4415
6	0.5194	0.6547	0.8897	0.5129	0.5462
7	0.4937	0.6939	0.7714	0.3628	0.4606
8	0.3474	0.6618	0.7637	0.4717	0.4309
9	0.5587	0.6574	0.7723	0.5108	0.4756
10	0.5587	0.6574	0.7723	0.5108	0.4756
AGE	1988	1989	1990	1991	1992
1	0.0145	0.0566	0.0078	0.0157	0.0287
2	0.1956	0.1545	0.5800	0.3011	0.4009
3	0.5343	0.4140	0.5406	0.9151	0.6864
4	0.5889	0.5766	0.5192	0.7209	0.8244
5	0.7968	0.4318	0.7087	0.9323	0.9419
6	0.7013	0.7038	0.5044	0.9192	0.8797
7	0.7592	0.6020	0.7662	0.6727	0.9223
8	0.8176	0.6421	0.3653	0.7979	0.4573
9	0.7815	0.5595	0.6891	0.9081	0.9261
10	0.7815	0.5595	0.6891	0.9081	0.9261

Fishing Mortality Calculated

AGE	1993	1994	1995	1996	1997
1	0.0340	0.0166	0.0091	0.0108	0.0132
2	0.3332	0.0906	0.1522	0.1046	0.1499
3	0.8014	0.6599	0.3126	0.3602	0.4299
4	1.0271	1.1091	0.6837	0.5058	0.7857
5	1.1730	1.4127	0.6553	0.6145	0.8127
6	1.1405	0.8272	0.4666	0.7819	0.9028
7	1.1436	1.2329	0.4261	0.3798	1.3371
8	1.3043	1.3802	0.5289	0.4333	0.8935
9	1.1537	1.2382	0.6158	0.6541	0.8508
10	1.1537	1.2382	0.6158	0.6541	0.8508
AGE	1998	1999	2000	2001	2002
1	0.0141	0.0043	0.0205	0.0045	0.0070
2	0.1248	0.1028	0.1084	0.1747	0.0550
3	0.4710	0.4391	0.3203	0.4993	0.4800
4	0.5650	0.6476	0.4859	0.6262	0.5959
5	0.8003	0.7680	0.5326	0.6175	0.7257
6	0.6848	0.6727	0.5704	0.6726	0.8055
7	0.6721	0.9245	0.5658	0.8724	0.7964
8	0.8806	1.0292	0.6990	0.7266	0.8687
9	0.7418	0.7765	0.5429	0.6384	0.7670
10	0.7418	0.7765	0.5429	0.6384	0.7670
AGE	2003	2004	2005	2006	2007
1	0.0095	0.0041	0.0046	0.0051	0.0017
2	0.0525	0.0488	0.0371	0.0326	0.1044
3	0.2823	0.1529	0.1948	0.1128	0.2591
4	0.7083	0.2960	0.3119	0.3155	0.2271
5	0.9027	0.6794	0.2664	0.3325	0.1705
6	0.8102	0.6919	0.5154	0.2020	0.1869
7	0.8651	0.8409	0.5308	0.2789	0.0647
8	0.6852	0.8695	0.6915	0.3379	0.1407
9	0.8851	0.6969	0.3688	0.2993	0.1407
10	0.8851	0.6969	0.3688	0.2993	0.1407

Average Fishing Mortality For Ages 5- 8

Year Average F N Weighted Biomass Wtd Catch Wtd

1978	0.2944	0.3141	0.2944	0.3425
1979	0.3840	0.3823	0.3842	0.3962
1980	0.4898	0.5227	0.5158	0.5442
1981	0.5501	0.5539	0.5704	0.5667
1982	0.6796	0.6589	0.6647	0.6594
1983	0.4887	0.5354	0.5104	0.5443
1984	0.6633	0.6577	0.6626	0.6581
1985	0.7935	0.7729	0.7769	0.7749
1986	0.4730	0.5098	0.5017	0.5137
1987	0.4698	0.4734	0.4746	0.4765
1988	0.7687	0.7855	0.7846	0.7864
1989	0.5949	0.5713	0.5934	0.5936
1990	0.5862	0.6867	0.6799	0.6933
1991	0.8305	0.9063	0.8959	0.9095
1992	0.8003	0.9119	0.8981	0.9179
1993	1.1903	1.1689	1.1748	1.1699
1994	1.2133	1.2726	1.2443	1.2946
1995	0.5192	0.6147	0.5963	0.6226
1996	0.5524	0.6522	0.6477	0.6666
1997	0.9866	0.8586	0.8874	0.8690
1998	0.7595	0.7463	0.7416	0.7497
1999	0.8486	0.7884	0.8010	0.7962
2000	0.5919	0.5535	0.5620	0.5558
2001	0.7223	0.6420	0.6505	0.6454
2002	0.7991	0.7698	0.7773	0.7713
2003	0.8158	0.8802	0.8725	0.8818
2004	0.7705	0.7087	0.7197	0.7120
2005	0.5010	0.3868	0.4106	0.4264
2006	0.2878	0.3027	0.2981	0.3109
2007	0.1407	0.1594	0.1534	0.1709

Average Fishing Mortality For Ages 6- 8

Year Average F N Weighted Biomass Wtd Catch Wtd

1978	0.2584	0.2117	0.2183	0.2208
1979	0.3819	0.3720	0.3794	0.4037
1980	0.4884	0.5750	0.5440	0.6280
1981	0.6120	0.5987	0.6005	0.5990
1982	0.6914	0.6848	0.6846	0.6850
1983	0.4535	0.4788	0.4613	0.4874
1984	0.6702	0.6712	0.6736	0.6716
1985	0.8083	0.8280	0.8163	0.8310
1986	0.4491	0.4879	0.4829	0.4925
1987	0.4793	0.4912	0.4857	0.4944
1988	0.7594	0.7566	0.7658	0.7589
1989	0.6493	0.6852	0.6810	0.6867
1990	0.5453	0.5967	0.6039	0.6213
1991	0.7966	0.8789	0.8687	0.8846
1992	0.7531	0.8621	0.8502	0.8756
1993	1.1961	1.1666	1.1756	1.1682
1994	1.1468	1.0976	1.1175	1.1243
1995	0.4739	0.4690	0.4716	0.4712
1996	0.5317	0.7015	0.6767	0.7292
1997	1.0445	1.0376	1.0601	1.0593
1998	0.7458	0.6911	0.6947	0.6925
1999	0.8755	0.8089	0.8238	0.8239
2000	0.6117	0.5947	0.6010	0.5980
2001	0.7572	0.7145	0.7196	0.7199
2002	0.8235	0.8063	0.8069	0.8064
2003	0.7869	0.8211	0.8191	0.8234
2004	0.8008	0.7355	0.7460	0.7403
2005	0.5793	0.5342	0.5389	0.5368
2006	0.2729	0.2399	0.2477	0.2500
2007	0.1308	0.1547	0.1480	0.1711

Average Fishing Mortality For Ages 7- 8

Year Average F N Weighted Biomass Wtd Catch Wtd

1978	0.3032	0.2535	0.2568	0.2561
1979	0.3918	0.3818	0.3911	0.4442
1980	0.4120	0.4750	0.4443	0.6017
1981	0.6238	0.6251	0.6249	0.6251
1982	0.6909	0.6824	0.6829	0.6825
1983	0.4206	0.3897	0.3814	0.3988
1984	0.6779	0.6901	0.6893	0.6902
1985	0.7676	0.7681	0.7676	0.7681
1986	0.4172	0.4063	0.4111	0.4120
1987	0.4458	0.4554	0.4546	0.4556
1988	0.7884	0.7931	0.7953	0.7938
1989	0.6220	0.6170	0.6193	0.6175
1990	0.5657	0.7025	0.6887	0.7274
1991	0.7353	0.7178	0.7256	0.7213
1992	0.6898	0.8433	0.8248	0.8711
1993	1.2239	1.2119	1.2188	1.2146
1994	1.3066	1.2695	1.2764	1.2711
1995	0.4775	0.4714	0.4750	0.4758
1996	0.4065	0.3995	0.4021	0.4008
1997	1.1153	1.2480	1.2381	1.2631
1998	0.7763	0.7240	0.7310	0.7314
1999	0.9769	0.9377	0.9410	0.9385
2000	0.6324	0.6215	0.6257	0.6265
2001	0.7995	0.8218	0.8133	0.8257
2002	0.8325	0.8089	0.8107	0.8095
2003	0.7752	0.8313	0.8254	0.8354
2004	0.8552	0.8539	0.8556	0.8540
2005	0.6112	0.5546	0.5598	0.5588
2006	0.3084	0.3046	0.3053	0.3070
2007	0.1027	0.0826	0.0863	0.0944

Back Calculated Partial Recruitment

AGE	1978	1979	1980	1981	1982
1	0.0135	0.0213	0.0243	0.0474	0.0623
2	0.2377	0.1996	0.3698	0.4228	0.5347
3	1.0000	0.6391	0.7070	0.7830	0.7676
4	0.9886	0.8332	0.5260	0.6616	0.9444
5	0.9319	0.6976	0.7284	0.5819	0.9127
6	0.3909	0.6467	0.9449	0.9386	0.9809
7	0.5705	0.4000	1.0000	1.0000	0.9576
8	0.8339	1.0000	0.2145	0.9905	1.0000
9	0.7139	0.6428	0.7979	0.8689	0.9291
10	0.7139	0.6428	0.7979	0.8689	0.9291
AGE	1983	1984	1985	1986	1987
1	0.0836	0.0155	0.0229	0.0316	0.0118
2	0.6021	0.3140	0.4789	0.4237	0.5132
3	0.8350	0.9152	0.9220	0.8359	0.7613
4	1.0000	0.7540	0.8355	1.0000	0.8861
5	0.7891	0.9259	0.8422	0.8963	0.8083
6	0.6895	0.9435	1.0000	0.8438	1.0000
7	0.6554	1.0000	0.8671	0.5969	0.8433
8	0.4613	0.9537	0.8584	0.7760	0.7890
9	0.7417	0.9473	0.8681	0.8404	0.8707
10	0.7417	0.9473	0.8681	0.8404	0.8707
AGE	1988	1989	1990	1991	1992
1	0.0178	0.0805	0.0102	0.0168	0.0305
2	0.2392	0.2195	0.7570	0.3229	0.4256
3	0.6534	0.5882	0.7056	0.9815	0.7287
4	0.7203	0.8193	0.6776	0.7732	0.8753
5	0.9745	0.6135	0.9249	1.0000	1.0000
6	0.8578	1.0000	0.6583	0.9860	0.9340
7	0.9286	0.8553	1.0000	0.7215	0.9792
8	1.0000	0.9123	0.4767	0.8558	0.4856
9	0.9558	0.7949	0.8994	0.9740	0.9832
10	0.9558	0.7949	0.8994	0.9740	0.9832

Back Calculated Partial Recruitment

AGE	1993	1994	1995	1996	1997
1	0.0261	0.0118	0.0133	0.0138	0.0099
2	0.2555	0.0642	0.2226	0.1337	0.1121
3	0.6144	0.4671	0.4572	0.4607	0.3215
4	0.7875	0.7851	1.0000	0.6469	0.5876
5	0.8993	1.0000	0.9584	0.7858	0.6078
6	0.8744	0.5856	0.6824	1.0000	0.6752
7	0.8768	0.8727	0.6231	0.4857	1.0000
8	1.0000	0.9770	0.7736	0.5542	0.6682
9	0.8846	0.8765	0.9007	0.8365	0.6362
10	0.8846	0.8765	0.9007	0.8365	0.6362
AGE	1998	1999	2000	2001	2002
1	0.0160	0.0041	0.0294	0.0052	0.0080
2	0.1417	0.0999	0.1551	0.2003	0.0633
3	0.5348	0.4266	0.4582	0.5724	0.5525
4	0.6416	0.6292	0.6951	0.7177	0.6860
5	0.9089	0.7462	0.7619	0.7078	0.8354
6	0.7776	0.6536	0.8160	0.7710	0.9273
7	0.7632	0.8982	0.8093	1.0000	0.9168
8	1.0000	1.0000	1.0000	0.8328	1.0000
9	0.8424	0.7544	0.7766	0.7317	0.8830
10	0.8424	0.7544	0.7766	0.7317	0.8830
AGE	2003	2004	2005	2006	2007
1	0.0105	0.0047	0.0067	0.0150	0.0064
2	0.0581	0.0561	0.0536	0.0963	0.4027
3	0.3128	0.1758	0.2817	0.3340	1.0000
4	0.7846	0.3405	0.4511	0.9337	0.8763
5	1.0000	0.7814	0.3853	0.9842	0.6579
6	0.8975	0.7957	0.7453	0.5978	0.7212
7	0.9584	0.9671	0.7676	0.8254	0.2499
8	0.7591	1.0000	1.0000	1.0000	0.5430
9	0.9804	0.8014	0.5333	0.8859	0.5430
10	0.9804	0.8014	0.5333	0.8859	0.5430

JAN-1 Biomass

AGE	1978	1979	1980	1981	1982
1	10819.	12621.	9860.	17503.	8545.
2	4790.	20760.	20788.	17774.	32985.
3	46691.	5351.	31154.	24529.	22175.
4	21697.	43531.	5158.	25392.	19946.
5	8908.	16776.	33810.	4830.	20244.
6	5526.	8718.	13080.	22058.	3739.
7	6453.	6485.	7149.	7527.	13058.
8	652.	6432.	5603.	3470.	3957.
9	1621.	446.	3558.	4776.	1909.
10	615.	1729.	553.	2905.	2999.
Total	107772.	122849.	130713.	130763.	129555.
AGE	1983	1984	1985	1986	1987
1	5135.	9797.	5967.	20312.	6760.
2	14955.	8751.	20342.	8064.	35555.
3	37349.	15268.	10093.	23145.	8947.
4	16105.	26455.	10660.	5647.	19783.
5	11883.	8656.	18524.	6182.	4197.
6	11761.	7127.	5167.	10026.	4244.
7	1985.	7367.	3981.	2330.	6575.
8	6572.	1242.	3805.	1856.	1681.
9	1846.	4115.	618.	1767.	1145.
10	4693.	4143.	2551.	1107.	1176.
Total	112284.	92921.	81708.	80435.	90064.
AGE	1988	1989	1990	1991	1992
1	7153.	4193.	3204.	8823.	4939.
2	13043.	16855.	11111.	7447.	15506.
3	41273.	17093.	26462.	12213.	9607.
4	7770.	31575.	14888.	19753.	6395.
5	14844.	5106.	21013.	10713.	10655.
6	3028.	6871.	3668.	10580.	4490.
7	2536.	1442.	3468.	2155.	4126.
8	4096.	1100.	831.	1578.	1095.
9	1020.	1667.	566.	520.	691.
10	1574.	796.	1284.	694.	353.
Total	96337.	86699.	86495.	74476.	57856.

JAN-1 Biomass

AGE	1993	1994	1995	1996	1997
1	1364.	1794.	816.	1878.	3524.
2	6187.	4555.	4078.	2409.	4573.
3	15573.	5848.	8990.	6419.	4306.
4	5770.	8991.	4176.	8827.	5863.
5	3242.	2385.	3743.	2597.	6224.
6	4373.	1121.	721.	2155.	1428.
7	1889.	1442.	549.	482.	980.
8	1662.	605.	498.	344.	282.
9	700.	416.	158.	297.	202.
10	410.	134.	64.	6.	90.
Total	41171.	27292.	23795.	25413.	27469.
AGE	1998	1999	2000	2001	2002
1	2023.	3913.	1274.	1160.	1517.
2	7573.	3780.	9133.	3595.	2072.
3	6947.	10903.	5484.	13653.	5757.
4	3535.	5377.	8849.	4669.	9436.
5	3025.	2298.	3268.	6173.	2629.
6	2976.	1452.	1103.	1968.	3363.
7	584.	1576.	750.	586.	981.
8	230.	296.	614.	399.	242.
9	114.	87.	90.	291.	182.
10	74.	91.	33.	29.	155.
Total	27081.	29772.	30598.	32524.	26334.
AGE	2003	2004	2005	2006	2007
1	748.	2541.	802.	1406.	1720.
2	3668.	1545.	6461.	1636.	4291.
3	3110.	6259.	2251.	12803.	2734.
4	4257.	2936.	6380.	2159.	15670.
5	5628.	2331.	2383.	4771.	1694.
6	1319.	2387.	1259.	1814.	3266.
7	1462.	575.	1163.	794.	1477.
8	415.	602.	256.	645.	585.
9	98.	197.	255.	121.	424.
10	56.	121.	150.	131.	84.
Total	20760.	19494.	21360.	26280.	31945.

JAN-1 Biomass

AGE	2008
1	1317.
2	4400.
3	7145.
4	3081.
5	14086.
6	1476.
7	3011.
8	1414.
9	472.
10	530.
=====	
Total	36930.

Mean Biomass

AGE	1978	1979	1980	1981	1982
1	15013.	16229.	13264.	24080.	11333.
2	5082.	27387.	23876.	21266.	38590.
3	45837.	5044.	30176.	22993.	20784.
4	19392.	42080.	5415.	22857.	16673.
5	8946.	15241.	27839.	4406.	16724.
6	6020.	8917.	10347.	17455.	2821.
7	6496.	6885.	5118.	5841.	9903.
8	547.	5623.	4801.	2571.	2742.
9	1357.	374.	2381.	4003.	1476.
10	482.	1324.	391.	2048.	2015.
=====					
Total	109174.	129103.	123607.	127520.	123060.

AGE	1983	1984	1985	1986	1987
1	6723.	14143.	6951.	26928.	9407.
2	16410.	10649.	24205.	8398.	41679.
3	33254.	13591.	7443.	22045.	9025.
4	11927.	23330.	8458.	5110.	18705.
5	9298.	7100.	13935.	5297.	3915.
6	9264.	5608.	3594.	8606.	3558.
7	1627.	5670.	2856.	2092.	5363.
8	5372.	917.	2649.	1484.	1346.
9	1418.	2818.	422.	1419.	916.
10	3289.	2782.	1632.	793.	855.
=====					
Total	98582.	86608.	72144.	82173.	94769.

AGE	1988	1989	1990	1991	1992
1	11001.	6843.	4893.	11719.	5540.
2	16587.	24252.	14280.	9908.	17210.
3	37166.	16145.	24480.	9535.	8020.
4	6395.	27538.	13518.	15432.	4933.
5	10701.	4601.	15924.	7439.	7198.
6	2164.	4981.	2927.	6894.	3078.
7	1727.	1073.	2516.	1537.	2735.
8	2782.	795.	754.	1055.	913.
9	686.	1214.	418.	291.	465.
10	1003.	558.	851.	419.	212.
=====					
Total	90212.	88002.	80560.	64231.	50304.

Mean Biomass

AGE	1993	1994	1995	1996	1997
1	2498.	2710.	1405.	2936.	5175.
2	6017.	8120.	5775.	3961.	6690.
3	12205.	5036.	9038.	6548.	4059.
4	3848.	6351.	3645.	8078.	4475.
5	2020.	1442.	3062.	2034.	4381.
6	2733.	835.	656.	1527.	938.
7	1148.	851.	468.	382.	546.
8	965.	338.	461.	260.	171.
9	416.	222.	123.	190.	136.
10	225.	71.	43.	4.	55.
=====					
Total	32075.	25976.	24677.	25919.	26626.

AGE	1998	1999	2000	2001	2002
1	2771.	5989.	2144.	1553.	2363.
2	10546.	4961.	13296.	5624.	2707.
3	6291.	9840.	5521.	11815.	5187.
4	2997.	4417.	8062.	3526.	7523.
5	2202.	1695.	2698.	4640.	1988.
6	2322.	1097.	844.	1412.	2378.
7	443.	1033.	573.	376.	689.
8	141.	181.	445.	273.	172.
9	89.	62.	62.	210.	128.
10	48.	58.	23.	20.	99.
=====					
Total	27850.	29332.	33667.	29447.	23235.

AGE	2003	2004	2005	2006	2007
1	1077.	4059.	1147.	2460.	2705.
2	5591.	2183.	10161.	2309.	7160.
3	3228.	6716.	2177.	15634.	2923.

4	3286.	2706.	5689.	2051.	15009.
5	3899.	1792.	2171.	4050.	1529.
6	907.	1764.	1013.	1590.	2885.
7	953.	391.	879.	723.	1484.
8	285.	417.	195.	539.	514.
9	61.	145.	212.	95.	374.
10	34.	80.	114.	103.	71.
=====					
Total	19320.	20253.	23759.	29556.	34654.

Spawning Stock Biomass

AGE	1978	1979	1980	1981	1982
1	836.	853.	856.	1516.	656.
2	1503.	6701.	7328.	6250.	10785.
3	31517.	3803.	21975.	17270.	15480.
4	18567.	37396.	4512.	22002.	16572.
5	7977.	15051.	29814.	4352.	17410.
6	5197.	7938.	11369.	19341.	3223.
7	5990.	6042.	6175.	6557.	11284.
8	594.	5667.	5289.	3026.	3402.
9	1489.	407.	3145.	4219.	1655.
10	565.	1575.	489.	2566.	2600.
=====					
Total	74235.	85433.	90951.	87101.	83067.

AGE	1983	1984	1985	1986	1987
1	393.	1230.	1035.	3133.	1306.
2	5499.	3999.	10813.	4333.	19363.
3	27649.	11557.	7748.	18717.	7186.
4	13464.	22981.	9017.	4886.	17298.
5	10409.	7522.	15813.	5460.	3771.
6	10432.	6181.	4308.	8903.	3748.
7	1769.	6347.	3385.	2121.	5890.
8	5999.	1076.	3240.	1659.	1514.
9	1627.	3567.	525.	1570.	1023.
10	4135.	3591.	2170.	984.	1051.
=====					
Total	81375.	68051.	58056.	51766.	62150
AGE	1988	1989	1990	1991	1992

1	1725.	803.	371.	1107.	428.
2	7815.	9691.	4488.	3631.	6593.
3	32866.	14041.	19881.	9025.	7376.
4	6676.	27186.	12810.	16603.	5337.
5	12571.	4596.	18059.	8870.	8808.
6	2606.	5910.	3262.	8779.	3750.
7	2161.	1262.	2952.	1863.	3422.
8	3457.	956.	756.	1336.	982.
9	866.	1468.	488.	432.	572.
10	1336.	701.	1107.	577.	292.
=====					
Total	72080.	66616.	64174.	52224.	37561.

Spawning Stock Biomass

AGE	1993	1994	1995	1996	1997
1	52.	69.	32.	91.	340.
2	2434.	1779.	1923.	1099.	2459.
3	12256.	4661.	7924.	5554.	3644.
4	4703.	7228.	3604.	7847.	4925.
5	2579.	1823.	3246.	2267.	5257.
6	3498.	945.	646.	1830.	1188.
7	1510.	1136.	495.	437.	758.
8	1294.	465.	441.	309.	235.
9	559.	328.	138.	258.	169.
10	327.	106.	55.	5.	75.
Total	29212.	18540.	18503.	19697.	19050.
AGE	1998	1999	2000	2001	2002
1	176.	265.	86.	90.	103.
2	4018.	1833.	4424.	1689.	854.
3	5839.	9115.	4727.	11300.	4523.
4	3112.	4622.	7893.	4028.	8181.
5	2560.	1955.	2892.	5387.	2253.
6	2568.	1255.	970.	1701.	2844.
7	505.	1307.	660.	490.	831.
8	192.	241.	528.	342.	203.
9	97.	74.	80.	253.	155.
10	63.	77.	29.	25.	132.
Total	19130.	20744.	22290.	25305.	20078.
AGE	2003	2004	2005	2006	2007
1	29.	172.	47.	68.	67.
2	1161.	563.	2236.	551.	1509.
3	2410.	4898.	1749.	10208.	2254.
4	3585.	2649.	5741.	1942.	14448.
5	4683.	2013.	2205.	4365.	1592.
6	1115.	2057.	1118.	1696.	3062.
7	1224.	483.	1030.	733.	1413.
8	358.	504.	221.	590.	552.
9	82.	170.	232.	111.	400.
10	47.	104.	136.	120.	79.
Total	14694.	13613.	14714.	20385.	25377.

Catch Biomass

AGE	1978	1979	1980	1981	1982
1	88.	194.	219.	716.	499.
2	522.	3060.	5991.	5636.	14565.
3	19793.	1804.	14476.	11284.	11262.
4	8279.	19626.	1932.	9478.	11116.
5	3600.	5951.	13759.	1607.	10775.
6	1016.	3228.	6633.	10268.	1954.
7	1600.	1541.	3472.	3661.	6694.
8	197.	3147.	699.	1596.	1935.
9	418.	135.	1289.	2180.	968.
10	149.	476.	212.	1115.	1322.
Total	35661.	39162.	48682.	47542.	61088.
AGE	1983	1984	1985	1986	1987
1	423.	152.	142.	518.	60.
2	7442.	2320.	10313.	2163.	11683.
3	20916.	8631.	6105.	11201.	3753.
4	8984.	12207.	6287.	3106.	9053.
5	5527.	4562.	10441.	2886.	1729.
6	4812.	3672.	3197.	4414.	1944.
7	803.	3935.	2203.	759.	2470.
8	1867.	607.	2023.	700.	580.
9	792.	1853.	326.	725.	435.
10	1838.	1829.	1260.	405.	407.
Total	53404.	39767.	42297.	26877.	32113.
AGE	1988	1989	1990	1991	1992
1	160.	388.	38.	183.	159.
2	3244.	3746.	8282.	2983.	6900.
3	19856.	6685.	13235.	8726.	5505.
4	3766.	15879.	7018.	11124.	4067.
5	8527.	1987.	11285.	6935.	6780.
6	1518.	3506.	1476.	6337.	2708.
7	1311.	646.	1928.	1034.	2522.
8	2274.	511.	275.	842.	418.
9	536.	679.	288.	264.	431.
10	784.	312.	586.	381.	196.
Total	41977.	34339.	44412.	38810.	29685.

Catch Biomass

AGE	1993	1994	1995	1996	1997
1	85.	45.	13.	32.	68.
2	2005.	736.	879.	414.	1003.
3	9781.	3323.	2825.	2359.	1745.
4	3953.	7043.	2492.	4086.	3516.
5	2369.	2037.	2007.	1250.	3560.
6	3117.	690.	306.	1194.	847.
7	1313.	1049.	200.	145.	730.
8	1258.	467.	244.	113.	153.
9	480.	275.	76.	124.	115.
10	259.	88.	27.	3.	47.
=====					
Total	24620.	15754.	9068.	9719.	11784.
=====					
AGE	1998	1999	2000	2001	2002
1	39.	25.	44.	7.	16.
2	1316.	510.	1442.	983.	149.
3	2963.	4321.	1768.	5900.	2490.
4	1693.	2860.	3917.	2208.	4483.
5	1763.	1302.	1437.	2865.	1443.
6	1590.	738.	482.	950.	1916.
7	297.	955.	324.	328.	548.
8	124.	187.	311.	198.	150.
9	66.	48.	34.	134.	98.
10	36.	45.	13.	13.	76.
=====					
Total	9888.	10991.	9771.	13584.	11369.
=====					
AGE	2003	2004	2005	2006	2007
1	10.	17.	5.	12.	4.
2	293.	106.	377.	75.	747.
3	911.	1027.	424.	1764.	758.
4	2328.	801.	1775.	647.	3408.
5	3520.	1218.	579.	1347.	261.
6	735.	1221.	522.	321.	539.
7	824.	329.	466.	202.	96.
8	195.	363.	135.	182.	72.
9	54.	101.	78.	29.	60.
10	30.	56.	42.	31.	10.
=====					
Total	8900.	5238.	4403.	4610.	5955.

Catch Numbers

AGE	1978	1979	1980	1981	1982
1	151.6	279.2	339.9	1219.2	775.4
2	416.8	2242.7	4238.7	3910.7	10457.1
3	8109.1	953.6	5955.4	4738.2	4434.4
4	2429.6	4585.0	544.9	2685.5	2988.0
5	896.8	1206.9	2464.6	317.9	2039.8
6	178.4	449.8	983.0	1406.0	297.1
7	240.8	159.5	418.1	417.0	707.2
8	22.6	304.1	70.4	162.9	198.6
9	42.1	12.9	138.7	155.5	74.6
10	10.7	35.0	14.2	66.4	84.6
Total	12498.5	10228.7	15167.9	15079.3	22056.8
AGE	1983	1984	1985	1986	1987
1	626.2	280.9	176.0	768.3	103.8
2	5181.7	1547.7	7443.7	1594.1	7956.1
3	8753.3	3485.7	2942.2	4576.3	1515.5
4	2680.4	3328.4	1690.1	860.2	2170.1
5	1155.3	923.9	2097.7	525.3	299.7
6	746.4	560.2	496.5	615.4	249.9
7	94.6	450.3	267.2	85.5	277.3
8	175.0	58.9	196.8	70.4	56.1
9	67.7	167.0	27.7	56.0	36.2
10	112.6	124.9	89.7	27.8	26.0
Total	19593.2	10927.9	15427.6	9179.3	12690.7
AGE	1988	1989	1990	1991	1992
1	324.9	891.5	71.8	278.7	191.7
2	2352.1	2608.6	5561.1	1963.0	4808.4
3	8368.3	3032.8	5373.4	3491.4	2286.3
4	1074.1	4254.4	1964.0	3160.5	1070.7
5	1575.6	383.5	2272.1	1442.1	1500.0
6	223.8	534.2	230.6	1088.0	448.1
7	150.3	81.4	229.4	141.3	356.0
8	218.0	51.2	24.6	89.7	44.1
9	46.5	60.2	23.2	27.5	36.4
10	52.5	21.3	40.4	26.0	10.4
Total	14386.1	11919.1	15790.6	11708.2	10752.1

Catch Numbers

AGE	1993	1994	1995	1996	1997
1	299.2	94.4	32.3	64.9	126.9
2	1534.9	614.6	652.8	287.3	685.2
3	4429.4	1543.4	1429.0	986.6	749.6
4	1224.8	1987.7	669.9	1269.8	1020.7
5	475.3	425.6	382.3	256.3	882.9
6	535.6	97.6	41.2	183.8	147.7
7	178.0	146.2	21.4	17.9	94.4
8	141.0	51.2	20.0	11.6	18.9
9	43.1	30.5	6.4	11.3	10.1
10	21.2	5.6	1.4	0.3	3.9
Total	8882.5	4996.8	3256.7	3089.8	3740.3
AGE	1998	1999	2000	2001	2002
1	63.3	47.7	113.5	11.7	33.6
2	918.9	356.3	943.2	719.8	113.0
3	1310.3	2021.8	741.1	2667.3	1182.7
4	494.3	852.6	1156.4	751.6	1516.2
5	385.6	286.6	315.8	698.7	365.4
6	285.2	125.8	88.0	180.4	371.5
7	40.2	143.8	46.3	54.8	84.7
8	16.0	22.2	38.8	25.8	18.7
9	5.6	5.0	4.2	14.8	10.6
10	2.9	3.4	1.0	1.3	6.5
Total	3522.3	3865.2	3448.3	5126.2	3702.9
AGE	2003	2004	2005	2006	2007
1	17.0	50.5	12.3	32.8	10.6
2	201.3	69.4	364.1	69.7	526.1
3	404.4	434.3	201.8	842.8	395.2
4	800.7	260.1	578.4	208.3	1175.8
5	910.4	313.6	144.5	366.1	71.9
6	156.0	253.0	106.0	70.8	129.2
7	142.4	58.2	85.3	31.2	16.2
8	28.2	49.2	18.0	28.5	10.4
9	6.5	11.8	8.9	3.8	8.6
10	2.9	5.0	3.7	3.4	1.1
Total	2669.8	1505.2	1523.0	1657.4	2345.1

Surplus Production

Average Adjustment Factor (Delta) = 1.0000

Year	Biomass	Delta Biomass	Catch Biomass	Surplus Production
1978	107771.534	15077.374	35660.721	50738.095
1979	122848.908	7864.015	39162.286	47026.301
1980	130712.923	50.259	48682.434	48732.694
1981	130763.183	-1207.795	47541.857	46334.062
1982	129555.388	-17271.698	61088.247	43816.549
1983	112283.690	-19362.222	53404.330	34042.108
1984	92921.468	-11213.851	39767.136	28553.284
1985	81707.616	-1272.242	42297.434	41025.193
1986	80435.375	9628.756	26876.781	36505.537
1987	90064.131	6272.381	32112.683	38385.065
1988	96336.512	-9637.748	41976.636	32338.888
1989	86698.764	-203.999	34338.791	34134.792
1990	86494.764	-12018.565	44411.969	32393.405
1991	74476.200	-16619.991	38810.185	22190.193
1992	57856.208	-16685.047	29684.877	12999.830
1993	41171.161	-13879.167	24620.033	10740.867
1994	27291.994	-3497.010	15754.070	12257.060
1995	23794.985	1618.018	9068.146	10686.164
1996	25413.002	2056.393	9718.713	11775.106
1997	27469.395	-388.372	11784.450	11396.079
1998	27081.024	2690.824	9887.960	12578.784
1999	29771.848	825.652	10991.218	11816.870
2000	30597.500	1926.115	9770.992	11697.107
2001	32523.616	-6190.113	13584.079	7393.966
2002	26333.503	-5573.083	11369.031	5795.948
2003	20760.420	-1266.742	8900.391	7633.649
2004	19493.678	1866.809	5237.603	7104.412
2005	21360.488	4919.513	4402.945	9322.458
2006	26280.000	5664.618	4610.067	10274.685
2007	31944.618	4985.780	5955.462	10941.242
2008	36930.398			

Summary of Survey Indices Used in the Estimate

INDEX	Survey Tag	Age	Time	Type	Catchability	Std. Error	CV
1	spr_36	1	JAN-1	NUMBER	0.2194E-01	0.4344E-02	0.1980E+00
2	spr_36	2	JAN-1	NUMBER	0.9200E-01	0.7276E-02	0.7909E-01
3	spr_36	3	JAN-1	NUMBER	0.1862E+00	0.1931E-01	0.1037E+00
4	spr_36	4	JAN-1	NUMBER	0.3161E+00	0.4509E-01	0.1426E+00
5	spr_36	5	JAN-1	NUMBER	0.4022E+00	0.6249E-01	0.1554E+00
6	spr_36	6	JAN-1	NUMBER	0.4090E+00	0.6140E-01	0.1501E+00
7	spr_36	7	JAN-1	NUMBER	0.4272E+00	0.7710E-01	0.1805E+00
8	spr_36	8	JAN-1	NUMBER	0.5178E+00	0.8356E-01	0.1614E+00
9	spr_41	1	JAN-1	NUMBER	0.1413E-01	0.1069E-01	0.7560E+00
10	spr_41	2	JAN-1	NUMBER	0.8999E-01	0.2087E-01	0.2319E+00
11	spr_41	3	JAN-1	NUMBER	0.1987E+00	0.4671E-01	0.2350E+00
12	spr_41	4	JAN-1	NUMBER	0.1773E+00	0.2236E-01	0.1261E+00
13	spr_41	5	JAN-1	NUMBER	0.2163E+00	0.5405E-01	0.2499E+00
14	spr_41	6	JAN-1	NUMBER	0.2077E+00	0.3557E-01	0.1713E+00
15	spr_41	7	JAN-1	NUMBER	0.3002E+00	0.1126E+00	0.3750E+00
16	spr_41	8	JAN-1	NUMBER	0.2915E+00	0.1651E+00	0.5663E+00
17	sp_can	1	JAN-1	NUMBER	0.2092E-01	0.5624E-02	0.2688E+00
18	sp_can	2	JAN-1	NUMBER	0.9815E-01	0.2095E-01	0.2135E+00
19	sp_can	3	JAN-1	NUMBER	0.3272E+00	0.3356E-01	0.1026E+00
20	sp_can	4	JAN-1	NUMBER	0.6153E+00	0.7791E-01	0.1266E+00
21	sp_can	5	JAN-1	NUMBER	0.9495E+00	0.1127E+00	0.1187E+00
22	sp_can	6	JAN-1	NUMBER	0.1129E+01	0.1895E+00	0.1678E+00
23	sp_can	7	JAN-1	NUMBER	0.1217E+01	0.2357E+00	0.1936E+00
24	sp_can	8	JAN-1	NUMBER	0.1282E+01	0.2649E+00	0.2067E+00
25	us0aut	1	JAN-1	NUMBER	0.1722E-01	0.3661E-02	0.2126E+00
26	us1aut	2	JAN-1	NUMBER	0.7467E-01	0.8750E-02	0.1172E+00
27	us2aut	3	JAN-1	NUMBER	0.1312E+00	0.1526E-01	0.1163E+00
28	us3aut	4	JAN-1	NUMBER	0.1586E+00	0.2294E-01	0.1447E+00
29	us4aut	5	JAN-1	NUMBER	0.1229E+00	0.2235E-01	0.1818E+00
30	us5aut	6	JAN-1	NUMBER	0.1431E+00	0.2336E-01	0.1632E+00

Survey Index: 1 Tag: spr_36 AGE = 1
Time = JAN-1 Type = NUMBER
Catchability = 0.219439E-01 % Variance Contribution = 7.1686
Residual = LN(Observed) - LN(Predicted)

Year	Observed	Predicted	Residual
1978	N/A	0.629901E+03	N/A
1979	N/A	0.569281E+03	N/A
1980	N/A	0.502813E+03	N/A
1981	N/A	0.100702E+04	N/A
1982	0.693828E+03	0.435869E+03	0.464881E+00
1983	0.452853E+03	0.248083E+03	0.601803E+00
1984	0.549434E+03	0.636826E+03	-0.147609E+00
1985	0.151770E+03	0.210997E+03	-0.329473E+00
1986	0.119053E+04	0.976626E+03	0.198052E+00
1987	0.269116E+02	0.392754E+03	-0.268063E+01

1988	0.983845E+03	0.545403E+03	0.589944E+00
1989	0.424029E+03	0.391672E+03	0.793757E-01
1990	0.236877E+03	0.223922E+03	0.562433E-01
1991	0.140241E+04	0.434410E+03	0.117196E+01
1992	0.167617E+03	0.163924E+03	0.222766E-01
1993	0.116116E+02	0.216663E+03	-0.292634E+01
1994	0.170486E+03	0.138644E+03	0.206745E+00
1995	0.676205E+02	0.861973E+02	-0.242727E+00
1996	0.997232E+02	0.146805E+03	-0.386707E+00
1997	0.397254E+03	0.234179E+03	0.528488E+00
1998	0.152044E+03	0.109196E+03	0.331027E+00
1999	0.290017E+03	0.272079E+03	0.638480E-01
2000	0.301492E+03	0.135147E+03	0.802378E+00
2001	0.829205E+02	0.627228E+02	0.279157E+00
2002	0.883848E+02	0.117140E+03	-0.281673E+00
2003	0.224036E+02	0.435161E+02	-0.663908E+00
2004	0.870051E+03	0.296740E+03	0.107570E+01
2005	0.162563E+02	0.646176E+02	-0.138001E+01
2006	0.243980E+03	0.157510E+03	0.437598E+00
2007	0.170895E+03	0.155108E+03	0.969288E-01
2008	0.864177E+03	0.113194E+03	0.203267E+01

Survey Index: 2 Tag: spr_36 AGE = 2
Time = JAN-1 Type = NUMBER
Catchability = 0.919973E-01 % Variance Contribution = 1.1443
Residual = LN(Observed) - LN(Predicted)

Year	Observed	Predicted	Residual
1978	N/A	0.433026E+03	N/A
1979	N/A	0.214949E+04	N/A
1980	N/A	0.193082E+04	N/A
1981	N/A	0.169763E+04	N/A
1982	0.742514E+04	0.335525E+04	0.794345E+00
1983	0.266630E+04	0.143170E+04	0.621829E+00
1984	0.588777E+03	0.799543E+03	-0.305993E+00
1985	0.362432E+04	0.216252E+04	0.516393E+00
1986	0.558723E+03	0.709610E+03	-0.239061E+00
1987	0.220279E+04	0.328837E+04	-0.400667E+00
1988	0.831664E+03	0.133947E+04	-0.476604E+00
1989	0.192671E+04	0.184506E+04	0.432995E-01
1990	0.125883E+04	0.127037E+04	-0.912143E-02
1991	0.721013E+03	0.762630E+03	-0.561161E-01
1992	0.171087E+04	0.146793E+04	0.153150E+00
1993	0.544789E+03	0.546735E+03	-0.356575E-02
1994	0.372118E+03	0.718830E+03	-0.658415E+00
1995	0.521429E+03	0.468042E+03	0.108017E+00
1996	0.292203E+03	0.293182E+03	-0.334671E-02
1997	0.597110E+03	0.498505E+03	0.180487E+00
1998	0.908711E+03	0.793261E+03	0.135875E+00
1999	0.397390E+03	0.369547E+03	0.726405E-01
2000	0.110187E+04	0.929927E+03	0.169660E+00
2001	0.320480E+03	0.454454E+03	-0.349277E+00
2002	0.126908E+03	0.214320E+03	-0.524006E+00
2003	0.290700E+03	0.399284E+03	-0.317381E+00
2004	0.792321E+02	0.147953E+03	-0.624515E+00
2005	0.660905E+03	0.101434E+04	-0.428386E+00
2006	0.315562E+03	0.220773E+03	0.357221E+00
2007	0.872783E+03	0.537917E+03	0.483983E+00
2008	0.113603E+04	0.531517E+03	0.759555E+00

Survey Index: 3 Tag: spr_36 AGE = 3
Time = JAN-1 Type = NUMBER
Catchability = 0.186189E+00 % Variance Contribution = 1.9673
Residual = LN(Observed) - LN(Predicted)

Year	Observed	Predicted	Residual
1978	N/A	0.471667E+04	N/A
1979	N/A	0.647539E+03	N/A
1980	N/A	0.318520E+04	N/A
1981	N/A	0.248941E+04	N/A
1982	0.129803E+05	0.215811E+04	0.179420E+01
1983	0.412144E+04	0.381182E+04	0.780942E-01
1984	0.103917E+04	0.150732E+04	-0.371914E+00
1985	0.906115E+03	0.106547E+04	-0.162005E+00

1986	0.251958E+04	0.234013E+04	0.738855E-01
1987	0.516921E+03	0.908851E+03	-0.564291E+00
1988	0.430258E+04	0.411688E+04	0.441184E-01
1989	0.910350E+03	0.182518E+04	-0.695607E+00
1990	0.237300E+04	0.261964E+04	-0.988808E-01
1991	0.940813E+03	0.117859E+04	-0.225326E+00
1992	0.639595E+03	0.935161E+03	-0.379884E+00
1993	0.178423E+04	0.162897E+04	0.910342E-01
1994	0.273214E+03	0.649205E+03	-0.865492E+00
1995	0.116649E+04	0.108788E+04	0.697642E-01
1996	0.100570E+04	0.666025E+03	0.412114E+00
1997	0.232505E+03	0.437564E+03	-0.632309E+00
1998	0.177316E+04	0.711063E+03	0.913758E+00
1999	0.831938E+03	0.116020E+04	-0.332589E+00
2000	0.113357E+04	0.552513E+03	0.718646E+00
2001	0.108425E+04	0.138253E+04	-0.243027E+00
2002	0.523615E+03	0.632316E+03	-0.188632E+00
2003	0.370479E+03	0.336138E+03	0.972743E-01
2004	0.790819E+03	0.627784E+03	0.230873E+00
2005	0.188245E+03	0.233488E+03	-0.215388E+00
2006	0.178395E+04	0.161956E+04	0.966774E-01
2007	0.513096E+03	0.354103E+03	0.370876E+00
2008	0.790272E+03	0.802993E+03	-0.159690E-01

Survey Index: 4 Tag: spr_36 AGE = 4
 Time = JAN-1 Type = NUMBER
 Catchability = 0.316089E+00 % Variance Contribution = 3.7219
 Residual = LN(Observed) - LN(Predicted)

Year	Observed	Predicted	Residual
1978	N/A	0.242136E+04	N/A
1979	N/A	0.425697E+04	N/A
1980	N/A	0.629366E+03	N/A
1981	N/A	0.274021E+04	N/A
1982	0.113717E+05	0.211816E+04	0.168058E+01
1983	0.108767E+04	0.174476E+04	-0.472583E+00
1984	0.169147E+04	0.282464E+04	-0.512783E+00
1985	0.151675E+04	0.111018E+04	0.312051E+00
1986	0.498889E+03	0.652071E+03	-0.267770E+00
1987	0.104272E+04	0.195689E+04	-0.629522E+00
1988	0.558450E+03	0.833493E+03	-0.400461E+00
1989	0.216263E+04	0.335380E+04	-0.438769E+00
1990	0.921005E+03	0.167685E+04	-0.599206E+00
1991	0.126894E+04	0.212050E+04	-0.513469E+00
1992	0.229637E+03	0.656061E+03	-0.104975E+01
1993	0.280454E+03	0.654340E+03	-0.847215E+00
1994	0.295755E+03	0.101596E+04	-0.123406E+01
1995	0.729482E+03	0.466430E+03	0.447226E+00
1996	0.170376E+04	0.110617E+04	0.431932E+00
1997	0.667462E+03	0.645705E+03	0.331410E-01
1998	0.115816E+04	0.395670E+03	0.107400E+01
1999	0.696287E+03	0.617105E+03	0.120722E+00
2000	0.155882E+04	0.103950E+04	0.405195E+00
2001	0.218845E+03	0.557473E+03	-0.935052E+00
2002	0.135651E+04	0.116630E+04	0.151080E+00

2003	0.850380E+03	0.543852E+03	0.447005E+00
2004	0.192138E+04	0.352281E+03	0.169637E+01
2005	0.861991E+03	0.748876E+03	0.140671E+00
2006	0.453399E+03	0.267099E+03	0.529152E+00
2007	0.245032E+04	0.201089E+04	0.197642E+00
2008	0.479901E+03	0.379823E+03	0.233874E+00

Survey Index: 5 Tag: spr_36 AGE = 5
Time = JAN-1 Type = NUMBER
Catchability = 0.402164E+00 % Variance Contribution = 4.4165
Residual = LN(Observed) - LN(Predicted)

Year	Observed	Predicted	Residual
1978	N/A	0.119316E+04	N/A
1979	N/A	0.164587E+04	N/A
1980	N/A	0.278155E+04	N/A
1981	N/A	0.458814E+03	N/A
1982	0.848057E+04	0.188551E+04	0.150358E+01
1983	0.952152E+03	0.113281E+04	-0.173731E+00
1984	0.576892E+03	0.855716E+03	-0.394284E+00
1985	0.192930E+04	0.174363E+04	0.101187E+00
1986	0.737679E+03	0.549920E+03	0.293736E+00
1987	0.848330E+02	0.369872E+03	-0.147247E+01
1988	0.879067E+03	0.125638E+04	-0.357130E+00
1989	0.321163E+03	0.481806E+03	-0.405591E+00
1990	0.124572E+04	0.196268E+04	-0.454595E+00
1991	0.654075E+03	0.103935E+04	-0.463129E+00
1992	0.372801E+03	0.107426E+04	-0.105835E+01
1993	0.122263E+03	0.299661E+03	-0.896473E+00
1994	0.453536E+02	0.244043E+03	-0.168285E+01
1995	0.818277E+03	0.349092E+03	0.851866E+00
1996	0.237970E+03	0.245232E+03	-0.300622E-01
1997	0.576892E+03	0.694826E+03	-0.186007E+00
1998	0.103125E+04	0.306567E+03	0.121309E+01
1999	0.325398E+03	0.234259E+03	0.328623E+00
2000	0.505856E+03	0.336379E+03	0.408013E+00
2001	0.522795E+03	0.666086E+03	-0.242228E+00
2002	0.327038E+03	0.310469E+03	0.519894E-01
2003	0.951332E+03	0.669490E+03	0.351347E+00
2004	0.184952E+04	0.279009E+03	0.189144E+01
2005	0.374850E+03	0.272933E+03	0.317299E+00
2006	0.988216E+03	0.571052E+03	0.548421E+00
2007	0.247122E+03	0.202956E+03	0.196896E+00
2008	0.131225E+04	0.166917E+04	-0.240583E+00

Survey Index: 6 Tag: spr_36 AGE = 6
Time = JAN-1 Type = NUMBER
Catchability = 0.408966E+00 % Variance Contribution = 4.1235
Residual = LN(Observed) - LN(Predicted)

Year	Observed	Predicted	Residual
1978	N/A	0.516862E+03	N/A
1979	N/A	0.664295E+03	N/A
1980	N/A	0.927325E+03	N/A
1981	N/A	0.141277E+04	N/A
1982	0.400122E+03	0.265264E+03	0.411044E+00
1983	0.605306E+03	0.824229E+03	-0.308714E+00
1984	0.546975E+03	0.520515E+03	0.495839E-01
1985	0.362555E+03	0.374729E+03	-0.330267E-01
1986	0.844096E+03	0.686242E+03	0.207035E+00
1987	0.245073E+03	0.265528E+03	-0.801644E-01
1988	0.874286E+02	0.198035E+03	-0.817621E+00
1989	0.479628E+03	0.471524E+03	0.170410E-01
1990	0.178136E+03	0.260474E+03	-0.379956E+00
1991	0.448208E+03	0.804430E+03	-0.584877E+00
1992	0.194529E+03	0.340640E+03	-0.560246E+00
1993	0.188791E+03	0.348724E+03	-0.613638E+00
1994	0.778660E+01	0.772038E+02	-0.229404E+01
1995	0.145760E+03	0.494726E+02	0.108054E+01
1996	0.284826E+03	0.150930E+03	0.635065E+00
1997	0.680304E+02	0.110445E+03	-0.484560E+00
1998	0.727570E+03	0.256647E+03	0.104201E+01
1999	0.162972E+03	0.114647E+03	0.351720E+00
2000	0.139886E+03	0.904873E+02	0.435616E+00
2001	0.241248E+03	0.164418E+03	0.383413E+00
2002	0.306956E+03	0.299063E+03	0.260502E-01
2003	0.875652E+02	0.125102E+03	-0.356744E+00
2004	0.121922E+04	0.226003E+03	0.168542E+01
2005	0.280454E+03	0.117751E+03	0.867840E+00
2006	0.290700E+03	0.174091E+03	0.512714E+00
2007	0.285782E+03	0.340941E+03	-0.176479E+00
2008	0.516375E+02	0.142489E+03	-0.101502E+01

Survey Index: 7 Tag: spr_36 AGE = 7
Time = JAN-1 Type = NUMBER
Catchability = 0.427224E+00 % Variance Contribution = 5.9587
Residual = LN(Observed) - LN(Predicted)

Year	Observed	Predicted	Residual
1978	N/A	0.517738E+03	N/A
1979	N/A	0.373407E+03	N/A
1980	N/A	0.395609E+03	N/A
1981	N/A	0.417749E+03	N/A
1982	0.254868E+04	0.670954E+03	0.133463E+01
1983	0.371571E+02	0.113517E+03	-0.111680E+01
1984	0.285236E+03	0.419358E+03	-0.385408E+00
1985	0.262149E+03	0.231313E+03	0.125142E+00
1986	0.842866E+02	0.131658E+03	-0.445982E+00

1987	0.185103E+03	0.351439E+03	-0.641124E+00
1988	0.505446E+02	0.131526E+03	-0.956345E+00
1989	0.689866E+02	0.839973E+02	-0.196872E+00
1990	0.195485E+03	0.199499E+03	-0.203288E-01
1991	0.739045E+02	0.134524E+03	-0.598966E+00
1992	0.216796E+03	0.274393E+03	-0.235605E+00
1993	0.400259E+02	0.120883E+03	-0.110530E+01
1994	0.602438E+02	0.953431E+02	-0.459083E+00
1995	0.319114E+03	0.288724E+02	0.240266E+01
1996	0.378402E+02	0.265352E+02	0.354898E+00
1997	0.182917E+03	0.590595E+02	0.113049E+01
1998	0.138793E+03	0.382960E+02	0.128764E+01
1999	0.868821E+02	0.110674E+03	-0.242038E+00
2000	0.348348E+02	0.500415E+02	-0.362236E+00
2001	0.315563E+02	0.437492E+02	-0.326701E+00
2002	0.532768E+02	0.717704E+02	-0.297971E+00
2003	0.108603E+03	0.114295E+03	-0.510902E-01
2004	0.243980E+03	0.475882E+02	0.163450E+01
2005	0.174037E+03	0.967652E+02	0.586983E+00
2006	0.165704E+03	0.601494E+02	0.101338E+01
2007	0.422116E+02	0.121665E+03	-0.105858E+01
2008	0.614732E+02	0.241894E+03	-0.136990E+01

Survey Index: 8 Tag: spr_36 AGE = 8
 Time = JAN-1 Type = NUMBER
 Catchability = 0.517786E+00 % Variance Contribution = 3.4338
 Residual = LN(Observed) - LN(Predicted)

Year	Observed	Predicted	Residual
1978	N/A	0.424445E+02	N/A
1979	N/A	0.401573E+03	N/A
1980	N/A	0.296199E+03	N/A
1981	N/A	0.199172E+03	N/A
1982	0.503397E+03	0.221488E+03	0.821012E+00
1983	0.298623E+03	0.338660E+03	-0.125813E+00
1984	N/A	0.687540E+02	N/A
1985	0.245756E+03	0.207895E+03	0.167306E+00
1986	0.170895E+03	0.106124E+03	0.476443E+00
1987	0.448071E+02	0.908907E+02	-0.707291E+00
1988	0.672107E+02	0.220010E+03	-0.118584E+01
1989	0.539598E+02	0.610824E+02	-0.123985E+00
1990	0.176223E+02	0.456522E+02	-0.951887E+00
1991	0.554625E+02	0.920049E+02	-0.506135E+00
1992	0.267750E+02	0.681236E+02	-0.933855E+00
1993	0.469929E+02	0.108255E+03	-0.834493E+00
1994	N/A	0.382234E+02	N/A
1995	0.382500E+02	0.275734E+02	0.327294E+00
1996	0.247259E+02	0.187106E+02	0.278764E+00
1997	0.274580E+02	0.180107E+02	0.421694E+00
1998	0.422116E+02	0.153890E+02	0.100904E+01
1999	0.416652E+02	0.194048E+02	0.764146E+00
2000	0.274580E+02	0.435692E+02	-0.461693E+00
2001	0.241795E+02	0.282009E+02	-0.153848E+00
2002	N/A	0.181436E+02	N/A
2003	0.168027E+02	0.321143E+02	-0.647762E+00
2004	0.356818E+03	0.477458E+02	0.201133E+01

2005	0.407089E+02	0.203667E+02	0.692547E+00
2006	0.736313E+02	0.564696E+02	0.265367E+00
2007	0.247259E+02	0.451595E+02	-0.602348E+00
2008	N/A	0.113157E+03	N/A

Survey Index: 9 Tag: spr_41 AGE = 1
 Time = JAN-1 Type = NUMBER
 Catchability = 0.141338E-01 % Variance Contribution = 1.7874
 Residual = LN(Observed) - LN(Predicted)

Year	Observed	Predicted	Residual
1978	0.477900E+03	0.405710E+03	0.163763E+00
1979	0.550671E+03	0.366665E+03	0.406688E+00
1980	0.401143E+02	0.323854E+03	-0.208856E+01
1981	0.295997E+04	0.648606E+03	0.151811E+01
1982	N/A	0.280737E+03	N/A
1983	N/A	0.159787E+03	N/A
1984	N/A	0.410170E+03	N/A
1985	N/A	0.135900E+03	N/A
1986	N/A	0.629030E+03	N/A
1987	N/A	0.252967E+03	N/A
1988	N/A	0.351286E+03	N/A
1989	N/A	0.252270E+03	N/A
1990	N/A	0.144225E+03	N/A
1991	N/A	0.279797E+03	N/A
1992	N/A	0.105581E+03	N/A
1993	N/A	0.139549E+03	N/A
1994	N/A	0.892983E+02	N/A
1995	N/A	0.555184E+02	N/A
1996	N/A	0.945549E+02	N/A
1997	N/A	0.150831E+03	N/A
1998	N/A	0.703313E+02	N/A
1999	N/A	0.175242E+03	N/A
2000	N/A	0.870463E+02	N/A
2001	N/A	0.403988E+02	N/A
2002	N/A	0.754484E+02	N/A
2003	N/A	0.280280E+02	N/A
2004	N/A	0.191126E+03	N/A
2005	N/A	0.416192E+02	N/A
2006	N/A	0.101450E+03	N/A
2007	N/A	0.999029E+02	N/A
2008	N/A	0.729069E+02	N/A

Survey Index: 10 Tag: spr_41 AGE = 2
Time = JAN-1 Type = NUMBER
Catchability = 0.899870E-01 % Variance Contribution = 0.1682
Residual = LN(Observed) - LN(Predicted)

Year	Observed	Predicted	Residual
1978	0.246600E+03	0.423564E+03	-0.540937E+00
1979	0.166847E+04	0.210252E+04	-0.231231E+00
1980	0.285043E+04	0.188863E+04	0.411618E+00
1981	0.238140E+04	0.166053E+04	0.360549E+00
1982	N/A	0.328194E+04	N/A
1983	N/A	0.140041E+04	N/A
1984	N/A	0.782072E+03	N/A
1985	N/A	0.211527E+04	N/A
1986	N/A	0.694104E+03	N/A
1987	N/A	0.321651E+04	N/A
1988	N/A	0.131021E+04	N/A
1989	N/A	0.180474E+04	N/A
1990	N/A	0.124261E+04	N/A
1991	N/A	0.745965E+03	N/A
1992	N/A	0.143585E+04	N/A
1993	N/A	0.534788E+03	N/A
1994	N/A	0.703123E+03	N/A
1995	N/A	0.457814E+03	N/A
1996	N/A	0.286776E+03	N/A
1997	N/A	0.487612E+03	N/A
1998	N/A	0.775927E+03	N/A
1999	N/A	0.361472E+03	N/A
2000	N/A	0.909607E+03	N/A
2001	N/A	0.444524E+03	N/A
2002	N/A	0.209636E+03	N/A
2003	N/A	0.390559E+03	N/A
2004	N/A	0.144720E+03	N/A
2005	N/A	0.992178E+03	N/A
2006	N/A	0.215949E+03	N/A
2007	N/A	0.526163E+03	N/A
2008	N/A	0.519903E+03	N/A

Survey Index: 11 Tag: spr_41 AGE = 3
Time = JAN-1 Type = NUMBER
Catchability = 0.198731E+00 % Variance Contribution = 0.1728
Residual = LN(Observed) - LN(Predicted)

Year	Observed	Predicted	Residual
1978	0.711116E+04	0.503439E+04	0.345372E+00
1979	0.353700E+03	0.691159E+03	-0.669921E+00
1980	0.345806E+04	0.339976E+04	0.170022E-01
1981	0.361389E+04	0.265710E+04	0.307547E+00
1982	N/A	0.230348E+04	N/A
1983	N/A	0.406860E+04	N/A
1984	N/A	0.160886E+04	N/A
1985	N/A	0.113724E+04	N/A

1986	N/A	0.249777E+04	N/A
1987	N/A	0.970074E+03	N/A
1988	N/A	0.439420E+04	N/A
1989	N/A	0.194813E+04	N/A
1990	N/A	0.279610E+04	N/A
1991	N/A	0.125798E+04	N/A
1992	N/A	0.998155E+03	N/A
1993	N/A	0.173871E+04	N/A
1994	N/A	0.692937E+03	N/A
1995	N/A	0.116117E+04	N/A
1996	N/A	0.710890E+03	N/A
1997	N/A	0.467039E+03	N/A
1998	N/A	0.758962E+03	N/A
1999	N/A	0.123835E+04	N/A
2000	N/A	0.589732E+03	N/A
2001	N/A	0.147566E+04	N/A
2002	N/A	0.674910E+03	N/A
2003	N/A	0.358781E+03	N/A
2004	N/A	0.670073E+03	N/A
2005	N/A	0.249216E+03	N/A
2006	N/A	0.172866E+04	N/A
2007	N/A	0.377956E+03	N/A
2008	N/A	0.857085E+03	N/A

Survey Index: 12 Tag: spr_41 AGE = 4
Time = JAN-1 Type = NUMBER
Catchability = 0.177261E+00 % Variance Contribution = 0.0498
Residual = LN(Observed) - LN(Predicted)

Year	Observed	Predicted	Residual
1978	0.124907E+04	0.135789E+04	-0.835318E-01
1979	0.238050E+04	0.238729E+04	-0.284902E-02
1980	0.272957E+03	0.352946E+03	-0.257001E+00
1981	0.216630E+04	0.153670E+04	0.343382E+00
1982	N/A	0.118786E+04	N/A
1983	N/A	0.978455E+03	N/A
1984	N/A	0.158405E+04	N/A
1985	N/A	0.622583E+03	N/A
1986	N/A	0.365679E+03	N/A
1987	N/A	0.109742E+04	N/A
1988	N/A	0.467420E+03	N/A
1989	N/A	0.188080E+04	N/A
1990	N/A	0.940372E+03	N/A
1991	N/A	0.118917E+04	N/A
1992	N/A	0.367917E+03	N/A
1993	N/A	0.366951E+03	N/A
1994	N/A	0.569748E+03	N/A
1995	N/A	0.261573E+03	N/A
1996	N/A	0.620339E+03	N/A
1997	N/A	0.362109E+03	N/A
1998	N/A	0.221891E+03	N/A
1999	N/A	0.346070E+03	N/A
2000	N/A	0.582946E+03	N/A
2001	N/A	0.312629E+03	N/A
2002	N/A	0.654056E+03	N/A
2003	N/A	0.304990E+03	N/A

2004	N/A	0.197558E+03	N/A
2005	N/A	0.419967E+03	N/A
2006	N/A	0.149788E+03	N/A
2007	N/A	0.112770E+04	N/A
2008	N/A	0.213004E+03	N/A

Survey Index: 13 Tag: spr_41 AGE = 5
 Time = JAN-1 Type = NUMBER
 Catchability = 0.216299E+00 % Variance Contribution = 0.1953
 Residual = LN(Observed) - LN(Predicted)

Year	Observed	Predicted	Residual
1978	0.999771E+03	0.641727E+03	0.443364E+00
1979	0.702771E+03	0.885211E+03	-0.230795E+00
1980	0.219214E+04	0.149602E+04	0.382068E+00
1981	0.136157E+03	0.246768E+03	-0.594637E+00
1982	N/A	0.101410E+04	N/A
1983	N/A	0.609268E+03	N/A
1984	N/A	0.460237E+03	N/A
1985	N/A	0.937793E+03	N/A
1986	N/A	0.295768E+03	N/A
1987	N/A	0.198931E+03	N/A
1988	N/A	0.675730E+03	N/A
1989	N/A	0.259133E+03	N/A
1990	N/A	0.105560E+04	N/A
1991	N/A	0.559003E+03	N/A
1992	N/A	0.577780E+03	N/A
1993	N/A	0.161169E+03	N/A
1994	N/A	0.131256E+03	N/A
1995	N/A	0.187755E+03	N/A
1996	N/A	0.131895E+03	N/A
1997	N/A	0.373704E+03	N/A
1998	N/A	0.164883E+03	N/A
1999	N/A	0.125993E+03	N/A
2000	N/A	0.180918E+03	N/A
2001	N/A	0.358247E+03	N/A
2002	N/A	0.166982E+03	N/A
2003	N/A	0.360077E+03	N/A
2004	N/A	0.150062E+03	N/A
2005	N/A	0.146794E+03	N/A
2006	N/A	0.307134E+03	N/A
2007	N/A	0.109157E+03	N/A
2008	N/A	0.897742E+03	N/A

Survey Index: 14 Tag: spr_41 AGE = 6
Time = JAN-1 Type = NUMBER
Catchability = 0.207689E+00 % Variance Contribution = 0.0917
Residual = LN(Observed) - LN(Predicted)

Year	Observed	Predicted	Residual
1978	0.182057E+03	0.262483E+03	-0.365866E+00
1979	0.302786E+03	0.337355E+03	-0.108111E+00
1980	0.480471E+03	0.470932E+03	0.200532E-01
1981	0.112963E+04	0.717462E+03	0.453924E+00
1982	N/A	0.134712E+03	N/A
1983	N/A	0.418576E+03	N/A
1984	N/A	0.264338E+03	N/A
1985	N/A	0.190302E+03	N/A
1986	N/A	0.348501E+03	N/A
1987	N/A	0.134846E+03	N/A
1988	N/A	0.100570E+03	N/A
1989	N/A	0.239458E+03	N/A
1990	N/A	0.132279E+03	N/A
1991	N/A	0.408522E+03	N/A
1992	N/A	0.172990E+03	N/A
1993	N/A	0.177096E+03	N/A
1994	N/A	0.392072E+02	N/A
1995	N/A	0.251241E+02	N/A
1996	N/A	0.766480E+02	N/A
1997	N/A	0.560882E+02	N/A
1998	N/A	0.130335E+03	N/A
1999	N/A	0.582225E+02	N/A
2000	N/A	0.459530E+02	N/A
2001	N/A	0.834981E+02	N/A
2002	N/A	0.151876E+03	N/A
2003	N/A	0.635317E+02	N/A
2004	N/A	0.114773E+03	N/A
2005	N/A	0.597986E+02	N/A
2006	N/A	0.884103E+02	N/A
2007	N/A	0.173143E+03	N/A
2008	N/A	0.723618E+02	N/A

Survey Index: 15 Tag: spr_41 AGE = 7
Time = JAN-1 Type = NUMBER
Catchability = 0.300243E+00 % Variance Contribution = 0.4397
Residual = LN(Observed) - LN(Predicted)

Year	Observed	Predicted	Residual
1978	0.915814E+03	0.363855E+03	0.923058E+00
1979	0.107486E+03	0.262422E+03	-0.892596E+00
1980	0.238500E+03	0.278025E+03	-0.153343E+00
1981	0.331971E+03	0.293585E+03	0.122881E+00
1982	N/A	0.471532E+03	N/A
1983	N/A	0.797775E+02	N/A
1984	N/A	0.294715E+03	N/A
1985	N/A	0.162562E+03	N/A
1986	N/A	0.925261E+02	N/A

1987	N/A	0.246983E+03	N/A
1988	N/A	0.924333E+02	N/A
1989	N/A	0.590315E+02	N/A
1990	N/A	0.140204E+03	N/A
1991	N/A	0.945403E+02	N/A
1992	N/A	0.192837E+03	N/A
1993	N/A	0.849539E+02	N/A
1994	N/A	0.670051E+02	N/A
1995	N/A	0.202909E+02	N/A
1996	N/A	0.186484E+02	N/A
1997	N/A	0.415057E+02	N/A
1998	N/A	0.269136E+02	N/A
1999	N/A	0.777793E+02	N/A
2000	N/A	0.351681E+02	N/A
2001	N/A	0.307460E+02	N/A
2002	N/A	0.504386E+02	N/A
2003	N/A	0.803243E+02	N/A
2004	N/A	0.334440E+02	N/A
2005	N/A	0.680045E+02	N/A
2006	N/A	0.422717E+02	N/A
2007	N/A	0.855034E+02	N/A
2008	N/A	0.169998E+03	N/A

Survey Index: 16 Tag: spr_41 AGE = 8
 Time = JAN-1 Type = NUMBER
 Catchability = 0.291472E+00 % Variance Contribution = 1.0030
 Residual = LN(Observed) - LN(Predicted)

Year	Observed	Predicted	Residual
1978	0.837000E+02	0.238929E+02	0.125366E+01
1979	0.178200E+03	0.226054E+03	-0.237867E+00
1980	0.398571E+02	0.166737E+03	-0.143111E+01
1981	0.169843E+03	0.112118E+03	0.415324E+00
1982	N/A	0.124680E+03	N/A
1983	N/A	0.190639E+03	N/A
1984	N/A	0.387030E+02	N/A
1985	N/A	0.117028E+03	N/A
1986	N/A	0.597394E+02	N/A
1987	N/A	0.511642E+02	N/A
1988	N/A	0.123848E+03	N/A
1989	N/A	0.343846E+02	N/A
1990	N/A	0.256986E+02	N/A
1991	N/A	0.517915E+02	N/A
1992	N/A	0.383482E+02	N/A
1993	N/A	0.609389E+02	N/A
1994	N/A	0.215168E+02	N/A
1995	N/A	0.155216E+02	N/A
1996	N/A	0.105326E+02	N/A
1997	N/A	0.101386E+02	N/A
1998	N/A	0.866276E+01	N/A
1999	N/A	0.109234E+02	N/A
2000	N/A	0.245260E+02	N/A
2001	N/A	0.158749E+02	N/A
2002	N/A	0.102134E+02	N/A
2003	N/A	0.180778E+02	N/A

2004	N/A	0.268771E+02	N/A
2005	N/A	0.114648E+02	N/A
2006	N/A	0.317879E+02	N/A
2007	N/A	0.254212E+02	N/A
2008	N/A	0.636984E+02	N/A

Survey Index: 17 Tag: sp_can AGE = 1
Time = JAN-1 Type = NUMBER
Catchability = 0.209249E-01 % Variance Contribution = 5.7602
Residual = LN(Observed) - LN(Predicted)

Year	Observed	Predicted	Residual
1978	N/A	0.600650E+03	N/A
1979	N/A	0.542845E+03	N/A
1980	N/A	0.479463E+03	N/A
1981	N/A	0.960256E+03	N/A
1982	N/A	0.415628E+03	N/A
1983	N/A	0.236563E+03	N/A
1984	N/A	0.607253E+03	N/A
1985	N/A	0.201198E+03	N/A
1986	0.844432E+03	0.931273E+03	-0.978887E-01
1987	0.351846E+03	0.374515E+03	-0.624372E-01
1988	0.394068E+03	0.520075E+03	-0.277450E+00
1989	0.229404E+04	0.373484E+03	0.181520E+01
1990	0.591102E+03	0.213523E+03	0.101824E+01
1991	0.166072E+04	0.414237E+03	0.138857E+01
1992	0.154812E+03	0.156312E+03	-0.963945E-02
1993	N/A	0.206602E+03	N/A
1994	N/A	0.132205E+03	N/A
1995	0.985170E+02	0.821945E+02	0.181141E+00
1996	0.197034E+03	0.139988E+03	0.341822E+00
1997	0.450363E+03	0.223305E+03	0.701519E+00
1998	0.140739E+02	0.104125E+03	-0.200127E+01
1999	0.464437E+03	0.259444E+03	0.582286E+00
2000	0.140739E+03	0.128871E+03	0.880899E-01
2001	N/A	0.598101E+02	N/A
2002	0.128934E+02	0.111701E+03	-0.215911E+01
2003	N/A	0.414953E+02	N/A
2004	0.753776E+03	0.282960E+03	0.979790E+00
2005	0.344185E+02	0.616168E+02	-0.582341E+00
2006	N/A	0.150196E+03	N/A
2007	0.193318E+03	0.147905E+03	0.267764E+00
2008	0.122714E+02	0.107938E+03	-0.217429E+01

Survey Index: 18 Tag: sp_can AGE = 2
Time = JAN-1 Type = NUMBER
Catchability = 0.981470E-01 % Variance Contribution = 4.9873
Residual = LN(Observed) - LN(Predicted)

Year	Observed	Predicted	Residual
1978	N/A	0.461972E+03	N/A
1979	N/A	0.229318E+04	N/A

1980	N/A	0.205989E+04	N/A
1981	N/A	0.181111E+04	N/A
1982	N/A	0.357954E+04	N/A
1983	N/A	0.152740E+04	N/A
1984	N/A	0.852989E+03	N/A
1985	N/A	0.230708E+04	N/A
1986	0.319477E+04	0.757045E+03	0.143985E+01
1987	0.299773E+04	0.350819E+04	-0.157243E+00
1988	0.142146E+04	0.142901E+04	-0.530002E-02
1989	0.391253E+04	0.196840E+04	0.686965E+00
1990	0.343402E+04	0.135529E+04	0.929717E+00
1991	0.163257E+04	0.813609E+03	0.696430E+00
1992	0.402512E+04	0.156605E+04	0.943998E+00
1993	N/A	0.583283E+03	N/A
1994	N/A	0.766882E+03	N/A
1995	0.942949E+03	0.499329E+03	0.635747E+00
1996	0.689619E+03	0.312780E+03	0.790638E+00
1997	0.745915E+03	0.531829E+03	0.338290E+00
1998	0.942949E+03	0.846287E+03	0.108153E+00
1999	0.450363E+03	0.394250E+03	0.133070E+00
2000	0.619250E+03	0.992090E+03	-0.471305E+00
2001	0.844432E+02	0.484833E+03	-0.174773E+01
2002	0.121746E+03	0.228646E+03	-0.630241E+00
2003	0.313603E+02	0.425975E+03	-0.260884E+01
2004	0.134499E+03	0.157843E+03	-0.160049E+00
2005	0.188003E+04	0.108215E+04	0.552337E+00
2006	0.527756E+02	0.235531E+03	-0.149579E+01
2007	0.730710E+03	0.573875E+03	0.241605E+00
2008	0.454928E+03	0.567047E+03	-0.220303E+00

Survey Index: 19 Tag: sp_can AGE = 3
 Time = JAN-1 Type = NUMBER
 Catchability = 0.327191E+00 % Variance Contribution = 1.1512
 Residual = LN(Observed) - LN(Predicted)

Year	Observed	Predicted	Residual
1978	N/A	0.828862E+04	N/A
1979	N/A	0.113792E+04	N/A
1980	N/A	0.559736E+04	N/A
1981	N/A	0.437466E+04	N/A
1982	N/A	0.379245E+04	N/A
1983	N/A	0.669854E+04	N/A
1984	N/A	0.264883E+04	N/A
1985	N/A	0.187236E+04	N/A
1986	0.395475E+04	0.411233E+04	-0.390703E-01
1987	0.130887E+04	0.159713E+04	-0.199044E+00
1988	0.655842E+04	0.723462E+04	-0.981279E-01
1989	0.194219E+04	0.320741E+04	-0.501645E+00
1990	0.531992E+04	0.460351E+04	0.144640E+00
1991	0.258959E+04	0.207114E+04	0.223403E+00
1992	0.249107E+04	0.164336E+04	0.415969E+00
1993	N/A	0.286260E+04	N/A
1994	N/A	0.114085E+04	N/A
1995	0.211108E+04	0.191174E+04	0.991842E-01
1996	0.325106E+04	0.117041E+04	0.102163E+01

1997	0.774062E+03	0.768933E+03	0.664815E-02
1998	0.133702E+04	0.124955E+04	0.676540E-01
1999	0.209701E+04	0.203882E+04	0.281383E-01
2000	0.147776E+04	0.970934E+03	0.420021E+00
2001	0.900727E+03	0.242953E+04	-0.992251E+00
2002	0.805617E+03	0.111117E+04	-0.321562E+00
2003	0.419145E+03	0.590697E+03	-0.343086E+00
2004	0.551716E+03	0.110321E+04	-0.692945E+00
2005	0.661996E+03	0.410309E+03	0.478347E+00
2006	0.197858E+04	0.284606E+04	-0.363554E+00
2007	0.132932E+04	0.622267E+03	0.759053E+00
2008	0.125982E+04	0.141110E+04	-0.113402E+00

Survey Index: 20 Tag: sp_can AGE = 4
Time = JAN-1 Type = NUMBER
Catchability = 0.615292E+00 % Variance Contribution = 1.7549
Residual = LN(Observed) - LN(Predicted)

Year	Observed	Predicted	Residual
1978	N/A	0.471337E+04	N/A
1979	N/A	0.828653E+04	N/A
1980	N/A	0.122511E+04	N/A
1981	N/A	0.533404E+04	N/A
1982	N/A	0.412317E+04	N/A
1983	N/A	0.339632E+04	N/A
1984	N/A	0.549839E+04	N/A
1985	N/A	0.216105E+04	N/A
1986	0.520733E+03	0.126931E+04	-0.890991E+00
1987	0.153405E+04	0.380925E+04	-0.909520E+00
1988	0.816284E+03	0.162246E+04	-0.686938E+00
1989	0.401105E+04	0.652844E+04	-0.487115E+00
1990	0.292736E+04	0.326412E+04	-0.108889E+00
1991	0.302588E+04	0.412773E+04	-0.310527E+00
1992	0.112591E+04	0.127707E+04	-0.125982E+00
1993	N/A	0.127372E+04	N/A
1994	N/A	0.197765E+04	N/A
1995	0.121035E+04	0.907944E+03	0.287484E+00
1996	0.565769E+04	0.215326E+04	0.966034E+00
1997	0.175923E+04	0.125692E+04	0.336216E+00
1998	0.492585E+03	0.770204E+03	-0.446988E+00
1999	0.153405E+04	0.120124E+04	0.244553E+00
2000	0.551695E+04	0.202346E+04	0.100301E+01
2001	0.591102E+03	0.108517E+04	-0.607499E+00
2002	0.288708E+04	0.227029E+04	0.240336E+00
2003	0.912160E+03	0.105865E+04	-0.148936E+00
2004	0.595577E+03	0.685744E+03	-0.140973E+00
2005	0.409251E+04	0.145775E+04	0.103227E+01
2006	0.925621E+03	0.519930E+03	0.576770E+00
2007	0.413611E+04	0.391436E+04	0.551031E-01
2008	0.835776E+03	0.739357E+03	0.122580E+00

Survey Index: 21 Tag: sp_can AGE = 5
Time = JAN-1 Type = NUMBER
Catchability = 0.949463E+00 % Variance Contribution = 1.5410
Residual = LN(Observed) - LN(Predicted)

Year	Observed	Predicted	Residual
1978	N/A	0.281691E+04	N/A
1979	N/A	0.388570E+04	N/A
1980	N/A	0.656692E+04	N/A
1981	N/A	0.108321E+04	N/A
1982	N/A	0.445147E+04	N/A
1983	N/A	0.267443E+04	N/A
1984	N/A	0.202025E+04	N/A
1985	N/A	0.411652E+04	N/A
1986	0.914801E+03	0.129830E+04	-0.350102E+00
1987	0.478511E+03	0.873224E+03	-0.601512E+00
1988	0.143553E+04	0.296617E+04	-0.725735E+00
1989	0.506659E+03	0.113749E+04	-0.808738E+00
1990	0.544658E+04	0.463365E+04	0.161644E+00
1991	0.147776E+04	0.245379E+04	-0.507108E+00
1992	0.137924E+04	0.253621E+04	-0.609140E+00
1993	N/A	0.707464E+03	N/A
1994	N/A	0.576156E+03	N/A
1995	0.844432E+03	0.824164E+03	0.242937E-01
1996	0.153405E+04	0.578964E+03	0.974426E+00
1997	0.173108E+04	0.164040E+04	0.538060E-01
1998	0.492585E+03	0.723769E+03	-0.384805E+00
1999	0.577028E+03	0.553058E+03	0.424293E-01
2000	0.240663E+04	0.794152E+03	0.110871E+01
2001	0.156220E+04	0.157255E+04	-0.660507E-02
2002	0.961543E+03	0.732982E+03	0.271418E+00
2003	0.170676E+04	0.158059E+04	0.768030E-01
2004	0.634621E+03	0.658708E+03	-0.372520E-01
2005	0.159149E+04	0.644363E+03	0.904163E+00
2006	0.229716E+04	0.134819E+04	0.532914E+00
2007	0.545841E+03	0.479154E+03	0.130305E+00
2008	0.306929E+04	0.394071E+04	-0.249915E+00

Survey Index: 22 Tag: sp_can AGE = 6
 Time = JAN-1 Type = NUMBER
 Catchability = 0.112928E+01 % Variance Contribution = 3.0804
 Residual = LN(Observed) - LN(Predicted)

Year	Observed	Predicted	Residual
1978	N/A	0.142722E+04	N/A
1979	N/A	0.183433E+04	N/A
1980	N/A	0.256064E+04	N/A
1981	N/A	0.390111E+04	N/A
1982	N/A	0.732478E+03	N/A
1983	N/A	0.227596E+04	N/A
1984	N/A	0.143731E+04	N/A
1985	N/A	0.103475E+04	N/A
1986	0.619250E+03	0.189493E+04	-0.111843E+01
1987	0.168886E+03	0.733207E+03	-0.146820E+01
1988	0.182960E+03	0.546837E+03	-0.109488E+01
1989	0.591102E+03	0.130202E+04	-0.789687E+00
1990	0.591102E+03	0.719250E+03	-0.196220E+00
1991	0.184368E+04	0.222128E+04	-0.186324E+00

1992	0.844432E+03	0.940613E+03	-0.107868E+00
1993	N/A	0.962935E+03	N/A
1994	N/A	0.213184E+03	N/A
1995	0.267403E+03	0.136609E+03	0.671633E+00
1996	0.111183E+04	0.416764E+03	0.981247E+00
1997	0.379994E+03	0.304972E+03	0.219935E+00
1998	0.394068E+03	0.708683E+03	-0.586884E+00
1999	0.365920E+03	0.316577E+03	0.144849E+00
2000	0.109776E+04	0.249864E+03	0.148011E+01
2001	0.731841E+03	0.454010E+03	0.477443E+00
2002	0.171816E+04	0.825808E+03	0.732647E+00
2003	0.447151E+03	0.345445E+03	0.258062E+00
2004	0.545454E+03	0.624065E+03	-0.134636E+00
2005	0.721660E+03	0.325147E+03	0.797277E+00
2006	0.982657E+03	0.480720E+03	0.714976E+00
2007	0.851245E+03	0.941445E+03	-0.100716E+00
2008	0.196496E+03	0.393458E+03	-0.694333E+00

Survey Index: 23 Tag: sp_can AGE = 7
Time = JAN-1 Type = NUMBER
Catchability = 0.121718E+01 % Variance Contribution = 4.1028
Residual = LN(Observed) - LN(Predicted)

Year	Observed	Predicted	Residual
1978	N/A	0.147506E+04	N/A
1979	N/A	0.106385E+04	N/A
1980	N/A	0.112711E+04	N/A
1981	N/A	0.119019E+04	N/A
1982	N/A	0.191158E+04	N/A
1983	N/A	0.323416E+03	N/A
1984	N/A	0.119477E+04	N/A
1985	N/A	0.659020E+03	N/A
1986	0.365920E+03	0.375098E+03	-0.247723E-01
1987	0.309625E+03	0.100126E+04	-0.117366E+01
1988	0.112591E+03	0.374722E+03	-0.120242E+01
1989	0.703693E+02	0.239312E+03	-0.122401E+01
1990	0.130887E+04	0.568382E+03	0.834124E+00
1991	0.225182E+03	0.383264E+03	-0.531815E+00
1992	0.605176E+03	0.781756E+03	-0.256023E+00
1993	N/A	0.344401E+03	N/A
1994	N/A	0.271637E+03	N/A
1995	0.562954E+02	0.822586E+02	-0.379256E+00
1996	0.464437E+03	0.756000E+02	0.181537E+01
1997	0.844432E+02	0.168263E+03	-0.689450E+00
1998	0.985170E+02	0.109107E+03	-0.102100E+00
1999	0.211108E+03	0.315315E+03	-0.401203E+00
2000	0.562954E+03	0.142570E+03	0.137336E+01
2001	0.365920E+03	0.124643E+03	0.107696E+01
2002	0.563812E+03	0.204477E+03	0.101427E+01
2003	0.474404E+03	0.325632E+03	0.376289E+00
2004	0.103828E+03	0.135581E+03	-0.266834E+00
2005	0.583521E+03	0.275688E+03	0.749810E+00
2006	0.283568E+03	0.171368E+03	0.503640E+00
2007	0.135474E+03	0.346628E+03	-0.939474E+00
2008	0.396500E+03	0.689165E+03	-0.552804E+00

Survey Index: 24 Tag: sp_can AGE = 8
Time = JAN-1 Type = NUMBER
Catchability = 0.128152E+01 % Variance Contribution = 4.6778
Residual = LN(Observed) - LN(Predicted)

Year	Observed	Predicted	Residual
1978	N/A	0.105050E+03	N/A
1979	N/A	0.993891E+03	N/A
1980	N/A	0.733091E+03	N/A
1981	N/A	0.492948E+03	N/A
1982	N/A	0.548181E+03	N/A
1983	N/A	0.838180E+03	N/A
1984	N/A	0.170165E+03	N/A
1985	N/A	0.514539E+03	N/A
1986	0.562954E+02	0.262656E+03	-0.154023E+01
1987	0.112591E+03	0.224954E+03	-0.692134E+00
1988	0.239256E+03	0.544524E+03	-0.822379E+00
1989	0.140739E+03	0.151178E+03	-0.715569E-01
1990	0.168886E+03	0.112989E+03	0.401936E+00
1991	0.309625E+03	0.227711E+03	0.307283E+00
1992	0.168886E+03	0.168605E+03	0.166526E-02
1993	N/A	0.267930E+03	N/A
1994	N/A	0.946027E+02	N/A
1995	0.703693E+02	0.682438E+02	0.306702E-01
1996	0.112591E+03	0.463085E+02	0.888436E+00
1997	0.422216E+02	0.445762E+02	-0.542687E-01
1998	0.281477E+02	0.380876E+02	-0.302422E+00
1999	0.140739E+02	0.480267E+02	-0.122744E+01
2000	0.337773E+03	0.107833E+03	0.114179E+01
2001	0.239256E+03	0.697970E+02	0.123194E+01
2002	0.232375E+03	0.449052E+02	0.164380E+01
2003	0.227599E+03	0.794826E+02	0.105204E+01
2004	0.165354E+03	0.118170E+03	0.335962E+00
2005	0.188549E+02	0.504074E+02	-0.983364E+00
2006	0.260250E+03	0.139762E+03	0.621702E+00
2007	0.106609E+03	0.111769E+03	-0.472670E-01
2008	0.412168E+02	0.280063E+03	-0.191617E+01

Survey Index: 25 Tag: us0aut AGE = 1
Time = JAN-1 Type = NUMBER
Catchability = 0.172164E-01 % Variance Contribution = 10.9577
Residual = LN(Observed) - LN(Predicted)

Year	Observed	Predicted	Residual
1978	0.207096E+03	0.494197E+03	-0.869750E+00
1979	0.540008E+03	0.446637E+03	0.189839E+00
1980	0.156415E+03	0.394488E+03	-0.925075E+00
1981	0.382090E+03	0.790070E+03	-0.726465E+00
1982	0.356545E+03	0.341967E+03	0.417457E-01
1983	0.494518E+03	0.194637E+03	0.932448E+00
1984	0.175253E+04	0.499630E+03	0.125495E+01
1985	0.244663E+03	0.165540E+03	0.390670E+00
1986	0.136867E+04	0.766224E+03	0.580118E+00
1987	0.103958E+03	0.308140E+03	-0.108657E+01
1988	0.278269E+03	0.427902E+03	-0.430308E+00
1989	0.750656E+03	0.307291E+03	0.893152E+00
1990	0.342611E+03	0.175681E+03	0.667927E+00
1991	0.214610E+03	0.340822E+03	-0.462538E+00
1992	0.553259E+02	0.128609E+03	-0.843535E+00
1993	0.479491E+02	0.169986E+03	-0.126557E+01
1994	0.243707E+03	0.108775E+03	0.806689E+00
1995	0.912536E+02	0.676272E+02	0.299633E+00
1996	0.218435E+03	0.115178E+03	0.640012E+00
1997	0.295071E+02	0.183728E+03	-0.182883E+01
1998	0.874290E+01	0.856708E+02	-0.228227E+01
1999	0.957616E+02	0.213463E+03	-0.801601E+00
2000	0.957616E+02	0.106031E+03	-0.101874E+00
2001	0.266384E+02	0.492100E+02	-0.613743E+00
2002	0.387964E+02	0.919039E+02	-0.862416E+00
2003	0.319661E+03	0.341411E+02	0.223676E+01
2004	0.446569E+03	0.232811E+03	0.651366E+00
2005	0.230224E+04	0.506965E+02	0.381578E+01
2006	0.711723E+02	0.123577E+03	-0.551757E+00
2007	0.135787E+03	0.121692E+03	0.109597E+00
2008	0.102319E+03	0.888081E+02	0.141615E+00

Survey Index: 26 Tag: us1aut AGE = 2
Time = JAN-1 Type = NUMBER
Catchability = 0.746671E-01 % Variance Contribution = 3.3279
Residual = LN(Observed) - LN(Predicted)

Year	Observed	Predicted	Residual
1978	0.323486E+03	0.351454E+03	-0.829237E-01
1979	0.252095E+04	0.174458E+04	0.368122E+00
1980	0.222000E+04	0.156710E+04	0.348283E+00
1981	0.112004E+04	0.137784E+04	-0.207148E+00
1982	0.481540E+04	0.272320E+04	0.570011E+00
1983	0.788633E+03	0.116200E+04	-0.387597E+00
1984	0.116048E+04	0.648927E+03	0.581266E+00
1985	0.260797E+04	0.175515E+04	0.396015E+00
1986	0.247669E+03	0.575936E+03	-0.843904E+00
1987	0.311314E+04	0.266892E+04	0.153959E+00
1988	0.565144E+03	0.108715E+04	-0.654233E+00

1989	0.119490E+04	0.149749E+04	-0.225729E+00
1990	0.382281E+04	0.103106E+04	0.131040E+01
1991	0.496704E+03	0.618968E+03	-0.220060E+00
1992	0.556811E+03	0.119140E+04	-0.760661E+00
1993	0.563368E+03	0.443743E+03	0.238687E+00
1994	0.132495E+04	0.583419E+03	0.820226E+00
1995	0.554079E+03	0.379873E+03	0.377469E+00
1996	0.334278E+03	0.237953E+03	0.339897E+00
1997	0.327721E+03	0.404598E+03	-0.210734E+00
1998	0.322666E+03	0.643829E+03	-0.690814E+00
1999	0.458317E+03	0.299933E+03	0.424002E+00
2000	0.190840E+03	0.754750E+03	-0.137495E+01
2001	0.780027E+03	0.368846E+03	0.748950E+00
2002	0.643420E+02	0.173947E+03	-0.994536E+00
2003	0.652982E+03	0.324068E+03	0.700596E+00
2004	0.227178E+03	0.120082E+03	0.637555E+00
2005	0.101745E+04	0.823264E+03	0.211778E+00
2006	0.755438E+02	0.179185E+03	-0.863704E+00
2007	0.590826E+03	0.436586E+03	0.302536E+00
2008	0.156688E+03	0.431392E+03	-0.101276E+01

Survey Index: 27 Tag: us2aut AGE = 3
 Time = JAN-1 Type = NUMBER
 Catchability = 0.131211E+00 % Variance Contribution = 3.2794
 Residual = LN(Observed) - LN(Predicted)

Year	Observed	Predicted	Residual
1978	0.469041E+04	0.332391E+04	0.344377E+00
1979	0.534407E+03	0.456331E+03	0.157939E+00
1980	0.229090E+04	0.224466E+04	0.203913E-01
1981	0.769918E+03	0.175433E+04	-0.823558E+00
1982	0.307366E+04	0.152085E+04	0.703597E+00
1983	0.260851E+04	0.268625E+04	-0.293673E-01
1984	0.148806E+04	0.106224E+04	0.337098E+00
1985	0.931388E+03	0.750854E+03	0.215464E+00
1986	0.115105E+04	0.164913E+04	-0.359571E+00
1987	0.175540E+03	0.640482E+03	-0.129435E+01
1988	0.184802E+04	0.290123E+04	-0.451021E+00
1989	0.596973E+03	0.128624E+04	-0.767604E+00
1990	0.142946E+04	0.184610E+04	-0.255782E+00
1991	0.221905E+04	0.830569E+03	0.982722E+00
1992	0.239336E+03	0.659023E+03	-0.101289E+01
1993	0.129627E+04	0.114796E+04	0.121497E+00
1994	0.726204E+03	0.457505E+03	0.462042E+00
1995	0.907481E+03	0.766649E+03	0.168644E+00
1996	0.247341E+04	0.469359E+03	0.166199E+01
1997	0.267477E+03	0.308358E+03	-0.142230E+00
1998	0.438372E+03	0.501098E+03	-0.133732E+00
1999	0.140186E+04	0.817610E+03	0.539171E+00
2000	0.210648E+03	0.389365E+03	-0.614328E+00
2001	0.734673E+03	0.974293E+03	-0.282286E+00
2002	0.520200E+03	0.445603E+03	0.154784E+00
2003	0.965812E+03	0.236882E+03	0.140541E+01
2004	0.422389E+03	0.442410E+03	-0.463086E-01
2005	0.185512E+03	0.164543E+03	0.119952E+00

2006	0.791502E+03	0.114133E+04	-0.366017E+00
2007	0.221030E+03	0.249542E+03	-0.121328E+00
2008	0.282504E+03	0.565883E+03	-0.694695E+00

Survey Index: 28 Tag: us3aut AGE = 4
 Time = JAN-1 Type = NUMBER
 Catchability = 0.158575E+00 % Variance Contribution = 5.0712
 Residual = LN(Observed) - LN(Predicted)

Year	Observed	Predicted	Residual
1978	0.943682E+03	0.121474E+04	-0.252498E+00
1979	0.554311E+04	0.213562E+04	0.953796E+00
1980	0.221440E+03	0.315739E+03	-0.354763E+00
1981	0.105720E+04	0.137470E+04	-0.262612E+00
1982	0.212971E+04	0.106263E+04	0.695234E+00
1983	0.330316E+03	0.875307E+03	-0.974525E+00
1984	0.101117E+04	0.141706E+04	-0.337479E+00
1985	0.126867E+04	0.556951E+03	0.823248E+00
1986	0.911170E+02	0.327130E+03	-0.127821E+01
1987	0.449438E+03	0.981729E+03	-0.781318E+00
1988	0.147536E+03	0.418145E+03	-0.104176E+01
1989	0.123466E+04	0.168253E+04	-0.309504E+00
1990	0.220074E+03	0.841238E+03	-0.134091E+01
1991	0.247819E+04	0.106381E+04	0.845672E+00
1992	0.374577E+03	0.329131E+03	0.129341E+00
1993	0.238106E+03	0.328268E+03	-0.321112E+00
1994	0.522659E+03	0.509685E+03	0.251356E-01
1995	0.592055E+03	0.233998E+03	0.928289E+00
1996	0.170554E+04	0.554943E+03	0.112277E+01
1997	0.566100E+03	0.323936E+03	0.558226E+00
1998	0.149312E+03	0.198499E+03	-0.284748E+00
1999	0.480584E+03	0.309588E+03	0.439760E+00
2000	0.422936E+03	0.521492E+03	-0.209474E+00
2001	0.963080E+02	0.279672E+03	-0.106606E+01
2002	0.627027E+03	0.585106E+03	0.691969E-01
2003	0.190704E+04	0.272838E+03	0.194443E+01
2004	0.273897E+03	0.176732E+03	0.438121E+00
2005	0.970047E+03	0.375694E+03	0.948569E+00
2006	0.176087E+03	0.133998E+03	0.273153E+00
2007	0.702434E+03	0.100882E+04	-0.361984E+00
2008	0.688500E+02	0.190549E+03	-0.101798E+01

Survey Index: 29 Tag: us4aut AGE = 5
Time = JAN-1 Type = NUMBER
Catchability = 0.122922E+00 % Variance Contribution = 8.0096
Residual = LN(Observed) - LN(Predicted)

Year	Observed	Predicted	Residual
1978	0.345343E+03	0.364691E+03	-0.545130E-01
1979	0.131635E+04	0.503063E+03	0.961900E+00
1980	0.230388E+04	0.850186E+03	0.996895E+00
1981	0.717188E+02	0.140237E+03	-0.670582E+00
1982	0.804616E+03	0.576309E+03	0.333721E+00
1983	0.926196E+02	0.346245E+03	-0.131865E+01
1984	0.943955E+02	0.261551E+03	-0.101914E+01
1985	0.112715E+04	0.532945E+03	0.749026E+00
1986	0.144120E+03	0.168084E+03	-0.153813E+00
1987	0.112018E+02	0.113052E+03	-0.231177E+01
1988	0.273624E+03	0.384015E+03	-0.338927E+00
1989	0.819643E+02	0.147265E+03	-0.585948E+00
1990	0.692735E+03	0.599895E+03	0.143892E+00
1991	0.563368E+03	0.317679E+03	0.572891E+00
1992	0.416652E+02	0.328351E+03	-0.206442E+01
1993	0.136607E+03	0.915918E+02	0.399767E+00
1994	0.225402E+02	0.745921E+02	-0.119673E+01
1995	0.209555E+03	0.106700E+03	0.674963E+00
1996	0.119121E+03	0.749556E+02	0.463247E+00
1997	0.195348E+03	0.212375E+03	-0.835692E-01
1998	0.176496E+03	0.937027E+02	0.633173E+00
1999	0.561455E+02	0.716016E+02	-0.243171E+00
2000	0.348212E+03	0.102815E+03	0.121988E+01
2001	0.107646E+03	0.203590E+03	-0.637258E+00
2002	0.811446E+02	0.948955E+02	-0.156544E+00
2003	0.222260E+04	0.204631E+03	0.238523E+01
2004	0.212561E+03	0.852796E+02	0.913292E+00
2005	0.344250E+03	0.834225E+02	0.141745E+01
2006	0.239882E+03	0.174543E+03	0.317976E+00
2007	0.461732E+02	0.620337E+02	-0.295279E+00
2008	0.177999E+03	0.510184E+03	-0.105299E+01

Survey Index: 30 Tag: us5aut AGE = 6
Time = JAN-1 Type = NUMBER
Catchability = 0.143092E+00 % Variance Contribution = 6.4563
Residual = LN(Observed) - LN(Predicted)

Year	Observed	Predicted	Residual
1978	0.236467E+03	0.180843E+03	0.268179E+00
1979	0.458317E+03	0.232428E+03	0.678982E+00
1980	0.437962E+03	0.324458E+03	0.299976E+00
1981	0.361736E+03	0.494310E+03	-0.312249E+00
1982	0.737679E+02	0.928123E+02	-0.229656E+00
1983	0.157371E+03	0.288387E+03	-0.605693E+00
1984	0.448071E+02	0.182121E+03	-0.140231E+01
1985	0.330589E+02	0.131113E+03	-0.137777E+01
1986	0.104641E+03	0.240107E+03	-0.830548E+00

1987	0.665277E+02	0.929047E+02	-0.333956E+00
1988	0.382500E+02	0.692898E+02	-0.594154E+00
1989	0.264608E+03	0.164980E+03	0.472427E+00
1990	0.747241E+02	0.911362E+02	-0.198552E+00
1991	0.390013E+03	0.281459E+03	0.326194E+00
1992	0.396161E+02	0.119185E+03	-0.110144E+01
1993	0.596973E+02	0.122014E+03	-0.714846E+00
1994	0.345616E+02	0.270126E+02	0.246441E+00
1995	0.927563E+02	0.173098E+02	0.167870E+01
1996	0.739045E+02	0.528082E+02	0.336107E+00
1997	0.815545E+02	0.386431E+02	0.746903E+00
1998	0.663911E+02	0.897972E+02	-0.301991E+00
1999	0.483589E+02	0.401135E+02	0.186936E+00
2000	0.118985E+03	0.316603E+02	0.132393E+01
2001	0.418018E+02	0.575277E+02	-0.319327E+00
2002	0.745875E+02	0.104638E+03	-0.338536E+00
2003	0.161196E+03	0.437714E+02	0.130364E+01
2004	0.112564E+03	0.790753E+02	0.353124E+00
2005	0.439192E+03	0.411994E+02	0.236651E+01
2006	0.353813E+02	0.609121E+02	-0.543248E+00
2007	0.170486E+03	0.119291E+03	0.357089E+00
2008	0.874290E+01	0.498551E+02	-0.174088E+01

Bootstrap Summary Report

Number of Bootstrap Repetitions Requested = 1000

Number of Bootstrap Repetitions Completed = 1000

Bootstrap Output Variable: Stock Estimates (2008)

	NLLS Estimate	Bootstrap Mean	Bootstrap Std Error	C.V. For NLLS Soln.
N 1	5158.	6533.	4768.	0.7298
N 2	5778.	6266.	2534.	0.4044
N 3	4313.	4506.	1340.	0.2974
N 4	1202.	1248.	338.	0.2705
N 5	4150.	4291.	1102.	0.2569
N 6	348.	366.	102.	0.2794
N 7	566.	591.	173.	0.2934
N 8	219.	225.	71.	0.3143

	Bias Estimate	Bias Std. Error	Per Cent Bias	NLLS Estimate Corrected For Bias	C.V. For Corrected Estimate
N 1	1375.	157.	26.6579	3783.	1.2603
N 2	489.	82.	8.4565	5289.	0.4792
N 3	194.	43.	4.4871	4119.	0.3254
N 4	47.	11.	3.8994	1155.	0.2925
N 5	141.	35.	3.3966	4009.	0.2749
N 6	17.	3.	4.9691	331.	0.3086
N 7	24.	6.	4.3101	542.	0.3198
N 8	6.	2.	2.8435	212.	0.3327

	LOWER 80. % CI	UPPER 80. % CI
N 1	2262.	12026.
N 2	3513.	9413.
N 3	2952.	6223.
N 4	873.	1747.
N 5	3037.	5708.
N 6	248.	498.
N 7	378.	829.
N 8	139.	320.

Bootstrap Output Variable: Catchability Estimates

	NLLS Estimate	Bootstrap Mean	Bootstrap Std Error	C.V. For NLLS Soln.
Q 1	0.219439E-01	0.224593E-01	0.453637E-02	0.2020
Q 2	0.919973E-01	0.918516E-01	0.740087E-02	0.0806
Q 3	0.186189E+00	0.186801E+00	0.193689E-01	0.1037
Q 4	0.316089E+00	0.318776E+00	0.461832E-01	0.1449
Q 5	0.402164E+00	0.405661E+00	0.630944E-01	0.1555
Q 6	0.408966E+00	0.411188E+00	0.605475E-01	0.1473
Q 7	0.427224E+00	0.434695E+00	0.805680E-01	0.1853
Q 8	0.517786E+00	0.522703E+00	0.856230E-01	0.1638
Q 9	0.141338E-01	0.187569E-01	0.153604E-01	0.8189
Q 10	0.899870E-01	0.908999E-01	0.203578E-01	0.2240
Q 11	0.198731E+00	0.205097E+00	0.478757E-01	0.2334
Q 12	0.177261E+00	0.178899E+00	0.226346E-01	0.1265
Q 13	0.216299E+00	0.223388E+00	0.550011E-01	0.2462
Q 14	0.207689E+00	0.209908E+00	0.352836E-01	0.1681
Q 15	0.300243E+00	0.322393E+00	0.124785E+00	0.3871
Q 16	0.291472E+00	0.340999E+00	0.192048E+00	0.5632
Q 17	0.209249E-01	0.214531E-01	0.589108E-02	0.2746
Q 18	0.981470E-01	0.990854E-01	0.214245E-01	0.2162
Q 19	0.327191E+00	0.327519E+00	0.339873E-01	0.1038
Q 20	0.615292E+00	0.621553E+00	0.782073E-01	0.1258
Q 21	0.949463E+00	0.957399E+00	0.112465E+00	0.1175
Q 22	0.112928E+01	0.114260E+01	0.190599E+00	0.1668
Q 23	0.121718E+01	0.123764E+01	0.248911E+00	0.2011
Q 24	0.128152E+01	0.129879E+01	0.274911E+00	0.2117
Q 25	0.172164E-01	0.175862E-01	0.371772E-02	0.2114
Q 26	0.746671E-01	0.753834E-01	0.859667E-02	0.1140
Q 27	0.131211E+00	0.132257E+00	0.151867E-01	0.1148
Q 28	0.158575E+00	0.159982E+00	0.228937E-01	0.1431
Q 29	0.122922E+00	0.124354E+00	0.224444E-01	0.1805
Q 30	0.143092E+00	0.145093E+00	0.237031E-01	0.1634

	Bias Estimate	Bias Std. Error	Per Cent Bias	NLLS Estimate Corrected For Bias	C.V. For Corrected Estimate
Q 1	0.5154E-03	0.1444E-03	2.3488	0.2143E-01	0.2117
Q 2	-0.1457E-03	0.2341E-03	-0.1583	0.9214E-01	0.0803
Q 3	0.6121E-03	0.6128E-03	0.3288	0.1856E+00	0.1044
Q 4	0.2687E-02	0.1463E-02	0.8502	0.3134E+00	0.1474
Q 5	0.3497E-02	0.1998E-02	0.8695	0.3987E+00	0.1583
Q 6	0.2222E-02	0.1916E-02	0.5433	0.4067E+00	0.1489
Q 7	0.7471E-02	0.2559E-02	1.7488	0.4198E+00	0.1919
Q 8	0.4917E-02	0.2712E-02	0.9496	0.5129E+00	0.1669
Q 9	0.4623E-02	0.5073E-03	32.7102	0.9511E-02	1.6151
Q 10	0.9128E-03	0.6444E-03	1.0144	0.8907E-01	0.2285
Q 11	0.6365E-02	0.1527E-02	3.2030	0.1924E+00	0.2489
Q 12	0.1638E-02	0.7176E-03	0.9241	0.1756E+00	0.1289
Q 13	0.7089E-02	0.1754E-02	3.2772	0.2092E+00	0.2629
Q 14	0.2218E-02	0.1118E-02	1.0681	0.2055E+00	0.1717
Q 15	0.2215E-01	0.4008E-02	7.3772	0.2781E+00	0.4487
Q 16	0.4953E-01	0.6272E-02	16.9918	0.2419E+00	0.7938
Q 17	0.5282E-03	0.1870E-03	2.5244	0.2040E-01	0.2888
Q 18	0.9385E-03	0.6782E-03	0.9562	0.9721E-01	0.2204
Q 19	0.3276E-03	0.1075E-02	0.1001	0.3269E+00	0.1040
Q 20	0.6261E-02	0.2481E-02	1.0175	0.6090E+00	0.1284
Q 21	0.7936E-02	0.3565E-02	0.8359	0.9415E+00	0.1194
Q 22	0.1332E-01	0.6042E-02	1.1792	0.1116E+01	0.1708
Q 23	0.2046E-01	0.7898E-02	1.6808	0.1197E+01	0.2080
Q 24	0.1728E-01	0.8711E-02	1.3481	0.1264E+01	0.2175
Q 25	0.3698E-03	0.1181E-03	2.1481	0.1685E-01	0.2207
Q 26	0.7163E-03	0.2728E-03	0.9593	0.7395E-01	0.1162
Q 27	0.1046E-02	0.4814E-03	0.7972	0.1302E+00	0.1167
Q 28	0.1408E-02	0.7253E-03	0.8877	0.1572E+00	0.1457
Q 29	0.1432E-02	0.7112E-03	1.1650	0.1215E+00	0.1847
Q 30	0.2001E-02	0.7522E-03	1.3984	0.1411E+00	0.1680

	LOWER	UPPER
	80. % CI	80. % CI
Q 1	0.171080E-01	0.284747E-01
Q 2	0.824644E-01	0.101632E+00
Q 3	0.162848E+00	0.211664E+00
Q 4	0.261463E+00	0.379759E+00
Q 5	0.328721E+00	0.483634E+00
Q 6	0.340594E+00	0.492365E+00
Q 7	0.337448E+00	0.537725E+00
Q 8	0.421175E+00	0.634985E+00
Q 9	0.553354E-02	0.371053E-01
Q 10	0.667041E-01	0.117456E+00
Q 11	0.150990E+00	0.267690E+00
Q 12	0.150555E+00	0.208511E+00
Q 13	0.161493E+00	0.297084E+00
Q 14	0.166932E+00	0.258730E+00
Q 15	0.188704E+00	0.478061E+00
Q 16	0.159412E+00	0.573340E+00
Q 17	0.145844E-01	0.292114E-01
Q 18	0.735690E-01	0.127626E+00
Q 19	0.284556E+00	0.370216E+00
Q 20	0.528958E+00	0.725873E+00
Q 21	0.816656E+00	0.110392E+01
Q 22	0.894573E+00	0.138485E+01
Q 23	0.936371E+00	0.155873E+01
Q 24	0.978545E+00	0.164180E+01
Q 25	0.130753E-01	0.225537E-01
Q 26	0.643867E-01	0.868744E-01
Q 27	0.112881E+00	0.152329E+00
Q 28	0.131884E+00	0.190578E+00
Q 29	0.968790E-01	0.154540E+00
Q 30	0.115862E+00	0.177230E+00

Bootstrap Output Variable: Fishing Mortality (2007)

	NLLS Estimate	Bootstrap Mean	Bootstrap Std Error	C.V. For NLLS Soln.
AGE 1	0.0017	0.0018	0.000684	0.3877
AGE 2	0.1044	0.1080	0.030238	0.2801
AGE 3	0.2591	0.2646	0.061457	0.2323
AGE 4	0.2271	0.2321	0.053591	0.2309
AGE 5	0.1705	0.1738	0.044442	0.2557
AGE 6	0.1869	0.1939	0.056194	0.2898
AGE 7	0.0647	0.0694	0.023411	0.3371
AGE 8	0.1407	0.1457	0.025088	0.1721
AGE 9	0.1407	0.1457	0.025088	0.1721
AGE 10	0.1407	0.1457	0.025088	0.1721

	Bias Estimate	Bias Std. Error	Per Cent Bias	NLLS Estimate Corrected For Bias	C.V. For Corrected Estimate
AGE 1	0.000109	0.000022	6.6054	0.0015	0.4425
AGE 2	0.003606	0.000963	3.4554	0.1008	0.3001
AGE 3	0.005418	0.001951	2.0909	0.2537	0.2422
AGE 4	0.005021	0.001702	2.2111	0.2221	0.2413
AGE 5	0.003348	0.001409	1.9636	0.1671	0.2659
AGE 6	0.007042	0.001791	3.7681	0.1798	0.3125
AGE 7	0.004697	0.000755	7.2536	0.0601	0.3898
AGE 8	0.005029	0.000809	3.5739	0.1357	0.1849
AGE 9	0.005029	0.000809	3.5739	0.1357	0.1849
AGE 10	0.005029	0.000809	3.5739	0.1357	0.1849

	LOWER 80. % CI	UPPER 80. % CI
AGE 1	0.001016	0.002715
AGE 2	0.073390	0.148701
AGE 3	0.185377	0.341005
AGE 4	0.170090	0.298353
AGE 5	0.121952	0.231915
AGE 6	0.131244	0.266855
AGE 7	0.044370	0.099813
AGE 8	0.116780	0.180193
AGE 9	0.116780	0.180193
AGE 10	0.116780	0.180193

Bootstrap Output Variable: Average F (2007) AGES 5 - 8

	NLLS Estimate	Bootstrap Mean	Bootstrap Std Error	C.V. For NLLS Soln.
AVG F	0.1407	0.1457	0.025088	0.1721
N WTD	0.1594	0.1587	0.028073	0.1769
B WTD	0.1534	0.1531	0.027092	0.1769
C WTD	0.1709	0.1765	0.035695	0.2022

	Bias Estimate	Bias Std. Error	Per Cent Bias	NLLS Estimate Corrected For Bias	C.V. For Corrected Estimate
AVG F	0.005029	0.000809	3.5739	0.1357	0.1849
N WTD	-0.000626	0.000888	-0.3929	0.1600	0.1755
B WTD	-0.000282	0.000857	-0.1841	0.1537	0.1763
C WTD	0.005617	0.001143	3.2863	0.1653	0.2159

	LOWER 80. % CI	UPPER 80. % CI
AVG F	0.116780	0.180193
N WTD	0.127188	0.197961
B WTD	0.122381	0.191581
C WTD	0.136571	0.225136

Bootstrap Output Variable: Biomass

JAN-1 Biomass (2008) Mean Biomass & SSB (2007)

	NLLS Estimate	Bootstrap Mean	Bootstrap Std Error	C.V. For NLLS Soln.
JAN-1	36930.	38830.	5418.	0.1395
MEAN	34654.	35969.	4702.	0.1307
SSB	25377.	26151.	3597.	0.1375

	Bias Estimate	Bias Std. Error	Per Cent Bias	NLLS Estimate Corrected For Bias	C.V. For Corrected Estimate
JAN-1	1899.	182.	5.1430	35031.	0.1547
MEAN	1315.	154.	3.7961	33338.	0.1410
SSB	774.	116.	3.0489	24604.	0.1462

	LOWER 80. % CI	UPPER 80. % CI
JAN-1	32236.	45859.
MEAN	30122.	42067.
SSB	21956.	30777.

Plus Group Diagnostic Report

Calculation Method Selected = Backward

Year	Population Backward	Population Forward	F Forward	F Backward	Ratio
1978	44.	44.	0.308259	0.308259	1.000000
1979	127.	131.	0.345514	0.359798	1.041340
1980	37.	103.	0.164657	0.541372	3.287884
1981	173.	244.	0.353951	0.544585	1.538590
1982	192.	333.	0.327151	0.655849	2.004726
1983	288.	268.	0.613105	0.558734	0.911319
1984	283.	200.	1.129093	0.657374	0.582214
1985	182.	213.	0.614331	0.772296	1.257135
1986	76.	116.	0.306033	0.510816	1.669156
1987	75.	145.	0.219497	0.475565	2.166617
1988	105.	149.	0.488756	0.781516	1.598990
1989	54.	110.	0.240156	0.559486	2.329678
1990	88.	142.	0.372456	0.689136	1.850247
1991	47.	101.	0.330944	0.908100	2.743969
1992	19.	76.	0.162994	0.926052	5.681498
1993	34.	74.	0.376019	1.153678	3.068139
1994	9.	59.	0.109812	1.238141	11.275120
1995	3.	55.	0.028722	0.615783	21.439721
1996	1.	50.	0.006627	0.653998	98.684231
1997	7.	52.	0.086785	0.850348	9.798357
1998	6.	46.	0.072801	0.741049	10.179071
1999	7.	39.	0.100418	0.774912	7.716849
2000	3.	33.	0.034158	0.539928	15.806849
2001	3.	31.	0.046971	0.632341	13.462251
2002	13.	39.	0.200182	0.754275	3.767954
2003	6.	35.	0.096275	0.850605	8.835135
2004	12.	30.	0.201696	0.636083	3.153673
2005	15.	32.	0.135933	0.311373	2.290637
2006	17.	45.	0.087321	0.243865	2.792736
2007	12.	46.	0.026732	0.105152	3.933531
2008	70.	98.	N/A	N/A	

Appendix A. Table A3. SPLIT MODEL VPA output and diagnostics for GB cod.

VPA Version 2.8.0

Model ID: Georges Bank Cod - spr 2008 Assessment TY 2008 sv swept split

Input File: C:\LOB\GBCOD\ASSESS_2008\VPA\TY07\10P_SWPT_SPLIT\10P-SWPT-SPLT_AUG_CORR_DFO.DAT

Date of Run: 05-AUG-2008

Time of Run: 12:24

Levenburg-Marquardt Algorithm Completed 9 Iterations
Residual Sum of Squares = 323.853

Number of Residuals = 595
Number of Parameters = 8
Degrees of Freedom = 587
Mean Squared Residual = 0.551709
Standard Deviation = 0.742771

Number of Years = 30
Number of Ages = 10
First Year = 1978
Youngest Age = 1
Oldest True Age = 9

Number of Survey Indices Available = 52
Number of Survey Indices Used in Estimate = 52

VPA Classic Method - Auto Estimated Q's

Stock Numbers Predicted in Terminal Year Plus One (2008)

Age	Stock Predicted	Std. Error	CV
1	4874.666	0.218662E+04	0.448568E+00
2	5751.749	0.182760E+04	0.317747E+00
3	3851.720	0.113398E+04	0.294410E+00
4	970.307	0.274066E+03	0.282453E+00
5	2929.571	0.803594E+03	0.274304E+00
6	157.359	0.498832E+02	0.317002E+00
7	237.651	0.866388E+02	0.364564E+00
8	80.692	0.313443E+02	0.388442E+00

Catchability Values for Each Survey Used in Estimate

INDEX	Catchability	Std. Error	CV
1	0.178394E-01	0.601117E-02	0.336960E+00
2	0.918544E-01	0.111156E-01	0.121014E+00
3	0.168705E+00	0.303091E-01	0.179657E+00
4	0.215614E+00	0.433017E-01	0.200829E+00
5	0.264241E+00	0.594130E-01	0.224844E+00

6	0.278657E+00	0.523770E-01	0.187962E+00
7	0.297561E+00	0.527492E-01	0.177272E+00
8	0.363074E+00	0.710421E-01	0.195668E+00
9	0.292985E-01	0.628344E-02	0.214463E+00
10	0.101150E+00	0.921209E-02	0.910737E-01
11	0.225276E+00	0.256921E-01	0.114047E+00
12	0.506259E+00	0.867519E-01	0.171359E+00
13	0.688799E+00	0.113946E+00	0.165426E+00
14	0.701770E+00	0.122594E+00	0.174693E+00
15	0.723118E+00	0.181470E+00	0.250954E+00
16	0.816798E+00	0.174300E+00	0.213394E+00
17	0.141338E-01	0.106855E-01	0.756029E+00
18	0.899870E-01	0.208708E-01	0.231931E+00
19	0.198731E+00	0.467107E-01	0.235044E+00
20	0.177261E+00	0.223604E-01	0.126144E+00
21	0.216299E+00	0.540535E-01	0.249901E+00
22	0.207689E+00	0.355707E-01	0.171269E+00
23	0.300243E+00	0.112587E+00	0.374986E+00
24	0.291472E+00	0.165071E+00	0.566335E+00
25	0.358799E-01	0.115005E-01	0.320529E+00
26	0.187587E+00	0.396148E-01	0.211181E+00
27	0.324684E+00	0.370155E-01	0.114005E+00
28	0.372132E+00	0.475039E-01	0.127653E+00
29	0.580779E+00	0.710335E-01	0.122307E+00
30	0.555873E+00	0.114979E+00	0.206844E+00
31	0.730017E+00	0.211842E+00	0.290188E+00
32	0.644843E-03	0.171054E-03	0.265264E+00
33	0.158633E-01	0.567279E-02	0.357605E+00
34	0.779414E-01	0.200113E-01	0.256748E+00
35	0.362628E+00	0.527704E-01	0.145522E+00
36	0.888325E+00	0.130864E+00	0.147315E+00
37	0.140774E+01	0.199374E+00	0.141627E+00
38	0.193422E+01	0.294172E+00	0.152088E+00
39	0.190133E+01	0.391504E+00	0.205911E+00
40	0.127804E-02	0.320091E-03	0.250454E+00
41	0.163752E-01	0.327145E-02	0.199780E+00
42	0.811005E-01	0.114794E-01	0.141545E+00
43	0.119082E+00	0.179800E-01	0.150989E+00
44	0.126944E+00	0.225861E-01	0.177922E+00
45	0.886514E-01	0.215241E-01	0.242795E+00
46	0.104097E+00	0.162056E-01	0.155678E+00
47	0.201548E-01	0.859432E-02	0.426415E+00
48	0.741493E-01	0.152083E-01	0.205104E+00
49	0.162972E+00	0.301554E-01	0.185035E+00
50	0.233271E+00	0.520419E-01	0.223096E+00
51	0.211986E+00	0.510959E-01	0.241035E+00
52	0.253043E+00	0.646169E-01	0.255360E+00

-- Non-Linear Least Squares Fit --
 Default Tolerances Used

Scaled Gradient Tolerance = 6.055454E-06
 Scaled Step Tolerance = 3.666853E-11
 Relative Function Tolerance = 3.666853E-11
 Absolute Function Tolerance = 4.930381E-32

VPA Method Options

- Catchability Values Estimated as an Analytic Function of N
- Catch Equation Used in Cohort Solution
- Plus Group Backward Calculation Method Used
- Rivard Weights Used for JAN-1 Biomass
- Rivard Weights Used for SSB Biomass
- Rivard Weights Calculation Used 5 Years for Terminal Year Plus One

- Heincke Rule Used in F-Oldest Calculation
- F-Oldest Calculation in Years Prior to Terminal Year
 Uses Stock Sizes in Ages 5 to 8
- Calculation of Population of Age 1 In Year 2008
 = Stock Estimate

Stock Estimates

Age 1
 Age 2
 Age 3
 Age 4
 Age 5
 Age 6
 Age 7
 Age 8

Full F in Terminal Year = 0.3025

F in Oldest True Age in Terminal Year = 0.3025

Full F Calculated Using Classic Method

Age	Input Partial Recruitment	Calc Partial Recruitment	Fishing Mortality	Used In Full F	Comments
1	0.010	0.004	0.0017	NO	Stock Estimate in
T+1					
2	0.100	0.292	0.1161	NO	Stock Estimate in
T+1					
3	0.390	0.785	0.3119	NO	Stock Estimate in
T+1					
4	0.740	0.775	0.3080	NO	Stock Estimate in
T+1					
5	1.000	0.865	0.3439	YES	Stock Estimate in
T+1					
6	1.000	1.000	0.3973	YES	Stock Estimate in
T+1					
7	1.000	0.418	0.1662	YES	Stock Estimate in
T+1					
8	1.000	0.761	0.3025	NO	Input PR * Full F
9	1.000	0.761	0.3025		Input PR * Full F

Catch At Age - Input Data

AGE	1978	1979	1980	1981	1982
1	151.6	279.2	339.9	1219.2	775.4
2	416.8	2242.7	4238.7	3910.7	10457.1
3	8109.1	953.6	5955.4	4738.2	4434.4
4	2429.6	4585.0	544.9	2685.5	2988.0
5	896.8	1206.9	2464.6	317.9	2039.8
6	178.4	449.8	983.0	1406.0	297.1
7	240.8	159.5	418.1	417.0	707.2
8	22.6	304.1	70.4	162.9	198.6
9	42.1	12.9	138.7	155.5	74.6
10	10.7	35.0	14.2	66.4	84.6
AGE	1983	1984	1985	1986	1987
1	626.2	280.9	176.0	768.3	103.8
2	5181.7	1547.7	7443.7	1594.1	7956.1
3	8753.3	3485.7	2942.2	4576.3	1515.5
4	2680.4	3328.4	1690.1	860.2	2170.1
5	1155.3	923.9	2097.7	525.3	299.7
6	746.4	560.2	496.5	615.4	249.9
7	94.6	450.3	267.2	85.5	277.3
8	175.0	58.9	196.8	70.4	56.1
9	67.7	167.0	27.7	56.0	36.2
10	112.6	124.9	89.7	27.8	26.0
AGE	1988	1989	1990	1991	1992
1	324.9	891.5	71.8	278.7	191.7
2	2352.1	2608.6	5561.1	1963.0	4808.4
3	8368.3	3032.8	5373.4	3491.4	2286.3
4	1074.1	4254.4	1964.0	3160.5	1070.7
5	1575.6	383.5	2272.1	1442.1	1500.0
6	223.8	534.2	230.6	1088.0	448.1
7	150.3	81.4	229.4	141.3	356.0
8	218.0	51.2	24.6	89.7	44.1
9	46.5	60.2	23.2	27.5	36.4
10	52.5	21.3	40.4	26.0	10.4

Catch At Age - Input Data

AGE	1993	1994	1995	1996	1997
1	299.2	94.4	32.3	64.9	126.9
2	1534.9	614.6	652.8	287.3	685.2
3	4429.4	1543.4	1429.0	986.6	749.6
4	1224.8	1987.7	669.9	1269.8	1020.7
5	475.3	425.6	382.3	256.3	882.9
6	535.6	97.6	41.2	183.8	147.7
7	178.0	146.2	21.4	17.9	94.4
8	141.0	51.2	20.0	11.6	18.9
9	43.1	30.5	6.4	11.3	10.1
10	21.2	5.6	1.4	0.3	3.9
AGE	1998	1999	2000	2001	2002
1	63.3	47.7	113.5	11.7	33.6
2	918.9	356.3	943.2	719.8	113.0
3	1310.3	2021.8	741.1	2667.3	1182.7
4	494.3	852.6	1156.4	751.6	1516.2
5	385.6	286.6	315.8	698.7	365.4
6	285.2	125.8	88.0	180.4	371.5
7	40.2	143.8	46.3	54.8	84.7
8	16.0	22.2	38.8	25.8	18.7
9	5.6	5.0	4.2	14.8	10.6
10	2.9	3.4	1.0	1.3	6.5
AGE	2003	2004	2005	2006	2007
1	17.0	50.5	12.3	32.8	10.6
2	201.3	69.4	364.1	69.7	526.1
3	404.4	434.3	201.8	842.8	395.2
4	800.7	260.1	578.4	208.3	1175.8
5	910.4	313.6	144.5	366.1	71.9
6	156.0	253.0	106.0	70.8	129.2
7	142.4	58.2	85.3	31.2	16.2
8	28.2	49.2	18.0	28.5	10.4
9	6.5	11.8	8.9	3.8	8.6
10	2.9	5.0	3.7	3.4	1.1

Weight At Age - Input Data

AGE	1978	1979	1980	1981	1982
1	0.5787	0.6942	0.6438	0.5873	0.6430
2	1.2513	1.3643	1.4133	1.4411	1.3928
3	2.4408	1.8920	2.4308	2.3815	2.5397
4	3.4074	4.2804	3.5465	3.5294	3.7201
5	4.0144	4.9312	5.5826	5.0546	5.2823
6	5.6957	7.1757	6.7481	7.3032	6.5758
7	6.6453	9.6642	8.3051	8.7797	9.4656
8	8.7084	10.3497	9.9256	9.7997	9.7448
9	9.9364	10.4378	9.2950	14.0178	12.9721
10	13.8870	13.6108	14.8999	16.7990	15.6229
AGE	1983	1984	1985	1986	1987
1	0.6763	0.5405	0.8055	0.6738	0.5817
2	1.4363	1.4991	1.3855	1.3568	1.4684
3	2.3895	2.4762	2.0750	2.4477	2.4763
4	3.3518	3.6676	3.7198	3.6106	4.1715
5	4.7839	4.9374	4.9774	5.4941	5.7677
6	6.4468	6.5544	6.4394	7.1726	7.7772
7	8.4913	8.7376	8.2465	8.8770	8.9078
8	10.6665	10.3090	10.2787	9.9439	10.3361
9	11.6989	11.0933	11.7651	12.9472	12.0274
10	16.3190	14.6426	14.0475	14.5623	15.6415
AGE	1988	1989	1990	1991	1992
1	0.4918	0.4347	0.5311	0.6581	0.8296
2	1.3794	1.4362	1.4893	1.5196	1.4349
3	2.3728	2.2041	2.4630	2.4992	2.4077
4	3.5065	3.7324	3.5732	3.5198	3.7982
5	5.4118	5.1806	4.9668	4.8089	4.5200
6	6.7808	6.5629	6.4025	5.8249	6.0428
7	8.7219	7.9373	8.4042	7.3177	7.0854
8	10.4333	9.9761	11.1911	9.3877	9.4720
9	11.5348	11.2867	12.4247	9.6151	11.8412
10	14.9262	14.6514	14.5119	14.6490	18.8362

Weight At Age - Input Data

AGE	1993	1994	1995	1996	1997
1	0.2837	0.4771	0.3963	0.4867	0.5385
2	1.3063	1.1976	1.3467	1.4419	1.4631
3	2.2082	2.1531	1.9769	2.3910	2.3278
4	3.2271	3.5435	3.7206	3.2180	3.4446
5	4.9843	4.7869	5.2487	4.8754	4.0326
6	5.8198	7.0741	7.4302	6.4963	5.7339
7	7.3782	7.1760	9.3273	8.1007	7.7343
8	8.9218	9.1163	12.1972	9.6991	8.0901
9	11.1348	9.0029	11.8414	10.9742	11.4196
10	12.2279	15.7618	19.1176	8.6207	12.0867
AGE	1998	1999	2000	2001	2002
1	0.6185	0.5340	0.3879	0.6008	0.4900
2	1.4324	1.4313	1.5286	1.3651	1.3165
3	2.2614	2.1372	2.3862	2.2118	2.1052
4	3.4254	3.3549	3.3875	2.9372	2.9569
5	4.5713	4.5433	4.5495	4.1007	3.9493
6	5.5756	5.8669	5.4719	5.2650	5.1562
7	7.3994	6.6406	6.9962	5.9799	6.4745
8	7.7535	8.4061	8.0125	7.6805	8.0004
9	11.8255	9.5624	8.0492	9.0431	9.2479
10	12.3102	13.2010	12.5970	9.7372	11.7081
AGE	2003	2004	2005	2006	2007
1	0.6020	0.3318	0.4309	0.3791	0.4225
2	1.4576	1.5332	1.0351	1.0785	1.4203
3	2.2536	2.3640	2.1015	2.0931	1.9169
4	2.9071	3.0802	3.0681	3.1067	2.8988
5	3.8660	3.8831	4.0035	3.6792	3.6265
6	4.7097	4.8244	4.9245	4.5349	4.1726
7	5.7888	5.6511	5.4675	6.4617	5.9316
8	6.9183	7.3709	7.4969	6.3936	6.9569
9	8.2509	8.5524	8.7863	7.5189	6.9220
10	10.4481	11.1003	11.3704	9.0737	9.0701

JAN-1 Weights at Age - Input Data

AGE	1978	1979	1980	1981	1982
1	0.3769	0.4865	0.4303	0.3814	0.4302
2	1.0176	0.8885	0.9905	0.9632	0.9044
3	1.8431	1.5387	1.8211	1.8346	1.9131
4	2.8324	3.2323	2.5904	2.9290	2.9765
5	3.0026	4.0991	4.8883	4.2339	4.3178
6	4.3726	5.3671	5.7686	6.3852	5.7652
7	5.3249	7.4192	7.7198	7.6972	8.3144
8	7.9543	8.2932	9.7940	9.0215	9.2497
9	9.3022	9.5340	9.8082	11.7956	11.2749
10	13.8870	13.6108	14.8999	16.7990	15.6229
AGE	1983	1984	1985	1986	1987
1	0.4542	0.3376	0.6206	0.4564	0.3777
2	0.9610	1.0069	0.8654	1.0454	0.9947
3	1.8243	1.8859	1.7637	1.8415	1.8330
4	2.9176	2.9604	3.0350	2.7372	3.1954
5	4.2186	4.0681	4.2726	4.5207	4.5634
6	5.8356	5.5996	5.6386	5.9750	6.5367
7	7.4724	7.5053	7.3519	7.5606	7.9933
8	10.0481	9.3561	9.4769	9.0555	9.5788
9	10.6772	10.8778	11.0130	11.5361	10.9362
10	16.3190	14.6426	14.0475	14.5623	15.6415
AGE	1988	1989	1990	1991	1992
1	0.2878	0.2349	0.3140	0.4457	0.6611
2	0.8958	0.8404	0.8046	0.8984	0.9718
3	1.8666	1.7437	1.8808	1.9293	1.9128
4	2.9467	2.9759	2.8064	2.9444	3.0810
5	4.7514	4.2621	4.3056	4.1453	3.9887
6	6.2538	5.9596	5.7592	5.3788	5.3907
7	8.2360	7.3363	7.4267	6.8448	6.4243
8	9.6404	9.3279	9.4248	8.8823	8.3255
9	10.9190	10.8516	11.1333	10.3732	10.5433
10	14.9262	14.6514	14.5119	14.6490	18.8362

JAN-1 Weights at Age - Input Data

AGE	1993	1994	1995	1996	1997
1	0.1381	0.2840	0.2078	0.2807	0.3302
2	1.0410	0.5829	0.8016	0.7559	0.8439
3	1.7800	1.6771	1.5387	1.7944	1.8321
4	2.7875	2.7973	2.8303	2.5222	2.8699
5	4.3510	3.9304	4.3126	4.2590	3.6023
6	5.1289	5.9380	5.9639	5.8393	5.2873
7	6.6772	6.4624	8.1229	7.7582	7.0883
8	7.9508	8.2013	9.3556	9.5114	8.0954
9	10.2698	8.9623	10.3899	11.5696	10.5243
10	12.2279	15.7618	19.1176	8.6207	12.0867
AGE	1998	1999	2000	2001	2002
1	0.4066	0.3156	0.2068	0.4059	0.2841
2	0.8783	0.9409	0.9035	0.7277	0.8894
3	1.8190	1.7497	1.8481	1.8387	1.6952
4	2.8238	2.7544	2.6907	2.6474	2.5574
5	3.9682	3.9449	3.9068	3.7271	3.4059
6	4.7417	5.1787	4.9860	4.8942	4.5983
7	6.5136	6.0848	6.4067	5.7203	5.8385
8	7.7439	7.8867	7.2944	7.3304	6.9168
9	9.7811	8.6106	8.2257	8.5122	8.4278
10	12.3102	13.2010	12.5970	9.7372	11.7081
AGE	2003	2004	2005	2006	2007
1	0.3772	0.1879	0.2724	0.1959	0.2433
2	0.8451	0.9607	0.5860	0.6817	0.7338
3	1.7225	1.8563	1.7950	1.4719	1.4378
4	2.4739	2.6347	2.6931	2.5551	2.4632
5	3.3810	3.3598	3.5116	3.3598	3.3566
6	4.3128	4.3187	4.3729	4.2609	3.9181
7	5.4634	5.1590	5.1359	5.6410	5.1864
8	6.6927	6.5321	6.5089	5.9124	6.7047
9	8.1247	7.6921	8.0475	7.5079	6.6526
10	10.4481	11.1003	11.3704	9.0737	9.0701

JAN-1 Weights at Age - Input Data

AGE	2008
1	0.2553
2	0.7615
3	1.6567
4	2.5640
5	3.3938
6	4.2367
7	5.3171
8	6.4702
9	7.6050
10	10.2125

SSB Weight At Age - Input Data

AGE	1978	1979	1980	1981	1982
1	0.3769	0.4865	0.4303	0.3814	0.4302
2	1.0176	0.8885	0.9905	0.9632	0.9044
3	1.8431	1.5387	1.8211	1.8346	1.9131
4	2.8324	3.2323	2.5904	2.9290	2.9765
5	3.0026	4.0991	4.8883	4.2339	4.3178
6	4.3726	5.3671	5.7686	6.3852	5.7652
7	5.3249	7.4192	7.7198	7.6972	8.3144
8	7.9543	8.2932	9.7940	9.0215	9.2497
9	9.3022	9.5340	9.8082	11.7956	11.2749
10	13.8870	13.6108	14.8999	16.7990	15.6229
AGE	1983	1984	1985	1986	1987
1	0.4542	0.3376	0.6206	0.4564	0.3777
2	0.9610	1.0069	0.8654	1.0454	0.9947
3	1.8243	1.8859	1.7637	1.8415	1.8330
4	2.9176	2.9604	3.0350	2.7372	3.1954
5	4.2186	4.0681	4.2726	4.5207	4.5634
6	5.8356	5.5996	5.6386	5.9750	6.5367
7	7.4724	7.5053	7.3519	7.5606	7.9933
8	10.0481	9.3561	9.4769	9.0555	9.5788
9	10.6772	10.8778	11.0130	11.5361	10.9362
10	16.3190	14.6426	14.0475	14.5623	15.6415
AGE	1988	1989	1990	1991	1992
1	0.2878	0.2349	0.3140	0.4457	0.6611
2	0.8958	0.8404	0.8046	0.8984	0.9718
3	1.8666	1.7437	1.8808	1.9293	1.9128
4	2.9467	2.9759	2.8064	2.9444	3.0810

5	4.7514	4.2621	4.3056	4.1453	3.9887
6	6.2538	5.9596	5.7592	5.3788	5.3907
7	8.2360	7.3363	7.4267	6.8448	6.4243
8	9.6404	9.3279	9.4248	8.8823	8.3255
9	10.9190	10.8516	11.1333	10.3732	10.5433
10	14.9262	14.6514	14.5119	14.6490	18.8362

SSB Weight At Age - Input Data

AGE	1993	1994	1995	1996	1997
1	0.1381	0.2840	0.2078	0.2807	0.3302
2	1.0410	0.5829	0.8016	0.7559	0.8439
3	1.7800	1.6771	1.5387	1.7944	1.8321
4	2.7875	2.7973	2.8303	2.5222	2.8699
5	4.3510	3.9304	4.3126	4.2590	3.6023
6	5.1289	5.9380	5.9639	5.8393	5.2873
7	6.6772	6.4624	8.1229	7.7582	7.0883
8	7.9508	8.2013	9.3556	9.5114	8.0954
9	10.2698	8.9623	10.3899	11.5696	10.5243
10	12.2279	15.7618	19.1176	8.6207	12.0867
AGE	1998	1999	2000	2001	2002
1	0.4066	0.3156	0.2068	0.4059	0.2841
2	0.8783	0.9409	0.9035	0.7277	0.8894
3	1.8190	1.7497	1.8481	1.8387	1.6952
4	2.8238	2.7544	2.6907	2.6474	2.5574
5	3.9682	3.9449	3.9068	3.7271	3.4059
6	4.7417	5.1787	4.9860	4.8942	4.5983
7	6.5136	6.0848	6.4067	5.7203	5.8385
8	7.7439	7.8867	7.2944	7.3304	6.9168
9	9.7811	8.6106	8.2257	8.5122	8.4278
10	12.3102	13.2010	12.5970	9.7372	11.7081
AGE	2003	2004	2005	2006	2007
1	0.3772	0.1879	0.2724	0.1959	0.2433
2	0.8451	0.9607	0.5860	0.6817	0.7338
3	1.7225	1.8563	1.7950	1.4719	1.4378
4	2.4739	2.6347	2.6931	2.5551	2.4632
5	3.3810	3.3598	3.5116	3.3598	3.3566
6	4.3128	4.3187	4.3729	4.2609	3.9181
7	5.4634	5.1590	5.1359	5.6410	5.1864
8	6.6927	6.5321	6.5089	5.9124	6.7047
9	8.1247	7.6921	8.0475	7.5079	6.6526
10	10.4481	11.1003	11.3704	9.0737	9.0701

Natural Mortality - Input Data

AGE	1978	1979	1980	1981	1982
1	0.2000	0.2000	0.2000	0.2000	0.2000
2	0.2000	0.2000	0.2000	0.2000	0.2000
3	0.2000	0.2000	0.2000	0.2000	0.2000
4	0.2000	0.2000	0.2000	0.2000	0.2000
5	0.2000	0.2000	0.2000	0.2000	0.2000
6	0.2000	0.2000	0.2000	0.2000	0.2000
7	0.2000	0.2000	0.2000	0.2000	0.2000
8	0.2000	0.2000	0.2000	0.2000	0.2000
9	0.2000	0.2000	0.2000	0.2000	0.2000
10	0.2000	0.2000	0.2000	0.2000	0.2000
AGE	1983	1984	1985	1986	1987
1	0.2000	0.2000	0.2000	0.2000	0.2000
2	0.2000	0.2000	0.2000	0.2000	0.2000
3	0.2000	0.2000	0.2000	0.2000	0.2000
4	0.2000	0.2000	0.2000	0.2000	0.2000
5	0.2000	0.2000	0.2000	0.2000	0.2000
6	0.2000	0.2000	0.2000	0.2000	0.2000
7	0.2000	0.2000	0.2000	0.2000	0.2000
8	0.2000	0.2000	0.2000	0.2000	0.2000
9	0.2000	0.2000	0.2000	0.2000	0.2000
10	0.2000	0.2000	0.2000	0.2000	0.2000
AGE	1988	1989	1990	1991	1992
1	0.2000	0.2000	0.2000	0.2000	0.2000
2	0.2000	0.2000	0.2000	0.2000	0.2000
3	0.2000	0.2000	0.2000	0.2000	0.2000
4	0.2000	0.2000	0.2000	0.2000	0.2000
5	0.2000	0.2000	0.2000	0.2000	0.2000
6	0.2000	0.2000	0.2000	0.2000	0.2000
7	0.2000	0.2000	0.2000	0.2000	0.2000
8	0.2000	0.2000	0.2000	0.2000	0.2000
9	0.2000	0.2000	0.2000	0.2000	0.2000
10	0.2000	0.2000	0.2000	0.2000	0.2000

Natural Mortality - Input Data

AGE	1993	1994	1995	1996	1997
1	0.2000	0.2000	0.2000	0.2000	0.2000
2	0.2000	0.2000	0.2000	0.2000	0.2000
3	0.2000	0.2000	0.2000	0.2000	0.2000
4	0.2000	0.2000	0.2000	0.2000	0.2000
5	0.2000	0.2000	0.2000	0.2000	0.2000
6	0.2000	0.2000	0.2000	0.2000	0.2000
7	0.2000	0.2000	0.2000	0.2000	0.2000
8	0.2000	0.2000	0.2000	0.2000	0.2000
9	0.2000	0.2000	0.2000	0.2000	0.2000
10	0.2000	0.2000	0.2000	0.2000	0.2000
AGE	1998	1999	2000	2001	2002
1	0.2000	0.2000	0.2000	0.2000	0.2000
2	0.2000	0.2000	0.2000	0.2000	0.2000
3	0.2000	0.2000	0.2000	0.2000	0.2000
4	0.2000	0.2000	0.2000	0.2000	0.2000
5	0.2000	0.2000	0.2000	0.2000	0.2000
6	0.2000	0.2000	0.2000	0.2000	0.2000
7	0.2000	0.2000	0.2000	0.2000	0.2000
8	0.2000	0.2000	0.2000	0.2000	0.2000
9	0.2000	0.2000	0.2000	0.2000	0.2000
10	0.2000	0.2000	0.2000	0.2000	0.2000
AGE	2003	2004	2005	2006	2007
1	0.2000	0.2000	0.2000	0.2000	0.2000
2	0.2000	0.2000	0.2000	0.2000	0.2000
3	0.2000	0.2000	0.2000	0.2000	0.2000
4	0.2000	0.2000	0.2000	0.2000	0.2000
5	0.2000	0.2000	0.2000	0.2000	0.2000
6	0.2000	0.2000	0.2000	0.2000	0.2000
7	0.2000	0.2000	0.2000	0.2000	0.2000
8	0.2000	0.2000	0.2000	0.2000	0.2000
9	0.2000	0.2000	0.2000	0.2000	0.2000
10	0.2000	0.2000	0.2000	0.2000	0.2000

Proportion of Natural Mortality Before Spawning = 0.1667
Proportion of Fishing Mortality Before Spawning = 0.1667

Maturity - Input Data

AGE	1978	1979	1980	1981	1982
1	0.0800	0.0700	0.0900	0.0900	0.0800
2	0.3300	0.3400	0.3800	0.3800	0.3600
3	0.7500	0.7800	0.7900	0.7900	0.7900
4	0.9500	0.9600	0.9600	0.9600	0.9600
5	0.9900	0.9900	0.9900	0.9900	0.9900
6	1.0000	1.0000	1.0000	1.0000	1.0000
7	1.0000	1.0000	1.0000	1.0000	1.0000
8	1.0000	1.0000	1.0000	1.0000	1.0000
9	1.0000	1.0000	1.0000	1.0000	1.0000
10	1.0000	1.0000	1.0000	1.0000	1.0000
AGE	1983	1984	1985	1986	1987
1	0.0800	0.1300	0.1800	0.1600	0.2000
2	0.4100	0.4900	0.5900	0.5800	0.5900
3	0.8500	0.8700	0.9100	0.9100	0.8900
4	0.9800	0.9800	0.9900	0.9900	0.9800
5	1.0000	1.0000	1.0000	1.0000	1.0000
6	1.0000	1.0000	1.0000	1.0000	1.0000
7	1.0000	1.0000	1.0000	1.0000	1.0000
8	1.0000	1.0000	1.0000	1.0000	1.0000
9	1.0000	1.0000	1.0000	1.0000	1.0000
10	1.0000	1.0000	1.0000	1.0000	1.0000
AGE	1988	1989	1990	1991	1992
1	0.2500	0.2000	0.1200	0.1300	0.0900
2	0.6400	0.6100	0.4600	0.5300	0.4700
3	0.9000	0.9100	0.8500	0.8900	0.8900
4	0.9800	0.9800	0.9700	0.9800	0.9900
5	1.0000	1.0000	1.0000	1.0000	1.0000
6	1.0000	1.0000	1.0000	1.0000	1.0000
7	1.0000	1.0000	1.0000	1.0000	1.0000
8	1.0000	1.0000	1.0000	1.0000	1.0000
9	1.0000	1.0000	1.0000	1.0000	1.0000
10	1.0000	1.0000	1.0000	1.0000	1.0000

Maturity - Input Data

AGE	1993	1994	1995	1996	1997
1	0.0400	0.0400	0.0400	0.0500	0.1000
2	0.4300	0.4100	0.5000	0.4800	0.5700
3	0.9300	0.9200	0.9600	0.9500	0.9400
4	1.0000	1.0000	1.0000	1.0000	0.9900
5	1.0000	1.0000	1.0000	1.0000	1.0000
6	1.0000	1.0000	1.0000	1.0000	1.0000
7	1.0000	1.0000	1.0000	1.0000	1.0000
8	1.0000	1.0000	1.0000	1.0000	1.0000
9	1.0000	1.0000	1.0000	1.0000	1.0000
10	1.0000	1.0000	1.0000	1.0000	1.0000
AGE	1998	1999	2000	2001	2002
1	0.0900	0.0700	0.0700	0.0800	0.0700
2	0.5600	0.5100	0.5100	0.5000	0.4300
3	0.9400	0.9300	0.9400	0.9300	0.8800
4	1.0000	0.9900	1.0000	0.9900	0.9900
5	1.0000	1.0000	1.0000	1.0000	1.0000
6	1.0000	1.0000	1.0000	1.0000	1.0000
7	1.0000	1.0000	1.0000	1.0000	1.0000
8	1.0000	1.0000	1.0000	1.0000	1.0000
9	1.0000	1.0000	1.0000	1.0000	1.0000
10	1.0000	1.0000	1.0000	1.0000	1.0000
AGE	2003	2004	2005	2006	2007
1	0.0400	0.0700	0.0600	0.0500	0.0400
2	0.3300	0.3800	0.3600	0.3500	0.3700
3	0.8400	0.8300	0.8300	0.8400	0.8900
4	0.9800	0.9800	0.9800	0.9800	0.9900
5	1.0000	1.0000	1.0000	1.0000	1.0000
6	1.0000	1.0000	1.0000	1.0000	1.0000
7	1.0000	1.0000	1.0000	1.0000	1.0000
8	1.0000	1.0000	1.0000	1.0000	1.0000
9	1.0000	1.0000	1.0000	1.0000	1.0000
10	1.0000	1.0000	1.0000	1.0000	1.0000

Input Partial Recruitment

AGE

1	0.0100
2	0.1000
3	0.3900
4	0.7400
5	1.0000
6	1.0000
7	1.0000
8	1.0000
9	1.0000

Input F-Plus Ratio

YEAR

1978	1.0000
1979	1.0000
1980	1.0000
1981	1.0000
1982	1.0000
1983	1.0000
1984	1.0000
1985	1.0000
1986	1.0000
1987	1.0000
1988	1.0000
1989	1.0000
1990	1.0000
1991	1.0000
1992	1.0000
1993	1.0000
1994	1.0000
1995	1.0000
1996	1.0000
1997	1.0000
1998	1.0000
1999	1.0000
2000	1.0000
2001	1.0000
2002	1.0000
2003	1.0000
2004	1.0000
2005	1.0000
2006	1.0000
2007	1.0000

SURVEY - INPUT DATA

INDEX	1	2	3	4	5
SURVEY TAG	spr_36pr	spr_36pr	spr_36pr	spr_36pr	spr_36pr
AGE	1	2	3	4	5
TIME	JAN-1	JAN-1	JAN-1	JAN-1	JAN-1
TYPE	NUMBERS	NUMBERS	NUMBERS	NUMBERS	NUMBERS
RETRO FLAG	1	1	1	1	1
1978	0.0000	0.0000	0.0000	0.0000	0.0000
1979	0.0000	0.0000	0.0000	0.0000	0.0000
1980	0.0000	0.0000	0.0000	0.0000	0.0000
1981	0.0000	0.0000	0.0000	0.0000	0.0000
1982	693.8277	7425.1446	12980.2741	11371.7250	8480.5714
1983	452.8527	2666.2982	4121.4375	1087.6661	952.1518
1984	549.4339	588.7768	1039.1705	1691.4696	576.8920
1985	151.7705	3624.3241	906.1152	1516.7491	1929.3027
1986	1190.5313	558.7232	2519.5821	498.8893	737.6786
1987	26.9116	2202.7902	516.9214	1042.7223	84.8330
1988	983.8446	831.6643	4302.5786	558.4500	879.0670
1989	424.0286	1926.7071	910.3500	2162.6277	321.1634
1990	236.8768	1258.8348	2373.0027	921.0054	1245.7205
1991	1402.4089	721.0125	940.8134	1268.9438	654.0750
1992	167.6170	1710.8679	639.5946	229.6366	372.8009
1993	11.6116	544.7893	1784.2259	280.4545	122.2634
1994	170.4857	372.1179	273.2143	295.7545	45.3536
1995	0.0000	0.0000	0.0000	0.0000	0.0000
1996	0.0000	0.0000	0.0000	0.0000	0.0000
1997	0.0000	0.0000	0.0000	0.0000	0.0000
1998	0.0000	0.0000	0.0000	0.0000	0.0000
1999	0.0000	0.0000	0.0000	0.0000	0.0000
2000	0.0000	0.0000	0.0000	0.0000	0.0000
2001	0.0000	0.0000	0.0000	0.0000	0.0000
2002	0.0000	0.0000	0.0000	0.0000	0.0000
2003	0.0000	0.0000	0.0000	0.0000	0.0000
2004	0.0000	0.0000	0.0000	0.0000	0.0000
2005	0.0000	0.0000	0.0000	0.0000	0.0000
2006	0.0000	0.0000	0.0000	0.0000	0.0000
2007	0.0000	0.0000	0.0000	0.0000	0.0000
2008	0.0000	0.0000	0.0000	0.0000	0.0000

SURVEY - INPUT DATA

INDEX	6	7	8	9	10
SURVEY TAG	spr_36pr	spr_36pr	spr_36pr	spr_36po	spr_36po
AGE	6	7	8	1	2
TIME	JAN-1	JAN-1	JAN-1	JAN-1	JAN-1
TYPE	NUMBERS	NUMBERS	NUMBERS	NUMBERS	NUMBERS
RETRO FLAG	1	1	1	1	1
1978	0.0000	0.0000	0.0000	0.0000	0.0000
1979	0.0000	0.0000	0.0000	0.0000	0.0000
1980	0.0000	0.0000	0.0000	0.0000	0.0000
1981	0.0000	0.0000	0.0000	0.0000	0.0000
1982	400.1223	2548.6795	503.3973	0.0000	0.0000
1983	605.3063	37.1571	298.6232	0.0000	0.0000
1984	546.9750	285.2357	0.0000	0.0000	0.0000
1985	362.5554	262.1491	245.7563	0.0000	0.0000
1986	844.0955	84.2866	170.8955	0.0000	0.0000
1987	245.0732	185.1027	44.8071	0.0000	0.0000
1988	87.4286	50.5446	67.2107	0.0000	0.0000
1989	479.6277	68.9866	53.9598	0.0000	0.0000
1990	178.1357	195.4848	17.6223	0.0000	0.0000
1991	448.2080	73.9045	55.4625	0.0000	0.0000
1992	194.5286	216.7955	26.7750	0.0000	0.0000
1993	188.7911	40.0259	46.9929	0.0000	0.0000
1994	7.7866	60.2438	0.0000	0.0000	0.0000
1995	0.0000	0.0000	0.0000	67.6205	521.4295
1996	0.0000	0.0000	0.0000	99.7232	292.2027
1997	0.0000	0.0000	0.0000	397.2536	597.1098
1998	0.0000	0.0000	0.0000	152.0438	908.7107
1999	0.0000	0.0000	0.0000	290.0170	397.3902
2000	0.0000	0.0000	0.0000	301.4920	1101.8732
2001	0.0000	0.0000	0.0000	82.9205	320.4804
2002	0.0000	0.0000	0.0000	88.3848	126.9080
2003	0.0000	0.0000	0.0000	22.4036	290.7000
2004	0.0000	0.0000	0.0000	870.0509	79.2321
2005	0.0000	0.0000	0.0000	16.2563	660.9054
2006	0.0000	0.0000	0.0000	243.9804	315.5625
2007	0.0000	0.0000	0.0000	170.8955	872.7830
2008	0.0000	0.0000	0.0000	864.1768	1136.0250

SURVEY - INPUT DATA

INDEX	11	12	13	14	15
SURVEY TAG	spr_36po	spr_36po	spr_36po	spr_36po	spr_36po
AGE	3	4	5	6	7
TIME	JAN-1	JAN-1	JAN-1	JAN-1	JAN-1
TYPE	NUMBERS	NUMBERS	NUMBERS	NUMBERS	NUMBERS
RETRO FLAG	1	1	1	1	1
1978	0.0000	0.0000	0.0000	0.0000	0.0000
1979	0.0000	0.0000	0.0000	0.0000	0.0000
1980	0.0000	0.0000	0.0000	0.0000	0.0000
1981	0.0000	0.0000	0.0000	0.0000	0.0000
1982	0.0000	0.0000	0.0000	0.0000	0.0000
1983	0.0000	0.0000	0.0000	0.0000	0.0000
1984	0.0000	0.0000	0.0000	0.0000	0.0000
1985	0.0000	0.0000	0.0000	0.0000	0.0000
1986	0.0000	0.0000	0.0000	0.0000	0.0000
1987	0.0000	0.0000	0.0000	0.0000	0.0000
1988	0.0000	0.0000	0.0000	0.0000	0.0000
1989	0.0000	0.0000	0.0000	0.0000	0.0000
1990	0.0000	0.0000	0.0000	0.0000	0.0000
1991	0.0000	0.0000	0.0000	0.0000	0.0000
1992	0.0000	0.0000	0.0000	0.0000	0.0000
1993	0.0000	0.0000	0.0000	0.0000	0.0000
1994	0.0000	0.0000	0.0000	0.0000	0.0000
1995	1166.4884	729.4821	818.2768	145.7598	319.1143
1996	1005.7018	1703.7643	237.9696	284.8259	37.8402
1997	232.5054	667.4625	576.8920	68.0304	182.9170
1998	1773.1607	1158.1554	1031.2473	727.5696	138.7929
1999	831.9375	696.2866	325.3982	162.9723	86.8821
2000	1133.5661	1558.8241	505.8563	139.8857	34.8348
2001	1084.2509	218.8446	522.7955	241.2482	31.5563
2002	523.6152	1356.5089	327.0375	306.9563	53.2768
2003	370.4786	850.3795	951.3321	87.5652	108.6027
2004	790.8188	1921.3795	1849.5241	1219.2188	243.9804
2005	188.2446	861.9911	374.8500	280.4545	174.0375
2006	1783.9527	453.3991	988.2161	290.7000	165.7045
2007	513.0964	2450.3223	247.1223	285.7821	42.2116
2008	790.2723	479.9009	1312.2482	51.6375	61.4732

SURVEY - INPUT DATA

INDEX	16	17	18	19	20
SURVEY TAG	spr_36po	spr_41	spr_41	spr_41	spr_41
AGE	8	1	2	3	4
TIME	JAN-1	JAN-1	JAN-1	JAN-1	JAN-1
TYPE	NUMBERS	NUMBERS	NUMBERS	NUMBERS	NUMBERS
RETRO FLAG	1	1	1	1	1
1978	0.0000	477.9000	246.6000	7111.1571	1249.0714
1979	0.0000	550.6714	1668.4714	353.7000	2380.5000
1980	0.0000	40.1143	2850.4286	3458.0571	272.9571
1981	0.0000	2959.9714	2381.4000	3613.8857	2166.3000
1982	0.0000	0.0000	0.0000	0.0000	0.0000
1983	0.0000	0.0000	0.0000	0.0000	0.0000
1984	0.0000	0.0000	0.0000	0.0000	0.0000
1985	0.0000	0.0000	0.0000	0.0000	0.0000
1986	0.0000	0.0000	0.0000	0.0000	0.0000
1987	0.0000	0.0000	0.0000	0.0000	0.0000
1988	0.0000	0.0000	0.0000	0.0000	0.0000
1989	0.0000	0.0000	0.0000	0.0000	0.0000
1990	0.0000	0.0000	0.0000	0.0000	0.0000
1991	0.0000	0.0000	0.0000	0.0000	0.0000
1992	0.0000	0.0000	0.0000	0.0000	0.0000
1993	0.0000	0.0000	0.0000	0.0000	0.0000
1994	0.0000	0.0000	0.0000	0.0000	0.0000
1995	38.2500	0.0000	0.0000	0.0000	0.0000
1996	24.7259	0.0000	0.0000	0.0000	0.0000
1997	27.4580	0.0000	0.0000	0.0000	0.0000
1998	42.2116	0.0000	0.0000	0.0000	0.0000
1999	41.6652	0.0000	0.0000	0.0000	0.0000
2000	27.4580	0.0000	0.0000	0.0000	0.0000
2001	24.1795	0.0000	0.0000	0.0000	0.0000
2002	0.0000	0.0000	0.0000	0.0000	0.0000
2003	16.8027	0.0000	0.0000	0.0000	0.0000
2004	356.8179	0.0000	0.0000	0.0000	0.0000
2005	40.7089	0.0000	0.0000	0.0000	0.0000
2006	73.6313	0.0000	0.0000	0.0000	0.0000
2007	24.7259	0.0000	0.0000	0.0000	0.0000
2008	0.0000	0.0000	0.0000	0.0000	0.0000

SURVEY - INPUT DATA

INDEX	21	22	23	24	25
SURVEY TAG	spr_41	spr_41	spr_41	spr_41	sp_can_p
AGE	5	6	7	8	1
TIME	JAN-1	JAN-1	JAN-1	JAN-1	JAN-1
TYPE	NUMBERS	NUMBERS	NUMBERS	NUMBERS	NUMBERS
RETRO FLAG	1	1	1	1	1
1978	999.7714	182.0571	915.8143	83.7000	0.0000
1979	702.7714	302.7857	107.4857	178.2000	0.0000
1980	2192.1429	480.4714	238.5000	39.8571	0.0000
1981	136.1571	1129.6286	331.9714	169.8429	0.0000
1982	0.0000	0.0000	0.0000	0.0000	0.0000
1983	0.0000	0.0000	0.0000	0.0000	0.0000
1984	0.0000	0.0000	0.0000	0.0000	0.0000
1985	0.0000	0.0000	0.0000	0.0000	0.0000
1986	0.0000	0.0000	0.0000	0.0000	844.4316
1987	0.0000	0.0000	0.0000	0.0000	351.8465
1988	0.0000	0.0000	0.0000	0.0000	394.0681
1989	0.0000	0.0000	0.0000	0.0000	2294.0392
1990	0.0000	0.0000	0.0000	0.0000	591.1021
1991	0.0000	0.0000	0.0000	0.0000	1660.7155
1992	0.0000	0.0000	0.0000	0.0000	154.8125
1993	0.0000	0.0000	0.0000	0.0000	0.0000
1994	0.0000	0.0000	0.0000	0.0000	0.0000
1995	0.0000	0.0000	0.0000	0.0000	0.0000
1996	0.0000	0.0000	0.0000	0.0000	0.0000
1997	0.0000	0.0000	0.0000	0.0000	0.0000
1998	0.0000	0.0000	0.0000	0.0000	0.0000
1999	0.0000	0.0000	0.0000	0.0000	0.0000
2000	0.0000	0.0000	0.0000	0.0000	0.0000
2001	0.0000	0.0000	0.0000	0.0000	0.0000
2002	0.0000	0.0000	0.0000	0.0000	0.0000
2003	0.0000	0.0000	0.0000	0.0000	0.0000
2004	0.0000	0.0000	0.0000	0.0000	0.0000
2005	0.0000	0.0000	0.0000	0.0000	0.0000
2006	0.0000	0.0000	0.0000	0.0000	0.0000
2007	0.0000	0.0000	0.0000	0.0000	0.0000
2008	0.0000	0.0000	0.0000	0.0000	0.0000

SURVEY - INPUT DATA

INDEX	26	27	28	29	30
SURVEY TAG	sp_can_p	sp_can_p	sp_can_p	sp_can_p	sp_can_p
AGE	2	3	4	5	6
TIME	JAN-1	JAN-1	JAN-1	JAN-1	JAN-1
TYPE	NUMBERS	NUMBERS	NUMBERS	NUMBERS	NUMBERS
RETRO FLAG	1	1	1	1	1
1978	0.0000	0.0000	0.0000	0.0000	0.0000
1979	0.0000	0.0000	0.0000	0.0000	0.0000
1980	0.0000	0.0000	0.0000	0.0000	0.0000
1981	0.0000	0.0000	0.0000	0.0000	0.0000
1982	0.0000	0.0000	0.0000	0.0000	0.0000
1983	0.0000	0.0000	0.0000	0.0000	0.0000
1984	0.0000	0.0000	0.0000	0.0000	0.0000
1985	0.0000	0.0000	0.0000	0.0000	0.0000
1986	3194.7662	3954.7547	520.7328	914.8009	619.2498
1987	2997.7322	1308.8690	1534.0507	478.5112	168.8863
1988	1421.4599	6558.4188	816.2839	1435.5337	182.9602
1989	3912.5331	1942.1927	4011.0501	506.6590	591.1021
1990	3434.0218	5319.9191	2927.3629	5446.5838	591.1021
1991	1632.5678	2589.5902	3025.8799	1477.7553	1843.6757
1992	4025.1240	2491.0732	1125.9088	1379.2383	844.4316
1993	0.0000	0.0000	0.0000	0.0000	0.0000
1994	0.0000	0.0000	0.0000	0.0000	0.0000
1995	0.0000	0.0000	0.0000	0.0000	0.0000
1996	0.0000	0.0000	0.0000	0.0000	0.0000
1997	0.0000	0.0000	0.0000	0.0000	0.0000
1998	0.0000	0.0000	0.0000	0.0000	0.0000
1999	0.0000	0.0000	0.0000	0.0000	0.0000
2000	0.0000	0.0000	0.0000	0.0000	0.0000
2001	0.0000	0.0000	0.0000	0.0000	0.0000
2002	0.0000	0.0000	0.0000	0.0000	0.0000
2003	0.0000	0.0000	0.0000	0.0000	0.0000
2004	0.0000	0.0000	0.0000	0.0000	0.0000
2005	0.0000	0.0000	0.0000	0.0000	0.0000
2006	0.0000	0.0000	0.0000	0.0000	0.0000
2007	0.0000	0.0000	0.0000	0.0000	0.0000
2008	0.0000	0.0000	0.0000	0.0000	0.0000

SURVEY - INPUT DATA

INDEX	31	32	33	34	35
SURVEY TAG	sp_can_p	sp_can_p	sp_canpo	sp_canpo	sp_canpo
AGE	7	8	1	2	3
TIME	JAN-1	JAN-1	JAN-1	JAN-1	JAN-1
TYPE	NUMBERS	NUMBERS	NUMBERS	NUMBERS	NUMBERS
RETRO FLAG	1	1	1	1	1
1978	0.0000	0.0000	0.0000	0.0000	0.0000
1979	0.0000	0.0000	0.0000	0.0000	0.0000
1980	0.0000	0.0000	0.0000	0.0000	0.0000
1981	0.0000	0.0000	0.0000	0.0000	0.0000
1982	0.0000	0.0000	0.0000	0.0000	0.0000
1983	0.0000	0.0000	0.0000	0.0000	0.0000
1984	0.0000	0.0000	0.0000	0.0000	0.0000
1985	0.0000	0.0000	0.0000	0.0000	0.0000
1986	365.9204	0.0400	0.0000	0.0000	0.0000
1987	309.6249	0.0800	0.0000	0.0000	0.0000
1988	112.5909	0.1700	0.0000	0.0000	0.0000
1989	70.3693	0.1000	0.0000	0.0000	0.0000
1990	1308.8690	0.1200	0.0000	0.0000	0.0000
1991	225.1818	0.2200	0.0000	0.0000	0.0000
1992	605.1760	0.1200	0.0000	0.0000	0.0000
1993	0.0000	0.0000	0.0000	0.0000	0.0000
1994	0.0000	0.0000	0.0000	0.0000	0.0000
1995	0.0000	0.0000	98.5170	942.9486	2111.0790
1996	0.0000	0.0000	197.0340	689.6191	3251.0617
1997	0.0000	0.0000	450.3635	745.9146	774.0623
1998	0.0000	0.0000	14.0739	942.9486	1337.0167
1999	0.0000	0.0000	464.4374	450.3635	2097.0051
2000	0.0000	0.0000	140.7386	619.2498	1477.7553
2001	0.0000	0.0000	0.0000	84.4432	900.7270
2002	0.0000	0.0000	12.8934	121.7457	805.6169
2003	0.0000	0.0000	0.0000	31.3603	419.1448
2004	0.0000	0.0000	753.7760	134.4987	551.7156
2005	0.0000	0.0000	34.4185	1880.0260	661.9957
2006	0.0000	0.0000	0.0000	52.7756	1978.5841
2007	0.0000	0.0000	193.3181	730.7096	1329.3200
2008	0.0000	0.0000	12.2714	454.9284	1259.8226

SURVEY - INPUT DATA

INDEX	36	37	38	39	40
SURVEY TAG	sp_canpo	sp_canpo	sp_canpo	sp_canpo	sp_canpo
AGE	4	5	6	7	8
TIME	JAN-1	JAN-1	JAN-1	JAN-1	JAN-1
TYPE	NUMBERS	NUMBERS	NUMBERS	NUMBERS	NUMBERS
RETRO FLAG	1	1	1	1	1
1978	0.0000	0.0000	0.0000	0.0000	0.0000
1979	0.0000	0.0000	0.0000	0.0000	0.0000
1980	0.0000	0.0000	0.0000	0.0000	0.0000
1981	0.0000	0.0000	0.0000	0.0000	0.0000
1982	0.0000	0.0000	0.0000	0.0000	0.0000
1983	0.0000	0.0000	0.0000	0.0000	0.0000
1984	0.0000	0.0000	0.0000	0.0000	0.0000
1985	0.0000	0.0000	0.0000	0.0000	0.0000
1986	0.0000	0.0000	0.0000	0.0000	0.0000
1987	0.0000	0.0000	0.0000	0.0000	0.0000
1988	0.0000	0.0000	0.0000	0.0000	0.0000
1989	0.0000	0.0000	0.0000	0.0000	0.0000
1990	0.0000	0.0000	0.0000	0.0000	0.0000
1991	0.0000	0.0000	0.0000	0.0000	0.0000
1992	0.0000	0.0000	0.0000	0.0000	0.0000
1993	0.0000	0.0000	0.0000	0.0000	0.0000
1994	0.0000	0.0000	0.0000	0.0000	0.0000
1995	1210.3520	844.4316	267.4033	56.2954	0.0500
1996	5657.6917	1534.0507	1111.8349	464.4374	0.0800
1997	1759.2325	1731.0848	379.9942	84.4432	0.0300
1998	492.5851	492.5851	394.0681	98.5170	0.0200
1999	1534.0507	577.0283	365.9204	211.1079	0.0100
2000	5516.9531	2406.6301	1097.7611	562.9544	0.2400
2001	591.1021	1562.1985	731.8407	365.9204	0.1700
2002	2887.0783	961.5430	1718.1603	563.8122	0.1700
2003	912.1602	1706.7639	447.1511	474.4035	0.1600
2004	595.5775	634.6213	545.4536	103.8278	0.1175
2005	4092.5096	1591.4896	721.6604	583.5206	0.0100
2006	925.6215	2297.1633	982.6574	283.5685	0.1850
2007	4136.1066	545.8412	851.2446	135.4739	0.0757
2008	835.7757	3069.2880	196.4960	396.5004	0.0300

SURVEY - INPUT DATA

INDEX	41	42	43	44	45
SURVEY TAG	us0autpr	us1autpr	us2autpr	us3autpr	us4autpr
AGE	1	2	3	4	5
TIME	JAN-1	JAN-1	JAN-1	JAN-1	JAN-1
TYPE	NUMBERS	NUMBERS	NUMBERS	NUMBERS	NUMBERS
RETRO FLAG	1	1	1	1	1
1978	207.0964	323.4857	4690.4063	943.6821	345.3429
1979	540.0080	2520.9482	534.4071	5543.1080	1316.3464
1980	156.4152	2220.0027	2290.9018	221.4402	2303.8795
1981	382.0902	1120.0420	769.9179	1057.2027	71.7188
1982	356.5446	4815.4018	3073.6607	2129.7054	804.6161
1983	494.5179	788.6330	2608.5134	330.3161	92.6196
1984	1752.5330	1160.4777	1488.0616	1011.1661	94.3955
1985	244.6634	2607.9670	931.3875	1268.6705	1127.1455
1986	1368.6670	247.6688	1151.0518	91.1170	144.1205
1987	103.9580	3113.1402	175.5402	449.4375	11.2018
1988	278.2688	565.1438	1848.0214	147.5357	273.6241
1989	750.6563	1194.9027	596.9732	1234.6554	81.9643
1990	342.6107	3822.8143	1429.4571	220.0741	692.7348
1991	214.6098	496.7036	2219.0464	2478.1902	563.3679
1992	55.3259	556.8107	239.3357	374.5768	41.6652
1993	47.9491	563.3679	1296.2652	238.1063	136.6071
1994	243.7071	1324.9527	726.2036	522.6589	22.5402
1995	0.0000	0.0000	0.0000	0.0000	0.0000
1996	0.0000	0.0000	0.0000	0.0000	0.0000
1997	0.0000	0.0000	0.0000	0.0000	0.0000
1998	0.0000	0.0000	0.0000	0.0000	0.0000
1999	0.0000	0.0000	0.0000	0.0000	0.0000
2000	0.0000	0.0000	0.0000	0.0000	0.0000
2001	0.0000	0.0000	0.0000	0.0000	0.0000
2002	0.0000	0.0000	0.0000	0.0000	0.0000
2003	0.0000	0.0000	0.0000	0.0000	0.0000
2004	0.0000	0.0000	0.0000	0.0000	0.0000
2005	0.0000	0.0000	0.0000	0.0000	0.0000
2006	0.0000	0.0000	0.0000	0.0000	0.0000
2007	0.0000	0.0000	0.0000	0.0000	0.0000
2008	0.0000	0.0000	0.0000	0.0000	0.0000

SURVEY - INPUT DATA

INDEX	46	47	48	49	50
SURVEY TAG	us5autpr	us0autpo	us1autpo	us2autpo	us3autpo
AGE	6	1	2	3	4
TIME	JAN-1	JAN-1	JAN-1	JAN-1	JAN-1
TYPE	NUMBERS	NUMBERS	NUMBERS	NUMBERS	NUMBERS
RETRO FLAG	1	1	1	1	1
1978	236.4670	0.0000	0.0000	0.0000	0.0000
1979	458.3170	0.0000	0.0000	0.0000	0.0000
1980	437.9625	0.0000	0.0000	0.0000	0.0000
1981	361.7357	0.0000	0.0000	0.0000	0.0000
1982	73.7679	0.0000	0.0000	0.0000	0.0000
1983	157.3714	0.0000	0.0000	0.0000	0.0000
1984	44.8071	0.0000	0.0000	0.0000	0.0000
1985	33.0589	0.0000	0.0000	0.0000	0.0000
1986	104.6411	0.0000	0.0000	0.0000	0.0000
1987	66.5277	0.0000	0.0000	0.0000	0.0000
1988	38.2500	0.0000	0.0000	0.0000	0.0000
1989	264.6080	0.0000	0.0000	0.0000	0.0000
1990	74.7241	0.0000	0.0000	0.0000	0.0000
1991	390.0134	0.0000	0.0000	0.0000	0.0000
1992	39.6161	0.0000	0.0000	0.0000	0.0000
1993	59.6973	0.0000	0.0000	0.0000	0.0000
1994	34.5616	0.0000	0.0000	0.0000	0.0000
1995	0.0000	91.2536	554.0786	907.4813	592.0554
1996	0.0000	218.4348	334.2777	2473.4089	1705.5402
1997	0.0000	29.5071	327.7205	267.4768	566.1000
1998	0.0000	8.7429	322.6661	438.3723	149.3116
1999	0.0000	95.7616	458.3170	1401.8625	480.5839
2000	0.0000	95.7616	190.8402	210.6482	422.9357
2001	0.0000	26.6384	780.0268	734.6732	96.3080
2002	0.0000	38.7964	64.3420	520.2000	627.0268
2003	0.0000	319.6607	652.9821	965.8125	1907.0357
2004	0.0000	446.5688	227.1777	422.3893	273.8973
2005	0.0000	2302.2402	1017.4500	185.5125	970.0473
2006	0.0000	71.1723	75.5438	791.5018	176.0866
2007	0.0000	135.7875	590.8259	221.0304	702.4339
2008	0.0000	102.3188	156.6884	282.5036	68.8500

SURVEY - INPUT DATA

INDEX	51	52			
SURVEY TAG	us4autpo	us5autpo			
AGE	5	6	NUMBERS	NUMBERS	NUMBERS
TIME	JAN-1	JAN-1	NUMBERS	NUMBERS	NUMBERS
TYPE	NUMBERS	NUMBERS	NUMBERS	NUMBERS	NUMBERS
RETRO FLAG	1	1			

1978	0.0000	0.0000
1979	0.0000	0.0000
1980	0.0000	0.0000
1981	0.0000	0.0000
1982	0.0000	0.0000
1983	0.0000	0.0000
1984	0.0000	0.0000
1985	0.0000	0.0000
1986	0.0000	0.0000
1987	0.0000	0.0000
1988	0.0000	0.0000
1989	0.0000	0.0000
1990	0.0000	0.0000
1991	0.0000	0.0000
1992	0.0000	0.0000
1993	0.0000	0.0000
1994	0.0000	0.0000
1995	209.5554	92.7563
1996	119.1214	73.9045
1997	195.3482	81.5545
1998	176.4964	66.3911
1999	56.1455	48.3589
2000	348.2116	118.9848
2001	107.6464	41.8018
2002	81.1446	74.5875
2003	2222.5982	161.1964
2004	212.5607	112.5643
2005	344.2500	439.1920
2006	239.8821	35.3813
2007	46.1732	170.4857
2008	177.9991	8.7429

Additional Output Files

Population File C:\LOB\GBCOD\ASSESS_2008\VPA\TY07\10P_SWPT_SPLIT\10P-SWPT-SPLT_A
 Auxilliary File C:\LOB\GBCOD\ASSESS_2008\VPA\TY07\10P_SWPT_SPLIT\10P-SWPT-SPLT_A
 Covariance File C:\LOB\GBCOD\ASSESS_2008\VPA\TY07\10P_SWPT_SPLIT\10P-SWPT-SPLT_A
 Residuals File C:\LOB\GBCOD\ASSESS_2008\VPA\TY07\10P_SWPT_SPLIT\10P-SWPT-SPLT_A

Log File C:\LOB\GBCOD\ASSESS_2008\VPA\TY07\10P_SWPT_SPLIT\10P-SWPT-SPLT_A

Bootstrap Files

Bootstrap Stock Numbers

C:\LOB\GBCOD\ASSESS_2008\VPA\TY07\10P_SWPT_SPLIT\10P-SWPT-SPLT_A

Bootstrap Fishing Mortality

C:\LOB\GBCOD\ASSESS_2008\VPA\TY07\10P_SWPT_SPLIT\10P-SWPT-SPLT_A

Bootstrap Biomass

C:\LOB\GBCOD\ASSESS_2008\VPA\TY07\10P_SWPT_SPLIT\10P-SWPT-SPLT_A

Bootstrap Catchability

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Estimation Results

JAN-1 Population Numbers

AGE	1978	1979	1980	1981	1982
1	28705.	25943.	22914.	45891.	19863.
2	4707.	23365.	20988.	18453.	36471.
3	25333.	3478.	17107.	13370.	11591.
4	7660.	13468.	1991.	8669.	6701.
5	2967.	4093.	6916.	1141.	4688.
6	1264.	1624.	2267.	3454.	649.
7	1212.	874.	926.	978.	1570.
8	82.	776.	572.	385.	428.
9	174.	47.	363.	405.	169.
10	44.	127.	37.	173.	192.
Total	72148.	73793.	74082.	92919.	82323.
AGE	1983	1984	1985	1986	1987
1	11305.	29021.	9615.	44505.	17898.
2	15562.	8691.	23506.	7713.	35744.
3	20473.	8096.	5723.	12569.	4881.
4	5520.	8936.	3512.	2063.	6191.
5	2817.	2128.	4336.	1367.	920.
6	2015.	1273.	916.	1678.	649.
7	266.	982.	541.	308.	823.
8	654.	133.	402.	205.	176.
9	173.	378.	56.	153.	105.
10	288.	283.	182.	76.	75.
Total	59073.	59920.	48789.	70638.	67462.
AGE	1988	1989	1990	1991	1992

1	24854.	17849.	10204.	19796.	7470.
2	14560.	20056.	13809.	8290.	15956.
3	22111.	9803.	14070.	6330.	5023.
4	2637.	10610.	5305.	6709.	2076.
5	3124.	1198.	4880.	2584.	2671.
6	484.	1153.	637.	1967.	833.
7	308.	197.	467.	315.	642.
8	425.	118.	88.	178.	132.
9	93.	154.	51.	50.	66.
10	105.	54.	88.	47.	19.
=====					
Total	68702.	61191.	49599.	46266.	34886.
JAN-1 Population Numbers					
AGE	1993	1994	1995	1996	1997
=====					
1	9871.	6316.	3925.	6675.	10621.
2	5943.	7812.	5086.	3185.	5407.
3	8749.	3487.	5841.	3575.	2348.
4	2070.	3214.	1475.	3498.	2041.
5	745.	607.	868.	610.	1727.
6	853.	189.	121.	369.	270.
7	283.	223.	68.	62.	138.
8	209.	74.	53.	36.	35.
9	68.	46.	15.	26.	19.
10	34.	9.	3.	1.	7.
=====					
Total	28824.	21975.	17456.	18037.	22614.
AGE	1998	1999	2000	2001	2002
=====					
1	4944.	12234.	5977.	2295.	4239.
2	8581.	3991.	9973.	4791.	1868.
3	3809.	6197.	2946.	7315.	3274.
4	1250.	1944.	3261.	1746.	3600.
5	761.	581.	830.	1634.	758.
6	627.	279.	220.	397.	713.
7	90.	258.	116.	102.	164.
8	30.	37.	84.	54.	34.
9	12.	10.	11.	34.	21.
10	6.	7.	3.	3.	13.
=====					
Total	20110.	25540.	23421.	18370.	14685.
AGE	2003	2004	2005	2006	2007

1	1461.	10802.	2523.	6490.	7037.
2	3441.	1181.	8798.	2054.	5284.
3	1428.	2635.	904.	6874.	1619.
4	1621.	806.	1767.	559.	4869.
5	1591.	613.	427.	928.	271.
6	294.	493.	223.	220.	432.
7	253.	102.	179.	88.	116.
8	59.	80.	32.	70.	44.
9	11.	23.	22.	10.	32.
10	5.	10.	9.	9.	5.
=====					
Total	10164.	16745.	14882.	17301.	19708.

JAN-1 Population Numbers

AGE	2008
1	4875.
2	5752.
3	3852.
4	970.
5	2930.
6	157.
7	238.
8	81.
9	26.
10	22.
=====	
Total	18902.

Fishing Mortality Calculated

AGE	1978	1979	1980	1981	1982
1	0.0058	0.0119	0.0165	0.0297	0.0440
2	0.1026	0.1117	0.2509	0.2650	0.3774
3	0.4318	0.3577	0.4797	0.4908	0.5419
4	0.4269	0.4664	0.3569	0.4147	0.6667
5	0.4024	0.3905	0.4942	0.3647	0.6443
6	0.1688	0.3620	0.6411	0.5883	0.6924
7	0.2463	0.2239	0.6785	0.6268	0.6760
8	0.3601	0.5597	0.1456	0.6208	0.7059
9	0.3083	0.3598	0.5414	0.5446	0.6558
10	0.3083	0.3598	0.5414	0.5446	0.6558
AGE	1983	1984	1985	1986	1987
1	0.0630	0.0107	0.0204	0.0192	0.0064
2	0.4535	0.2179	0.4261	0.2575	0.2803
3	0.6290	0.6351	0.8203	0.5081	0.4158
4	0.7533	0.5232	0.7433	0.6078	0.4840
5	0.5944	0.6425	0.7493	0.5448	0.4415
6	0.5194	0.6547	0.8897	0.5129	0.5462
7	0.4937	0.6939	0.7714	0.3628	0.4606
8	0.3474	0.6618	0.7637	0.4717	0.4309
9	0.5587	0.6574	0.7723	0.5108	0.4756
10	0.5587	0.6574	0.7723	0.5108	0.4756
AGE	1988	1989	1990	1991	1992
1	0.0145	0.0566	0.0078	0.0157	0.0287
2	0.1956	0.1545	0.5800	0.3011	0.4009
3	0.5343	0.4140	0.5406	0.9151	0.6864
4	0.5889	0.5766	0.5192	0.7209	0.8245
5	0.7968	0.4318	0.7087	0.9323	0.9419
6	0.7013	0.7038	0.5044	0.9193	0.8797
7	0.7592	0.6020	0.7662	0.6727	0.9223
8	0.8176	0.6421	0.3653	0.7979	0.4573
9	0.7815	0.5595	0.6891	0.9081	0.9261
10	0.7815	0.5595	0.6891	0.9081	0.9261

Fishing Mortality Calculated

AGE	1993	1994	1995	1996	1997
1	0.0340	0.0166	0.0091	0.0108	0.0133
2	0.3332	0.0907	0.1523	0.1047	0.1502
3	0.8014	0.6600	0.3127	0.3604	0.4303
4	1.0272	1.1091	0.6839	0.5061	0.7865
5	1.1730	1.4129	0.6554	0.6147	0.8135
6	1.1405	0.8274	0.4668	0.7821	0.9036
7	1.1436	1.2330	0.4262	0.3799	1.3379
8	1.3043	1.3803	0.5290	0.4335	0.8944
9	1.1537	1.2384	0.6159	0.6543	0.8515
10	1.1537	1.2384	0.6159	0.6543	0.8515
AGE	1998	1999	2000	2001	2002
1	0.0142	0.0043	0.0212	0.0056	0.0088
2	0.1255	0.1035	0.1100	0.1806	0.0690
3	0.4725	0.4421	0.3230	0.5091	0.5029
4	0.5659	0.6513	0.4912	0.6348	0.6162
5	0.8021	0.7704	0.5380	0.6293	0.7456
6	0.6861	0.6757	0.5739	0.6852	0.8374
7	0.6733	0.9285	0.5704	0.8835	0.8281
8	0.8821	1.0337	0.7057	0.7381	0.8951
9	0.7434	0.7794	0.5479	0.6503	0.7929
10	0.7434	0.7794	0.5479	0.6503	0.7929
AGE	2003	2004	2005	2006	2007
1	0.0129	0.0052	0.0054	0.0056	0.0017
2	0.0667	0.0670	0.0467	0.0381	0.1161
3	0.3719	0.2000	0.2811	0.1450	0.3119
4	0.7723	0.4362	0.4441	0.5236	0.3080
5	0.9709	0.8136	0.4635	0.5645	0.3439
6	0.8593	0.8168	0.7325	0.4354	0.3973
7	0.9477	0.9661	0.7358	0.4941	0.1662
8	0.7441	1.0957	0.9542	0.5883	0.3025
9	0.9521	0.8269	0.5855	0.5353	0.3025
10	0.9521	0.8269	0.5855	0.5353	0.3025

Average Fishing Mortality For Ages 5- 8

Year Average F N Weighted Biomass Wtd Catch Wtd

1978	0.2944	0.3141	0.2944	0.3425
1979	0.3840	0.3823	0.3842	0.3962
1980	0.4898	0.5227	0.5158	0.5442
1981	0.5501	0.5539	0.5704	0.5667
1982	0.6796	0.6589	0.6647	0.6594
1983	0.4887	0.5354	0.5104	0.5443
1984	0.6633	0.6577	0.6626	0.6581
1985	0.7935	0.7729	0.7769	0.7749
1986	0.4730	0.5098	0.5017	0.5137
1987	0.4698	0.4734	0.4746	0.4765
1988	0.7687	0.7855	0.7846	0.7864
1989	0.5949	0.5713	0.5934	0.5936
1990	0.5862	0.6867	0.6799	0.6933
1991	0.8305	0.9063	0.8960	0.9095
1992	0.8003	0.9119	0.8982	0.9180
1993	1.1904	1.1689	1.1749	1.1699
1994	1.2134	1.2728	1.2444	1.2948
1995	0.5193	0.6148	0.5964	0.6227
1996	0.5526	0.6525	0.6479	0.6668
1997	0.9873	0.8594	0.8881	0.8697
1998	0.7609	0.7478	0.7431	0.7512
1999	0.8521	0.7914	0.8041	0.7992
2000	0.5970	0.5586	0.5671	0.5609
2001	0.7340	0.6539	0.6625	0.6572
2002	0.8265	0.7960	0.8045	0.7978
2003	0.8805	0.9473	0.9397	0.9490
2004	0.9231	0.8445	0.8584	0.8486
2005	0.7215	0.6079	0.6340	0.6347
2006	0.5206	0.5393	0.5351	0.5431
2007	0.3025	0.3446	0.3356	0.3597

Back Calculated Partial Recruitment

AGE	1978	1979	1980	1981	1982
1	0.0135	0.0213	0.0243	0.0474	0.0623
2	0.2377	0.1996	0.3698	0.4228	0.5347
3	1.0000	0.6391	0.7070	0.7830	0.7676
4	0.9886	0.8332	0.5260	0.6616	0.9444
5	0.9319	0.6976	0.7284	0.5819	0.9127
6	0.3909	0.6467	0.9449	0.9386	0.9809
7	0.5705	0.4000	1.0000	1.0000	0.9576
8	0.8339	1.0000	0.2145	0.9905	1.0000
9	0.7139	0.6428	0.7979	0.8689	0.9291
10	0.7139	0.6428	0.7979	0.8689	0.9291
AGE	1983	1984	1985	1986	1987
1	0.0836	0.0155	0.0229	0.0316	0.0118
2	0.6021	0.3140	0.4789	0.4237	0.5132
3	0.8350	0.9152	0.9220	0.8359	0.7613
4	1.0000	0.7540	0.8355	1.0000	0.8861
5	0.7891	0.9259	0.8422	0.8963	0.8083
6	0.6895	0.9435	1.0000	0.8438	1.0000
7	0.6554	1.0000	0.8671	0.5969	0.8433
8	0.4613	0.9537	0.8584	0.7760	0.7890
9	0.7417	0.9473	0.8681	0.8404	0.8707
10	0.7417	0.9473	0.8681	0.8404	0.8707
AGE	1988	1989	1990	1991	1992
1	0.0178	0.0805	0.0102	0.0168	0.0305
2	0.2392	0.2195	0.7570	0.3229	0.4256
3	0.6534	0.5882	0.7056	0.9815	0.7287
4	0.7203	0.8193	0.6776	0.7732	0.8753
5	0.9745	0.6135	0.9249	1.0000	1.0000
6	0.8578	1.0000	0.6583	0.9860	0.9340
7	0.9286	0.8553	1.0000	0.7215	0.9792
8	1.0000	0.9123	0.4767	0.8558	0.4856
9	0.9558	0.7949	0.8994	0.9740	0.9832
10	0.9558	0.7949	0.8994	0.9740	0.9832

Back Calculated Partial Recruitment

AGE	1993	1994	1995	1996	1997
1	0.0261	0.0118	0.0133	0.0138	0.0099
2	0.2555	0.0642	0.2227	0.1338	0.1123
3	0.6144	0.4671	0.4572	0.4609	0.3216
4	0.7875	0.7850	1.0000	0.6471	0.5879
5	0.8994	1.0000	0.9583	0.7860	0.6080
6	0.8744	0.5856	0.6825	1.0000	0.6754
7	0.8768	0.8727	0.6232	0.4858	1.0000
8	1.0000	0.9769	0.7736	0.5543	0.6685
9	0.8846	0.8765	0.9006	0.8367	0.6364
10	0.8846	0.8765	0.9006	0.8367	0.6364
AGE	1998	1999	2000	2001	2002
1	0.0161	0.0042	0.0300	0.0064	0.0098
2	0.1422	0.1001	0.1559	0.2045	0.0771
3	0.5357	0.4277	0.4578	0.5762	0.5618
4	0.6416	0.6301	0.6960	0.7185	0.6884
5	0.9093	0.7453	0.7624	0.7123	0.8329
6	0.7778	0.6537	0.8132	0.7756	0.9355
7	0.7633	0.8982	0.8083	1.0000	0.9251
8	1.0000	1.0000	1.0000	0.8354	1.0000
9	0.8427	0.7540	0.7764	0.7361	0.8857
10	0.8427	0.7540	0.7764	0.7361	0.8857
AGE	2003	2004	2005	2006	2007
1	0.0133	0.0047	0.0057	0.0095	0.0042
2	0.0686	0.0611	0.0489	0.0648	0.2923
3	0.3830	0.1825	0.2946	0.2464	0.7850
4	0.7954	0.3981	0.4654	0.8900	0.7751
5	1.0000	0.7426	0.4857	0.9596	0.8654
6	0.8850	0.7455	0.7677	0.7401	1.0000
7	0.9761	0.8818	0.7711	0.8399	0.4184
8	0.7664	1.0000	1.0000	1.0000	0.7613
9	0.9806	0.7547	0.6136	0.9098	0.7613
10	0.9806	0.7547	0.6136	0.9098	0.7613

JAN-1 Biomass

AGE	1978	1979	1980	1981	1982
1	10819.	12621.	9860.	17503.	8545.
2	4790.	20760.	20788.	17774.	32985.
3	46691.	5351.	31154.	24529.	22175.
4	21697.	43531.	5158.	25392.	19946.
5	8908.	16776.	33810.	4830.	20244.
6	5526.	8718.	13080.	22058.	3739.
7	6453.	6485.	7149.	7527.	13058.
8	652.	6432.	5603.	3470.	3957.
9	1621.	446.	3558.	4776.	1909.
10	615.	1729.	553.	2905.	2999.
Total	107772.	122849.	130713.	130763.	129555.
AGE	1983	1984	1985	1986	1987
1	5135.	9797.	5967.	20312.	6760.
2	14955.	8751.	20342.	8064.	35555.
3	37349.	15268.	10093.	23145.	8947.
4	16105.	26455.	10660.	5647.	19783.
5	11883.	8656.	18524.	6182.	4197.
6	11761.	7127.	5167.	10026.	4244.
7	1985.	7367.	3981.	2330.	6575.
8	6572.	1242.	3805.	1856.	1681.
9	1846.	4115.	618.	1767.	1145.
10	4693.	4143.	2551.	1107.	1176.
Total	112284.	92921.	81708.	80435.	90064.
AGE	1988	1989	1990	1991	1992
1	7153.	4193.	3204.	8823.	4938.
2	13043.	16855.	11111.	7447.	15506.
3	41273.	17093.	26462.	12212.	9607.
4	7770.	31575.	14888.	19753.	6395.
5	14844.	5106.	21013.	10713.	10655.
6	3028.	6871.	3668.	10580.	4490.
7	2536.	1442.	3468.	2155.	4126.
8	4096.	1100.	831.	1578.	1095.
9	1020.	1667.	566.	520.	691.
10	1574.	796.	1284.	694.	353.
Total	96336.	86699.	86495.	74476.	57855.

JAN-1 Biomass

AGE	1993	1994	1995	1996	1997
1	1363.	1794.	816.	1874.	3507.
2	6186.	4553.	4077.	2407.	4563.
3	15573.	5847.	8988.	6416.	4302.
4	5770.	8991.	4176.	8823.	5859.
5	3242.	2385.	3743.	2596.	6220.
6	4373.	1121.	721.	2155.	1427.
7	1889.	1442.	549.	482.	980.
8	1662.	605.	498.	344.	281.
9	700.	416.	158.	297.	202.
10	410.	134.	64.	6.	89.
Total	41170.	27289.	23789.	25400.	27430.
AGE	1998	1999	2000	2001	2002
1	2010.	3861.	1236.	932.	1204.
2	7537.	3755.	9011.	3486.	1662.
3	6929.	10843.	5445.	13450.	5550.
4	3530.	5356.	8774.	4623.	9206.
5	3021.	2293.	3243.	6089.	2581.
6	2972.	1447.	1098.	1942.	3278.
7	583.	1572.	746.	581.	956.
8	230.	295.	610.	395.	238.
9	114.	87.	90.	288.	178.
10	74.	90.	33.	29.	151.
Total	27000.	29599.	30284.	31814.	25004.
AGE	2003	2004	2005	2006	2007
1	551.	2030.	687.	1271.	1712.
2	2908.	1135.	5156.	1400.	3877.
3	2459.	4892.	1623.	10119.	2328.
4	4011.	2123.	4758.	1428.	11993.
5	5380.	2060.	1498.	3117.	910.
6	1270.	2131.	973.	936.	1692.
7	1380.	527.	917.	494.	604.
8	392.	524.	207.	414.	293.
9	93.	175.	177.	75.	212.
10	54.	108.	104.	81.	42.
Total	18498.	15704.	16099.	19336.	23663.

JAN-1 Biomass

AGE	2008
1	1245.
2	4380.
3	6381.
4	2488.
5	9942.
6	667.
7	1264.
8	522.
9	201.
10	225.
=====	
Total	27315.

Mean Biomass

AGE	1978	1979	1980	1981	1982
1	15013.	16229.	13264.	24080.	11333.
2	5082.	27387.	23876.	21266.	38590.
3	45837.	5044.	30176.	22993.	20784.
4	19392.	42080.	5415.	22857.	16673.
5	8946.	15241.	27839.	4406.	16724.
6	6020.	8917.	10347.	17455.	2821.
7	6496.	6885.	5118.	5841.	9903.
8	547.	5623.	4801.	2571.	2742.
9	1357.	374.	2381.	4003.	1476.
10	482.	1324.	391.	2048.	2015.
=====					
Total	109174.	129103.	123607.	127520.	123060.

AGE	1983	1984	1985	1986	1987
1	6723.	14143.	6951.	26928.	9407.
2	16410.	10649.	24205.	8398.	41679.
3	33254.	13591.	7443.	22045.	9025.
4	11927.	23330.	8458.	5110.	18705.
5	9298.	7100.	13935.	5297.	3915.
6	9264.	5608.	3594.	8606.	3558.
7	1627.	5670.	2856.	2092.	5363.
8	5372.	917.	2649.	1484.	1346.
9	1418.	2818.	422.	1419.	916.
10	3289.	2782.	1632.	793.	855.
=====					
Total	98582.	86608.	72144.	82173.	94769.

AGE	1988	1989	1990	1991	1992
1	11001.	6843.	4893.	11719.	5539.
2	16587.	24252.	14280.	9908.	17210.
3	37166.	16145.	24480.	9535.	8020.
4	6395.	27538.	13518.	15432.	4933.
5	10701.	4601.	15924.	7438.	7198.
6	2164.	4981.	2927.	6894.	3078.
7	1727.	1073.	2516.	1537.	2735.
8	2782.	795.	754.	1055.	913.
9	686.	1214.	418.	291.	465.
10	1003.	558.	851.	419.	212.
=====					
Total	90212.	88002.	80559.	64230.	50303.
Mean Biomass					
AGE	1993	1994	1995	1996	1997
1	2497.	2709.	1404.	2929.	5151.
2	6017.	8118.	5772.	3958.	6674.
3	12205.	5035.	9035.	6545.	4055.
4	3848.	6350.	3645.	8074.	4470.
5	2020.	1442.	3062.	2033.	4377.
6	2733.	834.	656.	1527.	937.
7	1148.	851.	468.	382.	546.
8	964.	338.	461.	260.	171.
9	416.	222.	123.	190.	135.
10	225.	71.	43.	4.	55.
=====					
Total	32073.	25972.	24669.	25901.	26571.
AGE	1998	1999	2000	2001	2002
1	2753.	5909.	2080.	1246.	1875.
2	10492.	4927.	13108.	5439.	2157.
3	6271.	9773.	5474.	11589.	4951.
4	2992.	4392.	7975.	3478.	7275.
5	2198.	1690.	2670.	4553.	1936.
6	2318.	1092.	839.	1386.	2288.
7	442.	1028.	568.	371.	662.
8	141.	181.	441.	268.	167.
9	89.	61.	62.	206.	124.
10	48.	58.	23.	19.	96.
=====					
Total	27742.	29111.	33240.	28556.	21530.

AGE	2003	2004	2005	2006	2007
1	792.	3240.	983.	2224.	2692.
2	4402.	1589.	8070.	1971.	6434.
3	2451.	5135.	1509.	12170.	2429.
4	3014.	1837.	3996.	1236.	11066.
5	3625.	1496.	1248.	2386.	758.
6	855.	1494.	713.	737.	1357.
7	870.	340.	634.	408.	578.
8	262.	331.	141.	310.	239.
9	56.	122.	134.	53.	173.
10	32.	67.	72.	58.	33.
=====					
Total	16359.	15652.	17499.	21553.	25760.

Spawning Stock Biomass

AGE	1978	1979	1980	1981	1982
1	836.	853.	856.	1516.	656.
2	1503.	6701.	7328.	6250.	10785.
3	31517.	3803.	21975.	17270.	15480.
4	18567.	37396.	4512.	22002.	16572.
5	7977.	15051.	29814.	4352.	17410.
6	5197.	7938.	11369.	19341.	3223.
7	5990.	6042.	6175.	6557.	11284.
8	594.	5667.	5289.	3026.	3402.
9	1489.	407.	3145.	4219.	1655.
10	565.	1575.	489.	2566.	2600.
=====					
Total	74235.	85433.	90951.	87101.	83067.

AGE	1983	1984	1985	1986	1987
1	393.	1230.	1035.	3133.	1306.
2	5499.	3999.	10813.	4333.	19363.
3	27649.	11557.	7748.	18717.	7186.
4	13464.	22981.	9017.	4886.	17298.
5	10409.	7522.	15813.	5460.	3771.
6	10432.	6181.	4308.	8903.	3748.
7	1769.	6347.	3385.	2121.	5890.
8	5999.	1076.	3240.	1659.	1514.
9	1627.	3567.	525.	1570.	1023.
10	4135.	3591.	2170.	984.	1051.
=====					
Total	81375.	68051.	58056.	51766.	62150.

AGE	1988	1989	1990	1991	1992
1	1725.	803.	371.	1107.	428.
2	7815.	9691.	4488.	3631.	6593.
3	32866.	14041.	19881.	9025.	7376.
4	6676.	27186.	12810.	16603.	5337.
5	12571.	4596.	18059.	8870.	8808.
6	2606.	5910.	3262.	8779.	3750.
7	2161.	1262.	2952.	1863.	3422.
8	3457.	956.	756.	1336.	982.
9	866.	1468.	488.	432.	572.
10	1336.	701.	1107.	577.	292.
=====					
Total	72080.	66616.	64173.	52224.	37560.

Spawning Stock Biomass

AGE	1993	1994	1995	1996	1997
1	52.	69.	32.	90.	338.
2	2434.	1779.	1922.	1098.	2453.
3	12256.	4661.	7922.	5551.	3641.
4	4703.	7228.	3604.	7844.	4921.
5	2579.	1823.	3246.	2267.	5253.
6	3498.	944.	645.	1829.	1187.
7	1510.	1136.	494.	437.	758.
8	1294.	465.	441.	309.	234.
9	559.	328.	138.	258.	169.
10	327.	106.	55.	5.	75.
=====					
Total	29211.	18538.	18499.	19689.	19030.

AGE	1998	1999	2000	2001	2002
1	175.	261.	83.	72.	81.
2	3998.	1821.	4364.	1636.	683.
3	5823.	9061.	4691.	11114.	4344.
4	3107.	4601.	7819.	3982.	7954.
5	2556.	1950.	2867.	5303.	2205.
6	2564.	1251.	965.	1675.	2757.
7	504.	1302.	656.	485.	805.
8	192.	240.	524.	338.	198.
9	97.	74.	79.	250.	151.
10	63.	77.	29.	25.	128.
=====					
Total	19078.	20637.	22078.	24880.	19308.

AGE	2003	2004	2005	2006	2007
1	21.	137.	40.	61.	66.
2	918.	412.	1781.	471.	1361.
3	1878.	3798.	1243.	8025.	1902.
4	3342.	1872.	4188.	1241.	10909.
5	4426.	1740.	1341.	2744.	831.
6	1064.	1799.	833.	842.	1532.
7	1140.	434.	784.	440.	568.
8	335.	422.	171.	363.	270.
9	77.	148.	155.	67.	195.
10	44.	91.	91.	72.	39.
=====					
Total	13246.	10852.	10627.	14325.	17672.

Catch Biomass

AGE	1978	1979	1980	1981	1982
1	88.	194.	219.	716.	499.
2	522.	3060.	5991.	5636.	14565.
3	19793.	1804.	14476.	11284.	11262.
4	8279.	19626.	1932.	9478.	11116.
5	3600.	5951.	13759.	1607.	10775.
6	1016.	3228.	6633.	10268.	1954.
7	1600.	1541.	3472.	3661.	6694.
8	197.	3147.	699.	1596.	1935.
9	418.	135.	1289.	2180.	968.
10	149.	476.	212.	1115.	1322.
=====					
Total	35661.	39162.	48682.	47542.	61088.

AGE	1983	1984	1985	1986	1987
1	423.	152.	142.	518.	60.
2	7442.	2320.	10313.	2163.	11683.
3	20916.	8631.	6105.	11201.	3753.
4	8984.	12207.	6287.	3106.	9053.
5	5527.	4562.	10441.	2886.	1729.
6	4812.	3672.	3197.	4414.	1944.
7	803.	3935.	2203.	759.	2470.
8	1867.	607.	2023.	700.	580.
9	792.	1853.	326.	725.	435.
10	1838.	1829.	1260.	405.	407.
=====					
Total	53404.	39767.	42297.	26877.	32113.

AGE	1988	1989	1990	1991	1992
1	160.	388.	38.	183.	159.
2	3244.	3746.	8282.	2983.	6900.
3	19856.	6685.	13235.	8726.	5505.
4	3766.	15879.	7018.	11124.	4067.
5	8527.	1987.	11285.	6935.	6780.
6	1518.	3506.	1476.	6337.	2708.
7	1311.	646.	1928.	1034.	2522.
8	2274.	511.	275.	842.	418.
9	536.	679.	288.	264.	431.
10	784.	312.	586.	381.	196.
=====					
Total	41977.	34339.	44412.	38810.	29685.

Catch Biomass

AGE	1993	1994	1995	1996	1997
1	85.	45.	13.	32.	68.
2	2005.	736.	879.	414.	1003.
3	9781.	3323.	2825.	2359.	1745.
4	3953.	7043.	2492.	4086.	3516.
5	2369.	2037.	2007.	1250.	3560.
6	3117.	690.	306.	1194.	847.
7	1313.	1049.	200.	145.	730.
8	1258.	467.	244.	113.	153.
9	480.	275.	76.	124.	115.
10	259.	88.	27.	3.	47.
=====					
Total	24620.	15754.	9068.	9719.	11784.

AGE	1998	1999	2000	2001	2002
1	39.	25.	44.	7.	16.
2	1316.	510.	1442.	983.	149.
3	2963.	4321.	1768.	5900.	2490.
4	1693.	2860.	3917.	2208.	4483.
5	1763.	1302.	1437.	2865.	1443.
6	1590.	738.	482.	950.	1916.
7	297.	955.	324.	328.	548.
8	124.	187.	311.	198.	150.
9	66.	48.	34.	134.	98.
10	36.	45.	13.	13.	76.
=====					
Total	9888.	10991.	9771.	13584.	11369.

AGE	2003	2004	2005	2006	2007
1	10.	17.	5.	12.	4.
2	293.	106.	377.	75.	747.
3	911.	1027.	424.	1764.	758.
4	2328.	801.	1775.	647.	3408.
5	3520.	1218.	579.	1347.	261.
6	735.	1221.	522.	321.	539.
7	824.	329.	466.	202.	96.
8	195.	363.	135.	182.	72.
9	54.	101.	78.	29.	60.
10	30.	56.	42.	31.	10.
=====					
Total	8900.	5238.	4403.	4610.	5955.

Catch Numbers

AGE	1978	1979	1980	1981	1982
1	151.6	279.2	339.9	1219.2	775.4
2	416.8	2242.7	4238.7	3910.7	10457.1
3	8109.1	953.6	5955.4	4738.2	4434.4
4	2429.6	4585.0	544.9	2685.5	2988.0
5	896.8	1206.9	2464.6	317.9	2039.8
6	178.4	449.8	983.0	1406.0	297.1
7	240.8	159.5	418.1	417.0	707.2
8	22.6	304.1	70.4	162.9	198.6
9	42.1	12.9	138.7	155.5	74.6
10	10.7	35.0	14.2	66.4	84.6
=====					
Total	12498.5	10228.7	15167.9	15079.3	22056.8
AGE	1983	1984	1985	1986	1987
1	626.2	280.9	176.0	768.3	103.8
2	5181.7	1547.7	7443.7	1594.1	7956.1
3	8753.3	3485.7	2942.2	4576.3	1515.5
4	2680.4	3328.4	1690.1	860.2	2170.1
5	1155.3	923.9	2097.7	525.3	299.7
6	746.4	560.2	496.5	615.4	249.9
7	94.6	450.3	267.2	85.5	277.3
8	175.0	58.9	196.8	70.4	56.1
9	67.7	167.0	27.7	56.0	36.2
10	112.6	124.9	89.7	27.8	26.0
=====					
Total	19593.2	10927.9	15427.6	9179.3	12690.7

AGE	1988	1989	1990	1991	1992
1	324.9	891.5	71.8	278.7	191.7
2	2352.1	2608.6	5561.1	1963.0	4808.4
3	8368.3	3032.8	5373.4	3491.4	2286.3
4	1074.1	4254.4	1964.0	3160.5	1070.7
5	1575.6	383.5	2272.1	1442.1	1500.0
6	223.8	534.2	230.6	1088.0	448.1
7	150.3	81.4	229.4	141.3	356.0
8	218.0	51.2	24.6	89.7	44.1
9	46.5	60.2	23.2	27.5	36.4
10	52.5	21.3	40.4	26.0	10.4
=====					
Total	14386.1	11919.1	15790.6	11708.2	10752.1

Catch Numbers

AGE	1993	1994	1995	1996	1997
1	299.2	94.4	32.3	64.9	126.9
2	1534.9	614.6	652.8	287.3	685.2
3	4429.4	1543.4	1429.0	986.6	749.6
4	1224.8	1987.7	669.9	1269.8	1020.7
5	475.3	425.6	382.3	256.3	882.9
6	535.6	97.6	41.2	183.8	147.7
7	178.0	146.2	21.4	17.9	94.4
8	141.0	51.2	20.0	11.6	18.9
9	43.1	30.5	6.4	11.3	10.1
10	21.2	5.6	1.4	0.3	3.9
=====					
Total	8882.5	4996.8	3256.7	3089.8	3740.3

AGE	1998	1999	2000	2001	2002
1	63.3	47.7	113.5	11.7	33.6
2	918.9	356.3	943.2	719.8	113.0
3	1310.3	2021.8	741.1	2667.3	1182.7
4	494.3	852.6	1156.4	751.6	1516.2
5	385.6	286.6	315.8	698.7	365.4
6	285.2	125.8	88.0	180.4	371.5
7	40.2	143.8	46.3	54.8	84.7
8	16.0	22.2	38.8	25.8	18.7
9	5.6	5.0	4.2	14.8	10.6
10	2.9	3.4	1.0	1.3	6.5
=====					
Total	3522.3	3865.2	3448.3	5126.2	3702.9

AGE	2003	2004	2005	2006	2007
1	17.0	50.5	12.3	32.8	10.6
2	201.3	69.4	364.1	69.7	526.1
3	404.4	434.3	201.8	842.8	395.2
4	800.7	260.1	578.4	208.3	1175.8
5	910.4	313.6	144.5	366.1	71.9
6	156.0	253.0	106.0	70.8	129.2
7	142.4	58.2	85.3	31.2	16.2
8	28.2	49.2	18.0	28.5	10.4
9	6.5	11.8	8.9	3.8	8.6
10	2.9	5.0	3.7	3.4	1.1
=====					
Total	2669.8	1505.2	1523.0	1657.4	2345.1

Surplus Production

Average Adjustment Factor (Delta) = 1.0000

Year	Biomass	Delta Biomass	Catch Biomass	Surplus Production
1978	107771.534	15077.374	35660.721	50738.095
1979	122848.908	7864.015	39162.286	47026.301
1980	130712.922	50.259	48682.434	48732.693
1981	130763.181	-1207.795	47541.857	46334.062
1982	129555.386	-17271.699	61088.247	43816.548
1983	112283.687	-19362.224	53404.330	34042.106
1984	92921.463	-11213.858	39767.136	28553.278
1985	81707.605	-1272.252	42297.434	41025.182
1986	80435.353	9628.743	26876.781	36505.524
1987	90064.095	6272.358	32112.683	38385.042
1988	96336.453	-9637.788	41976.636	32338.849
1989	86698.666	-204.079	34338.791	34134.713
1990	86494.587	-12018.713	44411.969	32393.257
1991	74475.874	-16620.379	38810.185	22189.806
1992	57855.495	-16685.545	29684.877	12999.332
1993	41169.950	-13880.833	24620.033	10739.201
1994	27289.117	-3500.057	15754.070	12254.013
1995	23789.060	1610.467	9068.146	10678.613
1996	25399.527	2030.589	9718.713	11749.303
1997	27430.116	-430.234	11784.450	11354.216
1998	26999.882	2599.052	9887.960	12487.012
1999	29598.934	684.951	10991.218	11676.169
2000	30283.885	1529.855	9770.992	11300.847
2001	31813.740	-6809.653	13584.079	6774.425
2002	25004.087	-6506.016	11369.031	4863.015
2003	18498.071	-2794.267	8900.391	6106.124
2004	15703.804	394.698	5237.603	5632.301
2005	16098.502	3237.519	4402.945	7640.464
2006	19336.021	4326.664	4610.067	8936.731
2007	23662.684	3652.084	5955.462	9607.545
2008	27314.768			

Summary of Survey Indices Used in the Estimate

INDEX	Survey Tag	Age	Time	Type	Catchability	Std. Error	CV
1	spr_36pr	1	JAN-1	NUMBER	0.1784E-01	0.6011E-02	0.3370E+00
2	spr_36pr	2	JAN-1	NUMBER	0.9185E-01	0.1112E-01	0.1210E+00
3	spr_36pr	3	JAN-1	NUMBER	0.1687E+00	0.3031E-01	0.1797E+00
4	spr_36pr	4	JAN-1	NUMBER	0.2156E+00	0.4330E-01	0.2008E+00
5	spr_36pr	5	JAN-1	NUMBER	0.2642E+00	0.5941E-01	0.2248E+00
6	spr_36pr	6	JAN-1	NUMBER	0.2787E+00	0.5238E-01	0.1880E+00
7	spr_36pr	7	JAN-1	NUMBER	0.2976E+00	0.5275E-01	0.1773E+00
8	spr_36pr	8	JAN-1	NUMBER	0.3631E+00	0.7104E-01	0.1957E+00
9	spr_36po	1	JAN-1	NUMBER	0.2930E-01	0.6283E-02	0.2145E+00
10	spr_36po	2	JAN-1	NUMBER	0.1011E+00	0.9212E-02	0.9107E-01
11	spr_36po	3	JAN-1	NUMBER	0.2253E+00	0.2569E-01	0.1140E+00
12	spr_36po	4	JAN-1	NUMBER	0.5063E+00	0.8675E-01	0.1714E+00
13	spr_36po	5	JAN-1	NUMBER	0.6888E+00	0.1139E+00	0.1654E+00
14	spr_36po	6	JAN-1	NUMBER	0.7018E+00	0.1226E+00	0.1747E+00
15	spr_36po	7	JAN-1	NUMBER	0.7231E+00	0.1815E+00	0.2510E+00
16	spr_36po	8	JAN-1	NUMBER	0.8168E+00	0.1743E+00	0.2134E+00
17	spr_41	1	JAN-1	NUMBER	0.1413E-01	0.1069E-01	0.7560E+00
18	spr_41	2	JAN-1	NUMBER	0.8999E-01	0.2087E-01	0.2319E+00
19	spr_41	3	JAN-1	NUMBER	0.1987E+00	0.4671E-01	0.2350E+00
20	spr_41	4	JAN-1	NUMBER	0.1773E+00	0.2236E-01	0.1261E+00
21	spr_41	5	JAN-1	NUMBER	0.2163E+00	0.5405E-01	0.2499E+00
22	spr_41	6	JAN-1	NUMBER	0.2077E+00	0.3557E-01	0.1713E+00
23	spr_41	7	JAN-1	NUMBER	0.3002E+00	0.1126E+00	0.3750E+00
24	spr_41	8	JAN-1	NUMBER	0.2915E+00	0.1651E+00	0.5663E+00
25	sp_can_p	1	JAN-1	NUMBER	0.3588E-01	0.1150E-01	0.3205E+00
26	sp_can_p	2	JAN-1	NUMBER	0.1876E+00	0.3961E-01	0.2112E+00
27	sp_can_p	3	JAN-1	NUMBER	0.3247E+00	0.3702E-01	0.1140E+00
28	sp_can_p	4	JAN-1	NUMBER	0.3721E+00	0.4750E-01	0.1277E+00
29	sp_can_p	5	JAN-1	NUMBER	0.5808E+00	0.7103E-01	0.1223E+00
30	sp_can_p	6	JAN-1	NUMBER	0.5559E+00	0.1150E+00	0.2068E+00
31	sp_can_p	7	JAN-1	NUMBER	0.7300E+00	0.2118E+00	0.2902E+00
32	sp_can_p	8	JAN-1	NUMBER	0.6448E-03	0.1711E-03	0.2653E+00
33	sp_canpo	1	JAN-1	NUMBER	0.1586E-01	0.5673E-02	0.3576E+00
34	sp_canpo	2	JAN-1	NUMBER	0.7794E-01	0.2001E-01	0.2567E+00
35	sp_canpo	3	JAN-1	NUMBER	0.3626E+00	0.5277E-01	0.1455E+00
36	sp_canpo	4	JAN-1	NUMBER	0.8883E+00	0.1309E+00	0.1473E+00
37	sp_canpo	5	JAN-1	NUMBER	0.1408E+01	0.1994E+00	0.1416E+00
38	sp_canpo	6	JAN-1	NUMBER	0.1934E+01	0.2942E+00	0.1521E+00
39	sp_canpo	7	JAN-1	NUMBER	0.1901E+01	0.3915E+00	0.2059E+00
40	sp_canpo	8	JAN-1	NUMBER	0.1278E-02	0.3201E-03	0.2505E+00
41	us0autpr	1	JAN-1	NUMBER	0.1638E-01	0.3271E-02	0.1998E+00
42	us1autpr	2	JAN-1	NUMBER	0.8110E-01	0.1148E-01	0.1415E+00
43	us2autpr	3	JAN-1	NUMBER	0.1191E+00	0.1798E-01	0.1510E+00
44	us3autpr	4	JAN-1	NUMBER	0.1269E+00	0.2259E-01	0.1779E+00
45	us4autpr	5	JAN-1	NUMBER	0.8865E-01	0.2152E-01	0.2428E+00
46	us5autpr	6	JAN-1	NUMBER	0.1041E+00	0.1621E-01	0.1557E+00
47	us0autpo	1	JAN-1	NUMBER	0.2015E-01	0.8594E-02	0.4264E+00
48	us1autpo	2	JAN-1	NUMBER	0.7415E-01	0.1521E-01	0.2051E+00
49	us2autpo	3	JAN-1	NUMBER	0.1630E+00	0.3016E-01	0.1850E+00
50	us3autpo	4	JAN-1	NUMBER	0.2333E+00	0.5204E-01	0.2231E+00
51	us4autpo	5	JAN-1	NUMBER	0.2120E+00	0.5110E-01	0.2410E+00
52	us5autpo	6	JAN-1	NUMBER	0.2530E+00	0.6462E-01	0.2554E+00

Survey Index: 1 Tag: spr_36pr AGE = 1
Time = JAN-1 Type = NUMBER
Catchability = 0.178394E-01 % Variance Contribution = 5.4693
Residual = LN(Observed) - LN(Predicted)

Year	Observed	Predicted	Residual
1978	N/A	0.512080E+03	N/A
1979	N/A	0.462799E+03	N/A
1980	N/A	0.408763E+03	N/A
1981	N/A	0.818660E+03	N/A
1982	0.693828E+03	0.354341E+03	0.671963E+00
1983	0.452853E+03	0.201680E+03	0.808885E+00
1984	0.549434E+03	0.517710E+03	0.594732E-01
1985	0.151770E+03	0.171530E+03	-0.122390E+00
1986	0.119053E+04	0.793951E+03	0.405134E+00
1987	0.269116E+02	0.319290E+03	-0.247354E+01
1988	0.983845E+03	0.443386E+03	0.797027E+00
1989	0.424029E+03	0.318410E+03	0.286461E+00
1990	0.236877E+03	0.182036E+03	0.263334E+00
1991	0.140241E+04	0.353152E+03	0.137905E+01
1992	0.167617E+03	0.133256E+03	0.229412E+00
1993	0.116116E+02	0.176095E+03	-0.271902E+01
1994	0.170486E+03	0.112667E+03	0.414217E+00
1995	N/A	0.700245E+02	N/A
1996	N/A	0.119086E+03	N/A
1997	N/A	0.189472E+03	N/A
1998	N/A	0.882021E+02	N/A
1999	N/A	0.218245E+03	N/A
2000	N/A	0.106623E+03	N/A
2001	N/A	0.409422E+02	N/A
2002	N/A	0.756296E+02	N/A
2003	N/A	0.260685E+02	N/A
2004	N/A	0.192693E+03	N/A
2005	N/A	0.450014E+02	N/A
2006	N/A	0.115776E+03	N/A
2007	N/A	0.125534E+03	N/A
2008	N/A	0.869611E+02	N/A

Survey Index: 2 Tag: spr_36pr AGE = 2
Time = JAN-1 Type = NUMBER
Catchability = 0.918544E-01 % Variance Contribution = 0.7054
Residual = LN(Observed) - LN(Predicted)

Year	Observed	Predicted	Residual
1978	N/A	0.432354E+03	N/A
1979	N/A	0.214616E+04	N/A
1980	N/A	0.192782E+04	N/A
1981	N/A	0.169499E+04	N/A
1982	0.742514E+04	0.335004E+04	0.795899E+00
1983	0.266630E+04	0.142948E+04	0.623383E+00

1984	0.588777E+03	0.798301E+03	-0.304439E+00
1985	0.362432E+04	0.215916E+04	0.517947E+00
1986	0.558723E+03	0.708508E+03	-0.237507E+00
1987	0.220279E+04	0.328326E+04	-0.399113E+00
1988	0.831664E+03	0.133739E+04	-0.475049E+00
1989	0.192671E+04	0.184219E+04	0.448548E-01
1990	0.125883E+04	0.126839E+04	-0.756392E-02
1991	0.721013E+03	0.761439E+03	-0.545535E-01
1992	0.171087E+04	0.146564E+04	0.154711E+00
1993	0.544789E+03	0.545856E+03	-0.195628E-02
1994	0.372118E+03	0.717536E+03	-0.656613E+00
1995	N/A	0.467129E+03	N/A
1996	N/A	0.292517E+03	N/A
1997	N/A	0.496638E+03	N/A
1998	N/A	0.788213E+03	N/A
1999	N/A	0.366575E+03	N/A
2000	N/A	0.916079E+03	N/A
2001	N/A	0.440068E+03	N/A
2002	N/A	0.171626E+03	N/A
2003	N/A	0.316038E+03	N/A
2004	N/A	0.108484E+03	N/A
2005	N/A	0.808129E+03	N/A
2006	N/A	0.188688E+03	N/A
2007	N/A	0.485344E+03	N/A
2008	N/A	0.528324E+03	N/A

Survey Index: 3 Tag: spr_36pr AGE = 3
 Time = JAN-1 Type = NUMBER
 Catchability = 0.168705E+00 % Variance Contribution = 1.5548
 Residual = LN(Observed) - LN(Predicted)

Year	Observed	Predicted	Residual
1978	N/A	0.427374E+04	N/A
1979	N/A	0.586731E+03	N/A
1980	N/A	0.288609E+04	N/A
1981	N/A	0.225564E+04	N/A
1982	0.129803E+05	0.195545E+04	0.189281E+01
1983	0.412144E+04	0.345387E+04	0.176706E+00
1984	0.103917E+04	0.136578E+04	-0.273301E+00
1985	0.906115E+03	0.965416E+03	-0.633923E-01
1986	0.251958E+04	0.212038E+04	0.172498E+00
1987	0.516921E+03	0.823504E+03	-0.465678E+00
1988	0.430258E+04	0.373028E+04	0.142731E+00
1989	0.910350E+03	0.165379E+04	-0.596994E+00
1990	0.237300E+04	0.237364E+04	-0.267003E-03
1991	0.940813E+03	0.106790E+04	-0.126708E+00
1992	0.639595E+03	0.847334E+03	-0.281260E+00
1993	0.178423E+04	0.147599E+04	0.189657E+00
1994	0.273214E+03	0.588195E+03	-0.766803E+00
1995	N/A	0.985457E+03	N/A
1996	N/A	0.603202E+03	N/A
1997	N/A	0.396158E+03	N/A
1998	N/A	0.642647E+03	N/A
1999	N/A	0.104551E+04	N/A

2000	N/A	0.497023E+03	N/A
2001	N/A	0.123406E+04	N/A
2002	N/A	0.552376E+03	N/A
2003	N/A	0.240878E+03	N/A
2004	N/A	0.444591E+03	N/A
2005	N/A	0.152560E+03	N/A
2006	N/A	0.115976E+04	N/A
2007	N/A	0.273120E+03	N/A
2008	N/A	0.649804E+03	N/A

Survey Index: 4 Tag: spr_36pr AGE = 4
Time = JAN-1 Type = NUMBER
Catchability = 0.215614E+00 % Variance Contribution = 1.9428
Residual = LN(Observed) - LN(Predicted)

Year	Observed	Predicted	Residual
1978	N/A	0.165169E+04	N/A
1979	N/A	0.290382E+04	N/A
1980	N/A	0.429311E+03	N/A
1981	N/A	0.186919E+04	N/A
1982	0.113717E+05	0.144487E+04	0.206311E+01
1983	0.108767E+04	0.119016E+04	-0.900524E-01
1984	0.169147E+04	0.192678E+04	-0.130253E+00
1985	0.151675E+04	0.757288E+03	0.694581E+00
1986	0.498889E+03	0.444800E+03	0.114761E+00
1987	0.104272E+04	0.133486E+04	-0.246992E+00
1988	0.558450E+03	0.568553E+03	-0.179289E-01
1989	0.216263E+04	0.228773E+04	-0.562382E-01
1990	0.921005E+03	0.114383E+04	-0.216675E+00
1991	0.126894E+04	0.144646E+04	-0.130936E+00
1992	0.229637E+03	0.447514E+03	-0.667209E+00
1993	0.280454E+03	0.446337E+03	-0.464662E+00
1994	0.295755E+03	0.693005E+03	-0.851508E+00
1995	N/A	0.318120E+03	N/A
1996	N/A	0.754280E+03	N/A
1997	N/A	0.440166E+03	N/A
1998	N/A	0.269571E+03	N/A
1999	N/A	0.419235E+03	N/A
2000	N/A	0.703092E+03	N/A
2001	N/A	0.376504E+03	N/A
2002	N/A	0.776139E+03	N/A
2003	N/A	0.349550E+03	N/A
2004	N/A	0.173769E+03	N/A
2005	N/A	0.380896E+03	N/A
2006	N/A	0.120515E+03	N/A
2007	N/A	0.104980E+04	N/A
2008	N/A	0.209212E+03	N/A

Survey Index: 5 Tag: spr_36pr AGE = 5
Time = JAN-1 Type = NUMBER
Catchability = 0.264241E+00 % Variance Contribution = 2.4352
Residual = LN(Observed) - LN(Predicted)

Year	Observed	Predicted	Residual
1978	N/A	0.783962E+03	N/A
1979	N/A	0.108141E+04	N/A
1980	N/A	0.182761E+04	N/A
1981	N/A	0.301462E+03	N/A
1982	0.848057E+04	0.123887E+04	0.192358E+01
1983	0.952152E+03	0.744309E+03	0.246268E+00
1984	0.576892E+03	0.562246E+03	0.257159E-01
1985	0.192930E+04	0.114565E+04	0.521187E+00
1986	0.737679E+03	0.361323E+03	0.713735E+00
1987	0.848330E+02	0.243023E+03	-0.105247E+01
1988	0.879067E+03	0.825502E+03	0.628697E-01
1989	0.321163E+03	0.316568E+03	0.144114E-01
1990	0.124572E+04	0.128957E+04	-0.345941E-01
1991	0.654075E+03	0.682901E+03	-0.431286E-01
1992	0.372801E+03	0.705838E+03	-0.638342E+00
1993	0.122263E+03	0.196884E+03	-0.476439E+00
1994	0.453536E+02	0.160338E+03	-0.126279E+01
1995	N/A	0.229354E+03	N/A
1996	N/A	0.161082E+03	N/A
1997	N/A	0.456255E+03	N/A
1998	N/A	0.201140E+03	N/A
1999	N/A	0.153590E+03	N/A
2000	N/A	0.219310E+03	N/A
2001	N/A	0.431670E+03	N/A
2002	N/A	0.200239E+03	N/A
2003	N/A	0.420507E+03	N/A
2004	N/A	0.162015E+03	N/A
2005	N/A	0.112715E+03	N/A
2006	N/A	0.245131E+03	N/A
2007	N/A	0.716297E+02	N/A
2008	N/A	0.774113E+03	N/A

Survey Index: 6 Tag: spr_36pr AGE = 6
 Time = JAN-1 Type = NUMBER
 Catchability = 0.278657E+00 % Variance Contribution = 1.7018
 Residual = LN(Observed) - LN(Predicted)

Year	Observed	Predicted	Residual
1978	N/A	0.352174E+03	N/A
1979	N/A	0.452630E+03	N/A
1980	N/A	0.631851E+03	N/A
1981	N/A	0.962621E+03	N/A
1982	0.400122E+03	0.180743E+03	0.794694E+00
1983	0.605306E+03	0.561605E+03	0.749358E-01
1984	0.546975E+03	0.354663E+03	0.433234E+00
1985	0.362555E+03	0.255329E+03	0.350623E+00
1986	0.844096E+03	0.467585E+03	0.590685E+00
1987	0.245073E+03	0.180923E+03	0.303486E+00
1988	0.874286E+02	0.134935E+03	-0.433971E+00
1989	0.479628E+03	0.321282E+03	0.400691E+00

1990	0.178136E+03	0.177478E+03	0.369799E-02
1991	0.448208E+03	0.548113E+03	-0.201224E+00
1992	0.194529E+03	0.232101E+03	-0.176592E+00
1993	0.188791E+03	0.237606E+03	-0.229974E+00
1994	0.778660E+01	0.525986E+02	-0.191029E+01
1995	N/A	0.337007E+02	N/A
1996	N/A	0.102825E+03	N/A
1997	N/A	0.752134E+02	N/A
1998	N/A	0.174633E+03	N/A
1999	N/A	0.778703E+02	N/A
2000	N/A	0.613743E+02	N/A
2001	N/A	0.110563E+03	N/A
2002	N/A	0.198643E+03	N/A
2003	N/A	0.820283E+02	N/A
2004	N/A	0.137503E+03	N/A
2005	N/A	0.620035E+02	N/A
2006	N/A	0.612222E+02	N/A
2007	N/A	0.120347E+03	N/A
2008	N/A	0.438493E+02	N/A

Survey Index: 7 Tag: spr_36pr AGE = 7
 Time = JAN-1 Type = NUMBER
 Catchability = 0.297561E+00 % Variance Contribution = 1.5138
 Residual = LN(Observed) - LN(Predicted)

Year	Observed	Predicted	Residual
1978	N/A	0.360604E+03	N/A
1979	N/A	0.260077E+03	N/A
1980	N/A	0.275541E+03	N/A
1981	N/A	0.290962E+03	N/A
1982	0.254868E+04	0.467318E+03	0.169632E+01
1983	0.371571E+02	0.790646E+02	-0.755111E+00
1984	0.285236E+03	0.292082E+03	-0.237182E-01
1985	0.262149E+03	0.161109E+03	0.486832E+00
1986	0.842866E+02	0.916993E+02	-0.842922E-01
1987	0.185103E+03	0.244776E+03	-0.279434E+00
1988	0.505446E+02	0.916073E+02	-0.594655E+00
1989	0.689866E+02	0.585039E+02	0.164819E+00
1990	0.195485E+03	0.138951E+03	0.341362E+00
1991	0.739045E+02	0.936948E+02	-0.237269E+00
1992	0.216796E+03	0.191112E+03	0.126092E+00
1993	0.400259E+02	0.841940E+02	-0.743597E+00
1994	0.602438E+02	0.664035E+02	-0.973499E-01
1995	N/A	0.201046E+02	N/A
1996	N/A	0.184744E+02	N/A
1997	N/A	0.411231E+02	N/A
1998	N/A	0.266383E+02	N/A
1999	N/A	0.768777E+02	N/A
2000	N/A	0.346396E+02	N/A
2001	N/A	0.302269E+02	N/A
2002	N/A	0.487155E+02	N/A
2003	N/A	0.751719E+02	N/A
2004	N/A	0.303690E+02	N/A
2005	N/A	0.531161E+02	N/A

2006	N/A	0.260568E+02	N/A
2007	N/A	0.346308E+02	N/A
2008	N/A	0.707155E+02	N/A

Survey Index: 8 Tag: spr_36pr AGE = 8
Time = JAN-1 Type = NUMBER
Catchability = 0.363074E+00 % Variance Contribution = 1.3004
Residual = LN(Observed) - LN(Predicted)

Year	Observed	Predicted	Residual
1978	N/A	0.297623E+02	N/A
1979	N/A	0.281585E+03	N/A
1980	N/A	0.207696E+03	N/A
1981	N/A	0.139660E+03	N/A
1982	0.503397E+03	0.155309E+03	0.117597E+01
1983	0.298623E+03	0.237470E+03	0.229141E+00
1984	N/A	0.482106E+02	N/A
1985	0.245756E+03	0.145777E+03	0.522261E+00
1986	0.170895E+03	0.744148E+02	0.831398E+00
1987	0.448071E+02	0.637330E+02	-0.352336E+00
1988	0.672107E+02	0.154272E+03	-0.830886E+00
1989	0.539598E+02	0.428313E+02	0.230971E+00
1990	0.176223E+02	0.320115E+02	-0.596931E+00
1991	0.554625E+02	0.645142E+02	-0.151178E+00
1992	0.267750E+02	0.477680E+02	-0.578887E+00
1993	0.469929E+02	0.759075E+02	-0.479519E+00
1994	N/A	0.268018E+02	N/A
1995	N/A	0.193318E+02	N/A
1996	N/A	0.131150E+02	N/A
1997	N/A	0.126219E+02	N/A
1998	N/A	0.107794E+02	N/A
1999	N/A	0.135722E+02	N/A
2000	N/A	0.303475E+02	N/A
2001	N/A	0.195617E+02	N/A
2002	N/A	0.124814E+02	N/A
2003	N/A	0.212615E+02	N/A
2004	N/A	0.291097E+02	N/A
2005	N/A	0.115453E+02	N/A
2006	N/A	0.254226E+02	N/A
2007	N/A	0.158810E+02	N/A
2008	N/A	0.292973E+02	N/A

Survey Index: 9 Tag: spr_36po AGE = 1
Time = JAN-1 Type = NUMBER
Catchability = 0.292985E-01 % Variance Contribution = 2.5848
Residual = LN(Observed) - LN(Predicted)

Year	Observed	Predicted	Residual
1978	N/A	0.841015E+03	N/A
1979	N/A	0.760078E+03	N/A
1980	N/A	0.671332E+03	N/A

1981	N/A	0.134453E+04	N/A
1982	N/A	0.581953E+03	N/A
1983	N/A	0.331229E+03	N/A
1984	N/A	0.850261E+03	N/A
1985	N/A	0.281713E+03	N/A
1986	N/A	0.130394E+04	N/A
1987	N/A	0.524386E+03	N/A
1988	N/A	0.728195E+03	N/A
1989	N/A	0.522941E+03	N/A
1990	N/A	0.298967E+03	N/A
1991	N/A	0.580000E+03	N/A
1992	N/A	0.218852E+03	N/A
1993	N/A	0.289209E+03	N/A
1994	N/A	0.185038E+03	N/A
1995	0.676205E+02	0.115005E+03	-0.531063E+00
1996	0.997232E+02	0.195581E+03	-0.673578E+00
1997	0.397254E+03	0.311179E+03	0.244207E+00
1998	0.152044E+03	0.144859E+03	0.484103E-01
1999	0.290017E+03	0.358434E+03	-0.211806E+00
2000	0.301492E+03	0.175112E+03	0.543315E+00
2001	0.829205E+02	0.672415E+02	0.209592E+00
2002	0.883848E+02	0.124210E+03	-0.340275E+00
2003	0.224036E+02	0.428135E+02	-0.647632E+00
2004	0.870051E+03	0.316469E+03	0.101133E+01
2005	0.162563E+02	0.739080E+02	-0.151434E+01
2006	0.243980E+03	0.190144E+03	0.249306E+00
2007	0.170895E+03	0.206171E+03	-0.187652E+00
2008	0.864177E+03	0.142821E+03	0.180019E+01

Survey Index: 10 Tag: spr_36po AGE = 2
 Time = JAN-1 Type = NUMBER
 Catchability = 0.101150E+00 % Variance Contribution = 0.4661
 Residual = LN(Observed) - LN(Predicted)

Year	Observed	Predicted	Residual
1978	N/A	0.476107E+03	N/A
1979	N/A	0.236334E+04	N/A
1980	N/A	0.212291E+04	N/A
1981	N/A	0.186652E+04	N/A
1982	N/A	0.368906E+04	N/A
1983	N/A	0.157414E+04	N/A
1984	N/A	0.879087E+03	N/A
1985	N/A	0.237767E+04	N/A
1986	N/A	0.780207E+03	N/A
1987	N/A	0.361552E+04	N/A
1988	N/A	0.147273E+04	N/A
1989	N/A	0.202862E+04	N/A
1990	N/A	0.139675E+04	N/A
1991	N/A	0.838494E+03	N/A
1992	N/A	0.161396E+04	N/A
1993	N/A	0.601095E+03	N/A
1994	N/A	0.790149E+03	N/A
1995	0.521429E+03	0.514402E+03	0.135697E-01
1996	0.292203E+03	0.322119E+03	-0.974731E-01

1997	0.597110E+03	0.546897E+03	0.878413E-01
1998	0.908711E+03	0.867978E+03	0.458604E-01
1999	0.397390E+03	0.403671E+03	-0.156827E-01
2000	0.110187E+04	0.100878E+04	0.882662E-01
2001	0.320480E+03	0.484602E+03	-0.413506E+00
2002	0.126908E+03	0.188994E+03	-0.398254E+00
2003	0.290700E+03	0.348020E+03	-0.179968E+00
2004	0.792321E+02	0.119463E+03	-0.410622E+00
2005	0.660905E+03	0.889910E+03	-0.297509E+00
2006	0.315562E+03	0.207783E+03	0.417864E+00
2007	0.872783E+03	0.534460E+03	0.490430E+00
2008	0.113603E+04	0.581788E+03	0.669184E+00

Survey Index: 11 Tag: spr_36po AGE = 3
Time = JAN-1 Type = NUMBER
Catchability = 0.225276E+00 % Variance Contribution = 0.7310
Residual = LN(Observed) - LN(Predicted)

Year	Observed	Predicted	Residual
1978	N/A	0.570683E+04	N/A
1979	N/A	0.783476E+03	N/A
1980	N/A	0.385386E+04	N/A
1981	N/A	0.301201E+04	N/A
1982	N/A	0.261116E+04	N/A
1983	N/A	0.461204E+04	N/A
1984	N/A	0.182376E+04	N/A
1985	N/A	0.128914E+04	N/A
1986	N/A	0.283139E+04	N/A
1987	N/A	0.109964E+04	N/A
1988	N/A	0.498113E+04	N/A
1989	N/A	0.220834E+04	N/A
1990	N/A	0.316957E+04	N/A
1991	N/A	0.142600E+04	N/A
1992	N/A	0.113146E+04	N/A
1993	N/A	0.197092E+04	N/A
1994	N/A	0.785431E+03	N/A
1995	0.116649E+04	0.131590E+04	-0.120526E+00
1996	0.100570E+04	0.805470E+03	0.222014E+00
1997	0.232505E+03	0.529000E+03	-0.822074E+00
1998	0.177316E+04	0.858141E+03	0.725750E+00
1999	0.831938E+03	0.139610E+04	-0.517678E+00
2000	0.113357E+04	0.663687E+03	0.535313E+00
2001	0.108425E+04	0.164786E+04	-0.418590E+00
2002	0.523615E+03	0.737601E+03	-0.342645E+00
2003	0.370479E+03	0.321650E+03	0.141333E+00
2004	0.790819E+03	0.593673E+03	0.286740E+00
2005	0.188245E+03	0.203717E+03	-0.789908E-01
2006	0.178395E+04	0.154866E+04	0.141444E+00
2007	0.513096E+03	0.364704E+03	0.341379E+00
2008	0.790272E+03	0.867699E+03	-0.934675E-01

Survey Index: 12 Tag: spr_36po AGE = 4
Time = JAN-1 Type = NUMBER
Catchability = 0.506259E+00 % Variance Contribution = 1.6502

Residual = LN(Observed) - LN(Predicted)

Year	Observed	Predicted	Residual
1978	N/A	0.387814E+04	N/A
1979	N/A	0.681812E+04	N/A
1980	N/A	0.100802E+04	N/A
1981	N/A	0.438883E+04	N/A
1982	N/A	0.339252E+04	N/A
1983	N/A	0.279447E+04	N/A
1984	N/A	0.452405E+04	N/A
1985	N/A	0.177810E+04	N/A
1986	N/A	0.104438E+04	N/A
1987	N/A	0.313423E+04	N/A
1988	N/A	0.133495E+04	N/A
1989	N/A	0.537156E+04	N/A
1990	N/A	0.268570E+04	N/A
1991	N/A	0.339627E+04	N/A
1992	N/A	0.105076E+04	N/A
1993	N/A	0.104799E+04	N/A
1994	N/A	0.162716E+04	N/A
1995	0.729482E+03	0.746942E+03	-0.236520E-01
1996	0.170376E+04	0.177104E+04	-0.387246E-01
1997	0.667462E+03	0.103350E+04	-0.437225E+00
1998	0.115816E+04	0.632947E+03	0.604197E+00
1999	0.696287E+03	0.984357E+03	-0.346227E+00
2000	0.155882E+04	0.165085E+04	-0.573575E-01
2001	0.218845E+03	0.884026E+03	-0.139612E+01
2002	0.135651E+04	0.182236E+04	-0.295219E+00
2003	0.850380E+03	0.820738E+03	0.354789E-01
2004	0.192138E+04	0.408008E+03	0.154951E+01
2005	0.861991E+03	0.894338E+03	-0.368391E-01
2006	0.453399E+03	0.282967E+03	0.471443E+00
2007	0.245032E+04	0.246491E+04	-0.593506E-02
2008	0.479901E+03	0.491227E+03	-0.233271E-01

Survey Index: 13 Tag: spr_36po AGE = 5
Time = JAN-1 Type = NUMBER
Catchability = 0.688799E+00 % Variance Contribution = 1.5379
Residual = LN(Observed) - LN(Predicted)

Year	Observed	Predicted	Residual
1978	N/A	0.204356E+04	N/A
1979	N/A	0.281893E+04	N/A
1980	N/A	0.476405E+04	N/A
1981	N/A	0.785824E+03	N/A
1982	N/A	0.322937E+04	N/A
1983	N/A	0.194020E+04	N/A
1984	N/A	0.146561E+04	N/A
1985	N/A	0.298637E+04	N/A
1986	N/A	0.941864E+03	N/A
1987	N/A	0.633490E+03	N/A

1988	N/A	0.215184E+04	N/A
1989	N/A	0.825201E+03	N/A
1990	N/A	0.336153E+04	N/A
1991	N/A	0.178012E+04	N/A
1992	N/A	0.183991E+04	N/A
1993	N/A	0.513220E+03	N/A
1994	N/A	0.417953E+03	N/A
1995	0.818277E+03	0.597858E+03	0.313847E+00
1996	0.237970E+03	0.419894E+03	-0.567859E+00
1997	0.576892E+03	0.118932E+04	-0.723484E+00
1998	0.103125E+04	0.524313E+03	0.676436E+00
1999	0.325398E+03	0.400365E+03	-0.207328E+00
2000	0.505856E+03	0.571678E+03	-0.122323E+00
2001	0.522795E+03	0.112524E+04	-0.766560E+00
2002	0.327038E+03	0.521964E+03	-0.467524E+00
2003	0.951332E+03	0.109614E+04	-0.141687E+00
2004	0.184952E+04	0.422326E+03	0.147691E+01
2005	0.374850E+03	0.293814E+03	0.243579E+00
2006	0.988216E+03	0.638986E+03	0.436019E+00
2007	0.247122E+03	0.186718E+03	0.280286E+00
2008	0.131225E+04	0.201789E+04	-0.430308E+00

Survey Index: 14 Tag: spr_36po AGE = 6
 Time = JAN-1 Type = NUMBER
 Catchability = 0.701770E+00 % Variance Contribution = 1.7150
 Residual = LN(Observed) - LN(Predicted)

Year	Observed	Predicted	Residual
1978	N/A	0.886915E+03	N/A
1979	N/A	0.113990E+04	N/A
1980	N/A	0.159125E+04	N/A
1981	N/A	0.242426E+04	N/A
1982	N/A	0.455183E+03	N/A
1983	N/A	0.141435E+04	N/A
1984	N/A	0.893184E+03	N/A
1985	N/A	0.643021E+03	N/A
1986	N/A	0.117756E+04	N/A
1987	N/A	0.455636E+03	N/A
1988	N/A	0.339820E+03	N/A
1989	N/A	0.809116E+03	N/A
1990	N/A	0.446961E+03	N/A
1991	N/A	0.138037E+04	N/A
1992	N/A	0.584522E+03	N/A
1993	N/A	0.598388E+03	N/A
1994	N/A	0.132464E+03	N/A
1995	0.145760E+03	0.848718E+02	0.540818E+00
1996	0.284826E+03	0.258955E+03	0.952237E-01
1997	0.680304E+02	0.189417E+03	-0.102400E+01
1998	0.727570E+03	0.439796E+03	0.503398E+00
1999	0.162972E+03	0.196109E+03	-0.185088E+00
2000	0.139886E+03	0.154565E+03	-0.997887E-01
2001	0.241248E+03	0.278442E+03	-0.143383E+00
2002	0.306956E+03	0.500262E+03	-0.488427E+00
2003	0.875652E+02	0.206580E+03	-0.858303E+00

2004	0.121922E+04	0.346287E+03	0.125870E+01
2005	0.280454E+03	0.156150E+03	0.585597E+00
2006	0.290700E+03	0.154182E+03	0.634159E+00
2007	0.285782E+03	0.303082E+03	-0.587728E-01
2008	0.516375E+02	0.110430E+03	-0.760133E+00

Survey Index: 15 Tag: spr_36po AGE = 7
Time = JAN-1 Type = NUMBER
Catchability = 0.723118E+00 % Variance Contribution = 3.5393
Residual = LN(Observed) - LN(Predicted)

Year	Observed	Predicted	Residual
1978	N/A	0.876323E+03	N/A
1979	N/A	0.632027E+03	N/A
1980	N/A	0.669607E+03	N/A
1981	N/A	0.707082E+03	N/A
1982	N/A	0.113566E+04	N/A
1983	N/A	0.192139E+03	N/A
1984	N/A	0.709804E+03	N/A
1985	N/A	0.391520E+03	N/A
1986	N/A	0.222844E+03	N/A
1987	N/A	0.594844E+03	N/A
1988	N/A	0.222620E+03	N/A
1989	N/A	0.142174E+03	N/A
1990	N/A	0.337672E+03	N/A
1991	N/A	0.227693E+03	N/A
1992	N/A	0.464433E+03	N/A
1993	N/A	0.204604E+03	N/A
1994	N/A	0.161371E+03	N/A
1995	0.319114E+03	0.488573E+02	0.187665E+01
1996	0.378402E+02	0.448957E+02	-0.170970E+00
1997	0.182917E+03	0.999355E+02	0.604508E+00
1998	0.138793E+03	0.647353E+02	0.762676E+00
1999	0.868821E+02	0.186825E+03	-0.765618E+00
2000	0.348348E+02	0.841796E+02	-0.882335E+00
2001	0.315563E+02	0.734561E+02	-0.844914E+00
2002	0.532768E+02	0.118386E+03	-0.798452E+00
2003	0.108603E+03	0.182679E+03	-0.520036E+00
2004	0.243980E+03	0.738014E+02	0.119571E+01
2005	0.174037E+03	0.129080E+03	0.298836E+00
2006	0.165704E+03	0.633221E+02	0.961972E+00
2007	0.422116E+02	0.841583E+02	-0.690004E+00
2008	0.614732E+02	0.171850E+03	-0.102802E+01

Survey Index: 16 Tag: spr_36po AGE = 8
Time = JAN-1 Type = NUMBER
Catchability = 0.816798E+00 % Variance Contribution = 1.8560
Residual = LN(Observed) - LN(Predicted)

Year	Observed	Predicted	Residual
1978	N/A	0.669555E+02	N/A

1979	N/A	0.633475E+03	N/A
1980	N/A	0.467249E+03	N/A
1981	N/A	0.314189E+03	N/A
1982	N/A	0.349393E+03	N/A
1983	N/A	0.534230E+03	N/A
1984	N/A	0.108458E+03	N/A
1985	N/A	0.327951E+03	N/A
1986	N/A	0.167409E+03	N/A
1987	N/A	0.143378E+03	N/A
1988	N/A	0.347062E+03	N/A
1989	N/A	0.963563E+02	N/A
1990	N/A	0.720154E+02	N/A
1991	N/A	0.145136E+03	N/A
1992	N/A	0.107462E+03	N/A
1993	N/A	0.170767E+03	N/A
1994	N/A	0.602952E+02	N/A
1995	0.382500E+02	0.434902E+02	-0.128393E+00
1996	0.247259E+02	0.295044E+02	-0.176688E+00
1997	0.274580E+02	0.283950E+02	-0.335569E-01
1998	0.422116E+02	0.242502E+02	0.554272E+00
1999	0.416652E+02	0.305331E+02	0.310855E+00
2000	0.274580E+02	0.682718E+02	-0.910840E+00
2001	0.241795E+02	0.440075E+02	-0.598854E+00
2002	N/A	0.280790E+02	N/A
2003	0.168027E+02	0.478314E+02	-0.104614E+01
2004	0.356818E+03	0.654872E+02	0.169537E+01
2005	0.407089E+02	0.259731E+02	0.449385E+00
2006	0.736313E+02	0.571926E+02	0.252646E+00
2007	0.247259E+02	0.357269E+02	-0.368054E+00
2008	N/A	0.659093E+02	N/A

Survey Index: 17 Tag: spr_41 AGE = 1
 Time = JAN-1 Type = NUMBER
 Catchability = 0.141338E-01 % Variance Contribution = 2.1179
 Residual = LN(Observed) - LN(Predicted)

Year	Observed	Predicted	Residual
1978	0.477900E+03	0.405710E+03	0.163763E+00
1979	0.550671E+03	0.366665E+03	0.406688E+00
1980	0.401143E+02	0.323854E+03	-0.208856E+01
1981	0.295997E+04	0.648606E+03	0.151811E+01
1982	N/A	0.280737E+03	N/A
1983	N/A	0.159787E+03	N/A
1984	N/A	0.410170E+03	N/A
1985	N/A	0.135900E+03	N/A
1986	N/A	0.629030E+03	N/A
1987	N/A	0.252967E+03	N/A
1988	N/A	0.351285E+03	N/A
1989	N/A	0.252269E+03	N/A
1990	N/A	0.144223E+03	N/A
1991	N/A	0.279795E+03	N/A
1992	N/A	0.105576E+03	N/A
1993	N/A	0.139516E+03	N/A
1994	N/A	0.892634E+02	N/A

1995	N/A	0.554789E+02	N/A
1996	N/A	0.943495E+02	N/A
1997	N/A	0.150114E+03	N/A
1998	N/A	0.698806E+02	N/A
1999	N/A	0.172911E+03	N/A
2000	N/A	0.844751E+02	N/A
2001	N/A	0.324376E+02	N/A
2002	N/A	0.599196E+02	N/A
2003	N/A	0.206535E+02	N/A
2004	N/A	0.152666E+03	N/A
2005	N/A	0.356536E+02	N/A
2006	N/A	0.917265E+02	N/A
2007	N/A	0.994578E+02	N/A
2008	N/A	0.688974E+02	N/A

Survey Index: 18 Tag: spr_41 AGE = 2
 Time = JAN-1 Type = NUMBER
 Catchability = 0.899870E-01 % Variance Contribution = 0.1993
 Residual = LN(Observed) - LN(Predicted)

Year	Observed	Predicted	Residual
1978	0.246600E+03	0.423564E+03	-0.540937E+00
1979	0.166847E+04	0.210252E+04	-0.231231E+00
1980	0.285043E+04	0.188863E+04	0.411618E+00
1981	0.238140E+04	0.166053E+04	0.360549E+00
1982	N/A	0.328194E+04	N/A
1983	N/A	0.140041E+04	N/A
1984	N/A	0.782072E+03	N/A
1985	N/A	0.211527E+04	N/A
1986	N/A	0.694104E+03	N/A
1987	N/A	0.321651E+04	N/A
1988	N/A	0.131020E+04	N/A
1989	N/A	0.180474E+04	N/A
1990	N/A	0.124261E+04	N/A
1991	N/A	0.745959E+03	N/A
1992	N/A	0.143584E+04	N/A
1993	N/A	0.534759E+03	N/A
1994	N/A	0.702949E+03	N/A
1995	N/A	0.457633E+03	N/A
1996	N/A	0.286570E+03	N/A
1997	N/A	0.486541E+03	N/A
1998	N/A	0.772189E+03	N/A
1999	N/A	0.359123E+03	N/A
2000	N/A	0.897455E+03	N/A
2001	N/A	0.431121E+03	N/A
2002	N/A	0.168137E+03	N/A
2003	N/A	0.309613E+03	N/A
2004	N/A	0.106279E+03	N/A
2005	N/A	0.791700E+03	N/A
2006	N/A	0.184852E+03	N/A
2007	N/A	0.475477E+03	N/A
2008	N/A	0.517583E+03	N/A

Survey Index: 19 Tag: spr_41 AGE = 3

Time = JAN-1 Type = NUMBER
Catchability = 0.198731E+00 % Variance Contribution = 0.2047
Residual = LN(Observed) - LN(Predicted)

Year	Observed	Predicted	Residual
1978	0.711116E+04	0.503439E+04	0.345372E+00
1979	0.353700E+03	0.691159E+03	-0.669921E+00
1980	0.345806E+04	0.339976E+04	0.170022E-01
1981	0.361389E+04	0.265710E+04	0.307547E+00
1982	N/A	0.230348E+04	N/A
1983	N/A	0.406860E+04	N/A
1984	N/A	0.160886E+04	N/A
1985	N/A	0.113724E+04	N/A
1986	N/A	0.249777E+04	N/A
1987	N/A	0.970073E+03	N/A
1988	N/A	0.439420E+04	N/A
1989	N/A	0.194813E+04	N/A
1990	N/A	0.279610E+04	N/A
1991	N/A	0.125797E+04	N/A
1992	N/A	0.998144E+03	N/A
1993	N/A	0.173869E+04	N/A
1994	N/A	0.692883E+03	N/A
1995	N/A	0.116085E+04	N/A
1996	N/A	0.710561E+03	N/A
1997	N/A	0.466667E+03	N/A
1998	N/A	0.757026E+03	N/A
1999	N/A	0.123159E+04	N/A
2000	N/A	0.585485E+03	N/A
2001	N/A	0.145369E+04	N/A
2002	N/A	0.650689E+03	N/A
2003	N/A	0.283750E+03	N/A
2004	N/A	0.523720E+03	N/A
2005	N/A	0.179713E+03	N/A
2006	N/A	0.136618E+04	N/A
2007	N/A	0.321730E+03	N/A
2008	N/A	0.765458E+03	N/A

Survey Index: 20 Tag: spr_41 AGE = 4
Time = JAN-1 Type = NUMBER
Catchability = 0.177261E+00 % Variance Contribution = 0.0590
Residual = LN(Observed) - LN(Predicted)

Year	Observed	Predicted	Residual
1978	0.124907E+04	0.135789E+04	-0.835318E-01
1979	0.238050E+04	0.238729E+04	-0.284902E-02
1980	0.272957E+03	0.352946E+03	-0.257001E+00
1981	0.216630E+04	0.153670E+04	0.343382E+00
1982	N/A	0.118786E+04	N/A
1983	N/A	0.978455E+03	N/A
1984	N/A	0.158405E+04	N/A
1985	N/A	0.622583E+03	N/A

1986	N/A	0.365679E+03	N/A
1987	N/A	0.109742E+04	N/A
1988	N/A	0.467420E+03	N/A
1989	N/A	0.188080E+04	N/A
1990	N/A	0.940371E+03	N/A
1991	N/A	0.118917E+04	N/A
1992	N/A	0.367911E+03	N/A
1993	N/A	0.366943E+03	N/A
1994	N/A	0.569735E+03	N/A
1995	N/A	0.261534E+03	N/A
1996	N/A	0.620110E+03	N/A
1997	N/A	0.361870E+03	N/A
1998	N/A	0.221620E+03	N/A
1999	N/A	0.344662E+03	N/A
2000	N/A	0.578027E+03	N/A
2001	N/A	0.309532E+03	N/A
2002	N/A	0.638081E+03	N/A
2003	N/A	0.287373E+03	N/A
2004	N/A	0.142860E+03	N/A
2005	N/A	0.313143E+03	N/A
2006	N/A	0.990779E+02	N/A
2007	N/A	0.863062E+03	N/A
2008	N/A	0.171998E+03	N/A

Survey Index: 21 Tag: spr_41 AGE = 5
 Time = JAN-1 Type = NUMBER
 Catchability = 0.216299E+00 % Variance Contribution = 0.2314
 Residual = LN(Observed) - LN(Predicted)

Year	Observed	Predicted	Residual
1978	0.999771E+03	0.641727E+03	0.443364E+00
1979	0.702771E+03	0.885211E+03	-0.230795E+00
1980	0.219214E+04	0.149602E+04	0.382068E+00
1981	0.136157E+03	0.246768E+03	-0.594637E+00
1982	N/A	0.101410E+04	N/A
1983	N/A	0.609268E+03	N/A
1984	N/A	0.460237E+03	N/A
1985	N/A	0.937793E+03	N/A
1986	N/A	0.295768E+03	N/A
1987	N/A	0.198931E+03	N/A
1988	N/A	0.675730E+03	N/A
1989	N/A	0.259133E+03	N/A
1990	N/A	0.105560E+04	N/A
1991	N/A	0.559002E+03	N/A
1992	N/A	0.577777E+03	N/A
1993	N/A	0.161163E+03	N/A
1994	N/A	0.131247E+03	N/A
1995	N/A	0.187742E+03	N/A
1996	N/A	0.131857E+03	N/A
1997	N/A	0.373476E+03	N/A
1998	N/A	0.164647E+03	N/A
1999	N/A	0.125724E+03	N/A
2000	N/A	0.179521E+03	N/A
2001	N/A	0.353352E+03	N/A

2002	N/A	0.163909E+03	N/A
2003	N/A	0.344214E+03	N/A
2004	N/A	0.132620E+03	N/A
2005	N/A	0.922646E+02	N/A
2006	N/A	0.200657E+03	N/A
2007	N/A	0.586338E+02	N/A
2008	N/A	0.633664E+03	N/A

Survey Index: 22 Tag: spr_41 AGE = 6
Time = JAN-1 Type = NUMBER
Catchability = 0.207689E+00 % Variance Contribution = 0.1087
Residual = LN(Observed) - LN(Predicted)

Year	Observed	Predicted	Residual
1978	0.182057E+03	0.262483E+03	-0.365866E+00
1979	0.302786E+03	0.337355E+03	-0.108111E+00
1980	0.480471E+03	0.470932E+03	0.200532E-01
1981	0.112963E+04	0.717462E+03	0.453924E+00
1982	N/A	0.134712E+03	N/A
1983	N/A	0.418576E+03	N/A
1984	N/A	0.264338E+03	N/A
1985	N/A	0.190302E+03	N/A
1986	N/A	0.348501E+03	N/A
1987	N/A	0.134846E+03	N/A
1988	N/A	0.100570E+03	N/A
1989	N/A	0.239458E+03	N/A
1990	N/A	0.132278E+03	N/A
1991	N/A	0.408520E+03	N/A
1992	N/A	0.172990E+03	N/A
1993	N/A	0.177093E+03	N/A
1994	N/A	0.392029E+02	N/A
1995	N/A	0.251179E+02	N/A
1996	N/A	0.766379E+02	N/A
1997	N/A	0.560581E+02	N/A
1998	N/A	0.130158E+03	N/A
1999	N/A	0.580384E+02	N/A
2000	N/A	0.457436E+02	N/A
2001	N/A	0.824050E+02	N/A
2002	N/A	0.148053E+03	N/A
2003	N/A	0.611374E+02	N/A
2004	N/A	0.102484E+03	N/A
2005	N/A	0.462126E+02	N/A
2006	N/A	0.456302E+02	N/A
2007	N/A	0.896972E+02	N/A
2008	N/A	0.326818E+02	N/A

Survey Index: 23 Tag: spr_41 AGE = 7
Time = JAN-1 Type = NUMBER
Catchability = 0.300243E+00 % Variance Contribution = 0.5210
Residual = LN(Observed) - LN(Predicted)

Year	Observed	Predicted	Residual
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1978	0.915814E+03	0.363855E+03	0.923058E+00
1979	0.107486E+03	0.262422E+03	-0.892596E+00
1980	0.238500E+03	0.278025E+03	-0.153343E+00
1981	0.331971E+03	0.293585E+03	0.122881E+00
1982	N/A	0.471532E+03	N/A
1983	N/A	0.797775E+02	N/A
1984	N/A	0.294715E+03	N/A
1985	N/A	0.162562E+03	N/A
1986	N/A	0.925261E+02	N/A
1987	N/A	0.246983E+03	N/A
1988	N/A	0.924333E+02	N/A
1989	N/A	0.590314E+02	N/A
1990	N/A	0.140204E+03	N/A
1991	N/A	0.945396E+02	N/A
1992	N/A	0.192836E+03	N/A
1993	N/A	0.849532E+02	N/A
1994	N/A	0.670022E+02	N/A
1995	N/A	0.202859E+02	N/A
1996	N/A	0.186410E+02	N/A
1997	N/A	0.414939E+02	N/A
1998	N/A	0.268785E+02	N/A
1999	N/A	0.775708E+02	N/A
2000	N/A	0.349519E+02	N/A
2001	N/A	0.304994E+02	N/A
2002	N/A	0.491548E+02	N/A
2003	N/A	0.758497E+02	N/A
2004	N/A	0.306428E+02	N/A
2005	N/A	0.535950E+02	N/A
2006	N/A	0.262917E+02	N/A
2007	N/A	0.349431E+02	N/A
2008	N/A	0.713531E+02	N/A

Survey Index: 24 Tag: spr_41 AGE = 8
 Time = JAN-1 Type = NUMBER
 Catchability = 0.291472E+00 % Variance Contribution = 1.1884
 Residual = LN(Observed) - LN(Predicted)

Year	Observed	Predicted	Residual
1978	0.837000E+02	0.238929E+02	0.125366E+01
1979	0.178200E+03	0.226054E+03	-0.237867E+00
1980	0.398571E+02	0.166737E+03	-0.143111E+01
1981	0.169843E+03	0.112118E+03	0.415324E+00
1982	N/A	0.124680E+03	N/A
1983	N/A	0.190639E+03	N/A
1984	N/A	0.387030E+02	N/A
1985	N/A	0.117028E+03	N/A
1986	N/A	0.597394E+02	N/A
1987	N/A	0.511642E+02	N/A
1988	N/A	0.123848E+03	N/A
1989	N/A	0.343845E+02	N/A
1990	N/A	0.256985E+02	N/A
1991	N/A	0.517913E+02	N/A
1992	N/A	0.383476E+02	N/A

1993	N/A	0.609378E+02	N/A
1994	N/A	0.215162E+02	N/A
1995	N/A	0.155194E+02	N/A
1996	N/A	0.105286E+02	N/A
1997	N/A	0.101327E+02	N/A
1998	N/A	0.865361E+01	N/A
1999	N/A	0.108957E+02	N/A
2000	N/A	0.243626E+02	N/A
2001	N/A	0.157040E+02	N/A
2002	N/A	0.100199E+02	N/A
2003	N/A	0.170685E+02	N/A
2004	N/A	0.233689E+02	N/A
2005	N/A	0.926844E+01	N/A
2006	N/A	0.204090E+02	N/A
2007	N/A	0.127491E+02	N/A
2008	N/A	0.235196E+02	N/A

Survey Index: 25 Tag: sp_can_p AGE = 1
Time = JAN-1 Type = NUMBER
Catchability = 0.358799E-01 % Variance Contribution = 1.3324
Residual = LN(Observed) - LN(Predicted)

Year	Observed	Predicted	Residual
1978	N/A	0.102993E+04	N/A
1979	N/A	0.930816E+03	N/A
1980	N/A	0.822135E+03	N/A
1981	N/A	0.164655E+04	N/A
1982	N/A	0.712678E+03	N/A
1983	N/A	0.405634E+03	N/A
1984	N/A	0.104126E+04	N/A
1985	N/A	0.344995E+03	N/A
1986	0.844432E+03	0.159685E+04	-0.637126E+00
1987	0.351846E+03	0.642180E+03	-0.601674E+00
1988	0.394068E+03	0.891771E+03	-0.816686E+00
1989	0.229404E+04	0.640410E+03	0.127596E+01
1990	0.591102E+03	0.366125E+03	0.479014E+00
1991	0.166072E+04	0.710287E+03	0.849335E+00
1992	0.154812E+03	0.268014E+03	-0.548823E+00
1993	N/A	0.354175E+03	N/A
1994	N/A	0.226604E+03	N/A
1995	N/A	0.140839E+03	N/A
1996	N/A	0.239515E+03	N/A
1997	N/A	0.381080E+03	N/A
1998	N/A	0.177399E+03	N/A
1999	N/A	0.438950E+03	N/A
2000	N/A	0.214448E+03	N/A
2001	N/A	0.823461E+02	N/A
2002	N/A	0.152112E+03	N/A
2003	N/A	0.524308E+02	N/A
2004	N/A	0.387558E+03	N/A
2005	N/A	0.905101E+02	N/A
2006	N/A	0.232857E+03	N/A
2007	N/A	0.252483E+03	N/A
2008	N/A	0.174903E+03	N/A

Survey Index: 26 Tag: sp_can_p AGE = 2
Time = JAN-1 Type = NUMBER
Catchability = 0.187587E+00 % Variance Contribution = 0.5784
Residual = LN(Observed) - LN(Predicted)

Year	Observed	Predicted	Residual
1978	N/A	0.882961E+03	N/A
1979	N/A	0.438292E+04	N/A
1980	N/A	0.393704E+04	N/A
1981	N/A	0.346155E+04	N/A
1982	N/A	0.684153E+04	N/A
1983	N/A	0.291931E+04	N/A
1984	N/A	0.163031E+04	N/A
1985	N/A	0.440949E+04	N/A
1986	0.319477E+04	0.144693E+04	0.792071E+00
1987	0.299773E+04	0.670515E+04	-0.805019E+00
1988	0.142146E+04	0.273125E+04	-0.653076E+00
1989	0.391253E+04	0.376217E+04	0.391899E-01
1990	0.343402E+04	0.259034E+04	0.281944E+00
1991	0.163257E+04	0.155503E+04	0.486618E-01
1992	0.402512E+04	0.299315E+04	0.296228E+00
1993	N/A	0.111476E+04	N/A
1994	N/A	0.146537E+04	N/A
1995	N/A	0.953981E+03	N/A
1996	N/A	0.597384E+03	N/A
1997	N/A	0.101424E+04	N/A
1998	N/A	0.160970E+04	N/A
1999	N/A	0.748627E+03	N/A
2000	N/A	0.187084E+04	N/A
2001	N/A	0.898715E+03	N/A
2002	N/A	0.350498E+03	N/A
2003	N/A	0.645419E+03	N/A
2004	N/A	0.221549E+03	N/A
2005	N/A	0.165038E+04	N/A
2006	N/A	0.385343E+03	N/A
2007	N/A	0.991180E+03	N/A
2008	N/A	0.107895E+04	N/A

Survey Index: 27 Tag: sp_can_p AGE = 3
Time = JAN-1 Type = NUMBER
Catchability = 0.324684E+00 % Variance Contribution = 0.1686
Residual = LN(Observed) - LN(Predicted)

Year	Observed	Predicted	Residual
1978	N/A	0.822510E+04	N/A
1979	N/A	0.112920E+04	N/A
1980	N/A	0.555447E+04	N/A
1981	N/A	0.434113E+04	N/A
1982	N/A	0.376339E+04	N/A
1983	N/A	0.664720E+04	N/A

1984	N/A	0.262853E+04	N/A
1985	N/A	0.185801E+04	N/A
1986	0.395475E+04	0.408081E+04	-0.313768E-01
1987	0.130887E+04	0.158489E+04	-0.191350E+00
1988	0.655842E+04	0.717917E+04	-0.904340E-01
1989	0.194219E+04	0.318282E+04	-0.493951E+00
1990	0.531992E+04	0.456822E+04	0.152335E+00
1991	0.258959E+04	0.205525E+04	0.231102E+00
1992	0.249107E+04	0.163075E+04	0.423674E+00
1993	N/A	0.284064E+04	N/A
1994	N/A	0.113202E+04	N/A
1995	N/A	0.189658E+04	N/A
1996	N/A	0.116090E+04	N/A
1997	N/A	0.762433E+03	N/A
1998	N/A	0.123682E+04	N/A
1999	N/A	0.201216E+04	N/A
2000	N/A	0.956554E+03	N/A
2001	N/A	0.237502E+04	N/A
2002	N/A	0.106308E+04	N/A
2003	N/A	0.463585E+03	N/A
2004	N/A	0.855645E+03	N/A
2005	N/A	0.293612E+03	N/A
2006	N/A	0.223204E+04	N/A
2007	N/A	0.525637E+03	N/A
2008	N/A	0.125059E+04	N/A

Survey Index: 28 Tag: sp_can_p AGE = 4
Time = JAN-1 Type = NUMBER
Catchability = 0.372132E+00 % Variance Contribution = 0.2113
Residual = LN(Observed) - LN(Predicted)

Year	Observed	Predicted	Residual
1978	N/A	0.285067E+04	N/A
1979	N/A	0.501174E+04	N/A
1980	N/A	0.740954E+03	N/A
1981	N/A	0.322606E+04	N/A
1982	N/A	0.249371E+04	N/A
1983	N/A	0.205411E+04	N/A
1984	N/A	0.332546E+04	N/A
1985	N/A	0.130701E+04	N/A
1986	0.520733E+03	0.767685E+03	-0.388143E+00
1987	0.153405E+04	0.230385E+04	-0.406671E+00
1988	0.816284E+03	0.981272E+03	-0.184088E+00
1989	0.401105E+04	0.394843E+04	0.157348E-01
1990	0.292736E+04	0.197416E+04	0.393960E+00
1991	0.302588E+04	0.249647E+04	0.192325E+00
1992	0.112591E+04	0.772370E+03	0.376882E+00
1993	N/A	0.770338E+03	N/A
1994	N/A	0.119607E+04	N/A
1995	N/A	0.549048E+03	N/A
1996	N/A	0.130182E+04	N/A
1997	N/A	0.759687E+03	N/A
1998	N/A	0.465255E+03	N/A
1999	N/A	0.723563E+03	N/A

2000	N/A	0.121348E+04	N/A
2001	N/A	0.649814E+03	N/A
2002	N/A	0.133955E+04	N/A
2003	N/A	0.603293E+03	N/A
2004	N/A	0.299911E+03	N/A
2005	N/A	0.657394E+03	N/A
2006	N/A	0.207998E+03	N/A
2007	N/A	0.181186E+04	N/A
2008	N/A	0.361082E+03	N/A

Survey Index: 29 Tag: sp_can_p AGE = 5
Time = JAN-1 Type = NUMBER
Catchability = 0.580779E+00 % Variance Contribution = 0.1940
Residual = LN(Observed) - LN(Predicted)

Year	Observed	Predicted	Residual
1978	N/A	0.172308E+04	N/A
1979	N/A	0.237686E+04	N/A
1980	N/A	0.401693E+04	N/A
1981	N/A	0.662589E+03	N/A
1982	N/A	0.272293E+04	N/A
1983	N/A	0.163593E+04	N/A
1984	N/A	0.123577E+04	N/A
1985	N/A	0.251804E+04	N/A
1986	0.914801E+03	0.794158E+03	0.141424E+00
1987	0.478511E+03	0.534144E+03	-0.109986E+00
1988	0.143553E+04	0.181438E+04	-0.234209E+00
1989	0.506659E+03	0.695790E+03	-0.317210E+00
1990	0.544658E+04	0.283436E+04	0.653171E+00
1991	0.147776E+04	0.150096E+04	-0.155807E-01
1992	0.137924E+04	0.155137E+04	-0.117609E+00
1993	N/A	0.432735E+03	N/A
1994	N/A	0.352408E+03	N/A
1995	N/A	0.504100E+03	N/A
1996	N/A	0.354045E+03	N/A
1997	N/A	0.100281E+04	N/A
1998	N/A	0.442089E+03	N/A
1999	N/A	0.337579E+03	N/A
2000	N/A	0.482026E+03	N/A
2001	N/A	0.948775E+03	N/A
2002	N/A	0.440108E+03	N/A
2003	N/A	0.924240E+03	N/A
2004	N/A	0.356095E+03	N/A
2005	N/A	0.247737E+03	N/A
2006	N/A	0.538778E+03	N/A
2007	N/A	0.157436E+03	N/A
2008	N/A	0.170143E+04	N/A

Survey Index: 30 Tag: sp_can_p AGE = 6
Time = JAN-1 Type = NUMBER
Catchability = 0.555873E+00 % Variance Contribution = 0.5549
Residual = LN(Observed) - LN(Predicted)

Year	Observed	Predicted	Residual
1978	N/A	0.702526E+03	N/A
1979	N/A	0.902919E+03	N/A
1980	N/A	0.126043E+04	N/A
1981	N/A	0.192026E+04	N/A
1982	N/A	0.360551E+03	N/A
1983	N/A	0.112030E+04	N/A
1984	N/A	0.707492E+03	N/A
1985	N/A	0.509337E+03	N/A
1986	0.619250E+03	0.932750E+03	-0.409629E+00
1987	0.168886E+03	0.360910E+03	-0.759402E+00
1988	0.182960E+03	0.269172E+03	-0.386082E+00
1989	0.591102E+03	0.640901E+03	-0.808866E-01
1990	0.591102E+03	0.354038E+03	0.512584E+00
1991	0.184368E+04	0.109339E+04	0.522479E+00
1992	0.844432E+03	0.463000E+03	0.600936E+00
1993	N/A	0.473983E+03	N/A
1994	N/A	0.104925E+03	N/A
1995	N/A	0.672270E+02	N/A
1996	N/A	0.205119E+03	N/A
1997	N/A	0.150038E+03	N/A
1998	N/A	0.348363E+03	N/A
1999	N/A	0.155338E+03	N/A
2000	N/A	0.122431E+03	N/A
2001	N/A	0.220554E+03	N/A
2002	N/A	0.396258E+03	N/A
2003	N/A	0.163632E+03	N/A
2004	N/A	0.274294E+03	N/A
2005	N/A	0.123686E+03	N/A
2006	N/A	0.122128E+03	N/A
2007	N/A	0.240071E+03	N/A
2008	N/A	0.874717E+02	N/A

Survey Index: 31 Tag: sp_can_p AGE = 7
 Time = JAN-1 Type = NUMBER
 Catchability = 0.730017E+00 % Variance Contribution = 1.0921
 Residual = LN(Observed) - LN(Predicted)

Year	Observed	Predicted	Residual
1978	N/A	0.884683E+03	N/A
1979	N/A	0.638057E+03	N/A
1980	N/A	0.675996E+03	N/A
1981	N/A	0.713828E+03	N/A
1982	N/A	0.114649E+04	N/A
1983	N/A	0.193972E+03	N/A
1984	N/A	0.716576E+03	N/A
1985	N/A	0.395255E+03	N/A
1986	0.365920E+03	0.224970E+03	0.486450E+00
1987	0.309625E+03	0.600519E+03	-0.662433E+00
1988	0.112591E+03	0.224744E+03	-0.691200E+00
1989	0.703693E+02	0.143530E+03	-0.712787E+00

1990	0.130887E+04	0.340894E+03	0.134535E+01
1991	0.225182E+03	0.229865E+03	-0.205853E-01
1992	0.605176E+03	0.468864E+03	0.255207E+00
1993	N/A	0.206557E+03	N/A
1994	N/A	0.162910E+03	N/A
1995	N/A	0.493234E+02	N/A
1996	N/A	0.453240E+02	N/A
1997	N/A	0.100889E+03	N/A
1998	N/A	0.653529E+02	N/A
1999	N/A	0.188607E+03	N/A
2000	N/A	0.849827E+02	N/A
2001	N/A	0.741569E+02	N/A
2002	N/A	0.119516E+03	N/A
2003	N/A	0.184422E+03	N/A
2004	N/A	0.745055E+02	N/A
2005	N/A	0.130312E+03	N/A
2006	N/A	0.639262E+02	N/A
2007	N/A	0.849612E+02	N/A
2008	N/A	0.173489E+03	N/A

Survey Index: 32 Tag: sp_can_p AGE = 8
 Time = JAN-1 Type = NUMBER
 Catchability = 0.644843E-03 % Variance Contribution = 0.9126
 Residual = LN(Observed) - LN(Predicted)

Year	Observed	Predicted	Residual
1978	N/A	0.528599E-01	N/A
1979	N/A	0.500114E+00	N/A
1980	N/A	0.368883E+00	N/A
1981	N/A	0.248046E+00	N/A
1982	N/A	0.275838E+00	N/A
1983	N/A	0.421762E+00	N/A
1984	N/A	0.856253E-01	N/A
1985	N/A	0.258910E+00	N/A
1986	0.400000E-01	0.132166E+00	-0.119518E+01
1987	0.800000E-01	0.113194E+00	-0.347077E+00
1988	0.170000E+00	0.273998E+00	-0.477321E+00
1989	0.100000E+00	0.760712E-01	0.273501E+00
1990	0.120000E+00	0.568546E-01	0.746995E+00
1991	0.220000E+00	0.114581E+00	0.652342E+00
1992	0.120000E+00	0.848391E-01	0.346736E+00
1993	N/A	0.134817E+00	N/A
1994	N/A	0.476017E-01	N/A
1995	N/A	0.343346E-01	N/A
1996	N/A	0.232931E-01	N/A
1997	N/A	0.224173E-01	N/A
1998	N/A	0.191450E-01	N/A
1999	N/A	0.241052E-01	N/A
2000	N/A	0.538991E-01	N/A
2001	N/A	0.347429E-01	N/A
2002	N/A	0.221678E-01	N/A
2003	N/A	0.377618E-01	N/A
2004	N/A	0.517007E-01	N/A
2005	N/A	0.205052E-01	N/A

2006	N/A	0.451523E-01	N/A
2007	N/A	0.282056E-01	N/A
2008	N/A	0.520339E-01	N/A

Survey Index: 33 Tag: sp_canpo AGE = 1
Time = JAN-1 Type = NUMBER
Catchability = 0.158633E-01 % Variance Contribution = 4.3436
Residual = LN(Observed) - LN(Predicted)

Year	Observed	Predicted	Residual
1978	N/A	0.455356E+03	N/A
1979	N/A	0.411533E+03	N/A
1980	N/A	0.363483E+03	N/A
1981	N/A	0.727975E+03	N/A
1982	N/A	0.315090E+03	N/A
1983	N/A	0.179339E+03	N/A
1984	N/A	0.460362E+03	N/A
1985	N/A	0.152529E+03	N/A
1986	N/A	0.706002E+03	N/A
1987	N/A	0.283922E+03	N/A
1988	N/A	0.394271E+03	N/A
1989	N/A	0.283139E+03	N/A
1990	N/A	0.161872E+03	N/A
1991	N/A	0.314033E+03	N/A
1992	N/A	0.118495E+03	N/A
1993	N/A	0.156588E+03	N/A
1994	N/A	0.100186E+03	N/A
1995	0.985170E+02	0.622677E+02	0.458786E+00
1996	0.197034E+03	0.105895E+03	0.620930E+00
1997	0.450363E+03	0.168483E+03	0.983218E+00
1998	0.140739E+02	0.784317E+02	-0.171791E+01
1999	0.464437E+03	0.194069E+03	0.872612E+00
2000	0.140739E+03	0.948121E+02	0.395007E+00
2001	N/A	0.364069E+02	N/A
2002	0.128934E+02	0.672519E+02	-0.165173E+01
2003	N/A	0.231808E+02	N/A
2004	0.753776E+03	0.171348E+03	0.148140E+01
2005	0.344185E+02	0.400164E+02	-0.150696E+00
2006	N/A	0.102951E+03	N/A
2007	0.193318E+03	0.111628E+03	0.549163E+00
2008	0.122714E+02	0.773281E+02	-0.184079E+01

Survey Index: 34 Tag: sp_canpo AGE = 2
Time = JAN-1 Type = NUMBER
Catchability = 0.779414E-01 % Variance Contribution = 3.7046
Residual = LN(Observed) - LN(Predicted)

Year	Observed	Predicted	Residual
1978	N/A	0.366866E+03	N/A
1979	N/A	0.182108E+04	N/A
1980	N/A	0.163582E+04	N/A

1981	N/A	0.143826E+04	N/A
1982	N/A	0.284262E+04	N/A
1983	N/A	0.121296E+04	N/A
1984	N/A	0.677384E+03	N/A
1985	N/A	0.183212E+04	N/A
1986	N/A	0.601191E+03	N/A
1987	N/A	0.278595E+04	N/A
1988	N/A	0.113482E+04	N/A
1989	N/A	0.156316E+04	N/A
1990	N/A	0.107627E+04	N/A
1991	N/A	0.646105E+03	N/A
1992	N/A	0.124364E+04	N/A
1993	N/A	0.463176E+03	N/A
1994	N/A	0.608852E+03	N/A
1995	0.942949E+03	0.396374E+03	0.866653E+00
1996	0.689619E+03	0.248210E+03	0.102186E+01
1997	0.745915E+03	0.421413E+03	0.570997E+00
1998	0.942949E+03	0.668824E+03	0.343491E+00
1999	0.450363E+03	0.311051E+03	0.370100E+00
2000	0.619250E+03	0.777322E+03	-0.227346E+00
2001	0.844432E+02	0.373412E+03	-0.148660E+01
2002	0.121746E+03	0.145630E+03	-0.179136E+00
2003	0.313603E+02	0.268168E+03	-0.214607E+01
2004	0.134499E+03	0.920524E+02	0.379197E+00
2005	0.188003E+04	0.685723E+03	0.100857E+01
2006	0.527756E+02	0.160108E+03	-0.110980E+01
2007	0.730710E+03	0.411830E+03	0.573405E+00
2008	0.454928E+03	0.448299E+03	0.146790E-01

Survey Index: 35 Tag: sp_canpo AGE = 3
 Time = JAN-1 Type = NUMBER
 Catchability = 0.362628E+00 % Variance Contribution = 1.1901
 Residual = LN(Observed) - LN(Predicted)

Year	Observed	Predicted	Residual
1978	N/A	0.918634E+04	N/A
1979	N/A	0.126117E+04	N/A
1980	N/A	0.620359E+04	N/A
1981	N/A	0.484846E+04	N/A
1982	N/A	0.420320E+04	N/A
1983	N/A	0.742403E+04	N/A
1984	N/A	0.293572E+04	N/A
1985	N/A	0.207514E+04	N/A
1986	N/A	0.455772E+04	N/A
1987	N/A	0.177011E+04	N/A
1988	N/A	0.801817E+04	N/A
1989	N/A	0.355479E+04	N/A
1990	N/A	0.510209E+04	N/A
1991	N/A	0.229544E+04	N/A
1992	N/A	0.182133E+04	N/A
1993	N/A	0.317261E+04	N/A
1994	N/A	0.126432E+04	N/A
1995	0.211108E+04	0.211822E+04	-0.337802E-02
1996	0.325106E+04	0.129657E+04	0.919257E+00

1997	0.774062E+03	0.851535E+03	-0.953887E-01
1998	0.133702E+04	0.138136E+04	-0.326260E-01
1999	0.209701E+04	0.224731E+04	-0.692234E-01
2000	0.147776E+04	0.106834E+04	0.324415E+00
2001	0.900727E+03	0.265258E+04	-0.108009E+01
2002	0.805617E+03	0.118732E+04	-0.387847E+00
2003	0.419145E+03	0.517762E+03	-0.211300E+00
2004	0.551716E+03	0.955641E+03	-0.549349E+00
2005	0.661996E+03	0.327925E+03	0.702473E+00
2006	0.197858E+04	0.249289E+04	-0.231060E+00
2007	0.132932E+04	0.587067E+03	0.817285E+00
2008	0.125982E+04	0.139674E+04	-0.103172E+00

Survey Index: 36 Tag: sp_canpo AGE = 4
Time = JAN-1 Type = NUMBER
Catchability = 0.888325E+00 % Variance Contribution = 1.2196
Residual = LN(Observed) - LN(Predicted)

Year	Observed	Predicted	Residual
1978	N/A	0.680491E+04	N/A
1979	N/A	0.119636E+05	N/A
1980	N/A	0.176875E+04	N/A
1981	N/A	0.770101E+04	N/A
1982	N/A	0.595280E+04	N/A
1983	N/A	0.490342E+04	N/A
1984	N/A	0.793828E+04	N/A
1985	N/A	0.312000E+04	N/A
1986	N/A	0.183256E+04	N/A
1987	N/A	0.549958E+04	N/A
1988	N/A	0.234242E+04	N/A
1989	N/A	0.942540E+04	N/A
1990	N/A	0.471256E+04	N/A
1991	N/A	0.595938E+04	N/A
1992	N/A	0.184374E+04	N/A
1993	N/A	0.183889E+04	N/A
1994	N/A	0.285516E+04	N/A
1995	0.121035E+04	0.131065E+04	-0.796090E-01
1996	0.565769E+04	0.310761E+04	0.599163E+00
1997	0.175923E+04	0.181347E+04	-0.303637E-01
1998	0.492585E+03	0.111062E+04	-0.813008E+00
1999	0.153405E+04	0.172724E+04	-0.118610E+00
2000	0.551695E+04	0.289672E+04	0.644248E+00
2001	0.591102E+03	0.155119E+04	-0.964786E+00
2002	0.288708E+04	0.319767E+04	-0.102177E+00
2003	0.912160E+03	0.144014E+04	-0.456677E+00
2004	0.595577E+03	0.715925E+03	-0.184044E+00
2005	0.409251E+04	0.156928E+04	0.958541E+00
2006	0.925621E+03	0.496517E+03	0.622847E+00
2007	0.413611E+04	0.432513E+04	-0.446883E-01
2008	0.835776E+03	0.861948E+03	-0.308351E-01

Survey Index: 37 Tag: sp_canpo AGE = 5
Time = JAN-1 Type = NUMBER
Catchability = 0.140774E+01 % Variance Contribution = 1.1272

Residual = LN(Observed) - LN(Predicted)

Year	Observed	Predicted	Residual
1978	N/A	0.417655E+04	N/A
1979	N/A	0.576122E+04	N/A
1980	N/A	0.973658E+04	N/A
1981	N/A	0.160604E+04	N/A
1982	N/A	0.660006E+04	N/A
1983	N/A	0.396530E+04	N/A
1984	N/A	0.299536E+04	N/A
1985	N/A	0.610344E+04	N/A
1986	N/A	0.192495E+04	N/A
1987	N/A	0.129470E+04	N/A
1988	N/A	0.439785E+04	N/A
1989	N/A	0.168651E+04	N/A
1990	N/A	0.687017E+04	N/A
1991	N/A	0.363815E+04	N/A
1992	N/A	0.376034E+04	N/A
1993	N/A	0.104890E+04	N/A
1994	N/A	0.854196E+03	N/A
1995	0.844432E+03	0.122188E+04	-0.369482E+00
1996	0.153405E+04	0.858163E+03	0.580873E+00
1997	0.173108E+04	0.243069E+04	-0.339428E+00
1998	0.492585E+03	0.107157E+04	-0.777213E+00
1999	0.577028E+03	0.818251E+03	-0.349278E+00
2000	0.240663E+04	0.116837E+04	0.722615E+00
2001	0.156220E+04	0.229972E+04	-0.386693E+00
2002	0.961543E+03	0.106677E+04	-0.103852E+00
2003	0.170676E+04	0.224025E+04	-0.271987E+00
2004	0.634621E+03	0.863133E+03	-0.307541E+00
2005	0.159149E+04	0.600486E+03	0.974687E+00
2006	0.229716E+04	0.130593E+04	0.564756E+00
2007	0.545841E+03	0.381606E+03	0.357939E+00
2008	0.306929E+04	0.412408E+04	-0.295397E+00

Survey Index: 38 Tag: sp_canpo AGE = 6
Time = JAN-1 Type = NUMBER
Catchability = 0.193422E+01 % Variance Contribution = 1.2999
Residual = LN(Observed) - LN(Predicted)

Year	Observed	Predicted	Residual
1978	N/A	0.244451E+04	N/A
1979	N/A	0.314180E+04	N/A
1980	N/A	0.438581E+04	N/A
1981	N/A	0.668175E+04	N/A
1982	N/A	0.125457E+04	N/A
1983	N/A	0.389821E+04	N/A
1984	N/A	0.246179E+04	N/A
1985	N/A	0.177229E+04	N/A
1986	N/A	0.324560E+04	N/A
1987	N/A	0.125582E+04	N/A

1988	N/A	0.936611E+03	N/A
1989	N/A	0.223008E+04	N/A
1990	N/A	0.123191E+04	N/A
1991	N/A	0.380456E+04	N/A
1992	N/A	0.161106E+04	N/A
1993	N/A	0.164927E+04	N/A
1994	N/A	0.365098E+03	N/A
1995	0.267403E+03	0.233923E+03	0.133765E+00
1996	0.111183E+04	0.713731E+03	0.443261E+00
1997	0.379994E+03	0.522071E+03	-0.317647E+00
1998	0.394068E+03	0.121216E+04	-0.112364E+01
1999	0.365920E+03	0.540514E+03	-0.390104E+00
2000	0.109776E+04	0.426011E+03	0.946562E+00
2001	0.731841E+03	0.767440E+03	-0.474979E-01
2002	0.171816E+04	0.137882E+04	0.220025E+00
2003	0.447151E+03	0.569375E+03	-0.241642E+00
2004	0.545454E+03	0.954435E+03	-0.559502E+00
2005	0.721660E+03	0.430379E+03	0.516889E+00
2006	0.982657E+03	0.424956E+03	0.838276E+00
2007	0.851245E+03	0.835353E+03	0.188456E-01
2008	0.196496E+03	0.304367E+03	-0.437591E+00

Survey Index: 39 Tag: sp_canpo AGE = 7
 Time = JAN-1 Type = NUMBER
 Catchability = 0.190133E+01 % Variance Contribution = 2.3828
 Residual = LN(Observed) - LN(Predicted)

Year	Observed	Predicted	Residual
1978	N/A	0.230416E+04	N/A
1979	N/A	0.166182E+04	N/A
1980	N/A	0.176063E+04	N/A
1981	N/A	0.185916E+04	N/A
1982	N/A	0.298603E+04	N/A
1983	N/A	0.505201E+03	N/A
1984	N/A	0.186632E+04	N/A
1985	N/A	0.102944E+04	N/A
1986	N/A	0.585933E+03	N/A
1987	N/A	0.156405E+04	N/A
1988	N/A	0.585345E+03	N/A
1989	N/A	0.373824E+03	N/A
1990	N/A	0.887857E+03	N/A
1991	N/A	0.598684E+03	N/A
1992	N/A	0.122116E+04	N/A
1993	N/A	0.537976E+03	N/A
1994	N/A	0.424300E+03	N/A
1995	0.562954E+02	0.128463E+03	-0.825026E+00
1996	0.464437E+03	0.118046E+03	0.136975E+01
1997	0.844432E+02	0.262765E+03	-0.113518E+01
1998	0.985170E+02	0.170212E+03	-0.546813E+00
1999	0.211108E+03	0.491227E+03	-0.844536E+00
2000	0.562954E+03	0.221337E+03	0.933511E+00
2001	0.365920E+03	0.193141E+03	0.638993E+00
2002	0.563812E+03	0.311279E+03	0.594033E+00
2003	0.474404E+03	0.480327E+03	-0.124098E-01

2004	0.103828E+03	0.194050E+03	-0.625380E+00
2005	0.583521E+03	0.339397E+03	0.541909E+00
2006	0.283568E+03	0.166496E+03	0.532484E+00
2007	0.135474E+03	0.221281E+03	-0.490656E+00
2008	0.396500E+03	0.451852E+03	-0.130678E+00

Survey Index: 40 Tag: sp_canpo AGE = 8
Time = JAN-1 Type = NUMBER
Catchability = 0.127804E-02 % Variance Contribution = 3.5252
Residual = LN(Observed) - LN(Predicted)

Year	Observed	Predicted	Residual
1978	N/A	0.104765E+00	N/A
1979	N/A	0.991198E+00	N/A
1980	N/A	0.731104E+00	N/A
1981	N/A	0.491612E+00	N/A
1982	N/A	0.546696E+00	N/A
1983	N/A	0.835909E+00	N/A
1984	N/A	0.169704E+00	N/A
1985	N/A	0.513145E+00	N/A
1986	N/A	0.261945E+00	N/A
1987	N/A	0.224344E+00	N/A
1988	N/A	0.543048E+00	N/A
1989	N/A	0.150769E+00	N/A
1990	N/A	0.112683E+00	N/A
1991	N/A	0.227094E+00	N/A
1992	N/A	0.168146E+00	N/A
1993	N/A	0.267199E+00	N/A
1994	N/A	0.943439E-01	N/A
1995	0.500000E-01	0.680492E-01	-0.308208E+00
1996	0.800000E-01	0.461655E-01	0.549793E+00
1997	0.300000E-01	0.444297E-01	-0.392711E+00
1998	0.200000E-01	0.379442E-01	-0.640385E+00
1999	0.100000E-01	0.477752E-01	-0.156392E+01
2000	0.240000E+00	0.106825E+00	0.809447E+00
2001	0.170000E+00	0.688585E-01	0.903745E+00
2002	0.170000E+00	0.439352E-01	0.135308E+01
2003	0.160000E+00	0.748417E-01	0.759798E+00
2004	0.117500E+00	0.102468E+00	0.136890E+00
2005	0.100000E-01	0.406401E-01	-0.140217E+01
2006	0.185000E+00	0.894892E-01	0.726237E+00
2007	0.757000E-01	0.559019E-01	0.303179E+00
2008	0.300000E-01	0.103128E+00	-0.123478E+01

Survey Index: 41 Tag: us0autpr AGE = 1
Time = JAN-1 Type = NUMBER
Catchability = 0.163752E-01 % Variance Contribution = 3.3522
Residual = LN(Observed) - LN(Predicted)

Year	Observed	Predicted	Residual
1978	0.207096E+03	0.470051E+03	-0.819657E+00

1979	0.540008E+03	0.424815E+03	0.239931E+00
1980	0.156415E+03	0.375214E+03	-0.874982E+00
1981	0.382090E+03	0.751469E+03	-0.676373E+00
1982	0.356545E+03	0.325259E+03	0.918379E-01
1983	0.494518E+03	0.185127E+03	0.982541E+00
1984	0.175253E+04	0.475219E+03	0.130504E+01
1985	0.244663E+03	0.157452E+03	0.440763E+00
1986	0.136867E+04	0.728787E+03	0.630211E+00
1987	0.103958E+03	0.293085E+03	-0.103647E+01
1988	0.278269E+03	0.406995E+03	-0.380214E+00
1989	0.750656E+03	0.292277E+03	0.943247E+00
1990	0.342611E+03	0.167096E+03	0.718028E+00
1991	0.214610E+03	0.324168E+03	-0.412439E+00
1992	0.553259E+02	0.122319E+03	-0.793389E+00
1993	0.479491E+02	0.161642E+03	-0.121524E+01
1994	0.243707E+03	0.103420E+03	0.857172E+00
1995	N/A	0.642773E+02	N/A
1996	N/A	0.109312E+03	N/A
1997	N/A	0.173921E+03	N/A
1998	N/A	0.809629E+02	N/A
1999	N/A	0.200332E+03	N/A
2000	N/A	0.978720E+02	N/A
2001	N/A	0.375819E+02	N/A
2002	N/A	0.694223E+02	N/A
2003	N/A	0.239289E+02	N/A
2004	N/A	0.176878E+03	N/A
2005	N/A	0.413079E+02	N/A
2006	N/A	0.106273E+03	N/A
2007	N/A	0.115231E+03	N/A
2008	N/A	0.798238E+02	N/A

Survey Index: 42 Tag: us1autpr AGE = 2
 Time = JAN-1 Type = NUMBER
 Catchability = 0.811005E-01 % Variance Contribution = 1.6827
 Residual = LN(Observed) - LN(Predicted)

Year	Observed	Predicted	Residual
1978	0.323486E+03	0.381735E+03	-0.165573E+00
1979	0.252095E+04	0.189489E+04	0.285473E+00
1980	0.222000E+04	0.170212E+04	0.265634E+00
1981	0.112004E+04	0.149655E+04	-0.289797E+00
1982	0.481540E+04	0.295784E+04	0.487362E+00
1983	0.788633E+03	0.126212E+04	-0.470246E+00
1984	0.116048E+04	0.704839E+03	0.498617E+00
1985	0.260797E+04	0.190638E+04	0.313366E+00
1986	0.247669E+03	0.625558E+03	-0.926552E+00
1987	0.311314E+04	0.289887E+04	0.713103E-01
1988	0.565144E+03	0.118082E+04	-0.736882E+00
1989	0.119490E+04	0.162652E+04	-0.308377E+00
1990	0.382281E+04	0.111989E+04	0.122775E+01
1991	0.496704E+03	0.672293E+03	-0.302701E+00
1992	0.556811E+03	0.129405E+04	-0.843304E+00
1993	0.563368E+03	0.481950E+03	0.156093E+00
1994	0.132495E+04	0.633530E+03	0.737824E+00

1995	N/A	0.412440E+03	N/A
1996	N/A	0.258270E+03	N/A
1997	N/A	0.438494E+03	N/A
1998	N/A	0.695932E+03	N/A
1999	N/A	0.323658E+03	N/A
2000	N/A	0.808828E+03	N/A
2001	N/A	0.388547E+03	N/A
2002	N/A	0.151533E+03	N/A
2003	N/A	0.279037E+03	N/A
2004	N/A	0.957835E+02	N/A
2005	N/A	0.713517E+03	N/A
2006	N/A	0.166597E+03	N/A
2007	N/A	0.428522E+03	N/A
2008	N/A	0.466470E+03	N/A

Survey Index: 43 Tag: us2autpr AGE = 3
Time = JAN-1 Type = NUMBER
Catchability = 0.119082E+00 % Variance Contribution = 1.9147
Residual = LN(Observed) - LN(Predicted)

Year	Observed	Predicted	Residual
1978	0.469041E+04	0.301665E+04	0.441371E+00
1979	0.534407E+03	0.414148E+03	0.254934E+00
1980	0.229090E+04	0.203717E+04	0.117386E+00
1981	0.769918E+03	0.159216E+04	-0.726563E+00
1982	0.307366E+04	0.138027E+04	0.800592E+00
1983	0.260851E+04	0.243794E+04	0.676275E-01
1984	0.148806E+04	0.964044E+03	0.434093E+00
1985	0.931388E+03	0.681445E+03	0.312459E+00
1986	0.115105E+04	0.149668E+04	-0.262576E+00
1987	0.175540E+03	0.581276E+03	-0.119736E+01
1988	0.184802E+04	0.263304E+04	-0.354025E+00
1989	0.596973E+03	0.116734E+04	-0.670609E+00
1990	0.142946E+04	0.167545E+04	-0.158786E+00
1991	0.221905E+04	0.753787E+03	0.107972E+01
1992	0.239336E+03	0.598096E+03	-0.915885E+00
1993	0.129627E+04	0.104184E+04	0.218502E+00
1994	0.726204E+03	0.415182E+03	0.559114E+00
1995	N/A	0.695592E+03	N/A
1996	N/A	0.425775E+03	N/A
1997	N/A	0.279631E+03	N/A
1998	N/A	0.453617E+03	N/A
1999	N/A	0.737982E+03	N/A
2000	N/A	0.350827E+03	N/A
2001	N/A	0.871067E+03	N/A
2002	N/A	0.389898E+03	N/A
2003	N/A	0.170025E+03	N/A
2004	N/A	0.313818E+03	N/A
2005	N/A	0.107686E+03	N/A
2006	N/A	0.818626E+03	N/A
2007	N/A	0.192784E+03	N/A
2008	N/A	0.458669E+03	N/A

Survey Index: 44 Tag: us3autpr AGE = 4

Time = JAN-1 Type = NUMBER
Catchability = 0.126944E+00 % Variance Contribution = 2.6588
Residual = LN(Observed) - LN(Predicted)

Year	Observed	Predicted	Residual
1978	0.943682E+03	0.972437E+03	-0.300155E-01
1979	0.554311E+04	0.170963E+04	0.117628E+01
1980	0.221440E+03	0.252758E+03	-0.132281E+00
1981	0.105720E+04	0.110049E+04	-0.401295E-01
1982	0.212971E+04	0.850669E+03	0.917716E+00
1983	0.330316E+03	0.700709E+03	-0.752042E+00
1984	0.101117E+04	0.113440E+04	-0.114997E+00
1985	0.126867E+04	0.445855E+03	0.104573E+01
1986	0.911170E+02	0.261877E+03	-0.105573E+01
1987	0.449438E+03	0.785902E+03	-0.558836E+00
1988	0.147536E+03	0.334737E+03	-0.819275E+00
1989	0.123466E+04	0.134691E+04	-0.870210E-01
1990	0.220074E+03	0.673435E+03	-0.111843E+01
1991	0.247819E+04	0.851609E+03	0.106816E+01
1992	0.374577E+03	0.263475E+03	0.351839E+00
1993	0.238106E+03	0.262782E+03	-0.986068E-01
1994	0.522659E+03	0.408009E+03	0.247641E+00
1995	N/A	0.187294E+03	N/A
1996	N/A	0.444084E+03	N/A
1997	N/A	0.259149E+03	N/A
1998	N/A	0.158710E+03	N/A
1999	N/A	0.246826E+03	N/A
2000	N/A	0.413947E+03	N/A
2001	N/A	0.221668E+03	N/A
2002	N/A	0.456954E+03	N/A
2003	N/A	0.205799E+03	N/A
2004	N/A	0.102307E+03	N/A
2005	N/A	0.224254E+03	N/A
2006	N/A	0.709534E+02	N/A
2007	N/A	0.618071E+03	N/A
2008	N/A	0.123174E+03	N/A

Survey Index: 45 Tag: us4autpr AGE = 5
Time = JAN-1 Type = NUMBER
Catchability = 0.886514E-01 % Variance Contribution = 4.9511
Residual = LN(Observed) - LN(Predicted)

Year	Observed	Predicted	Residual
1978	0.345343E+03	0.263015E+03	0.272327E+00
1979	0.131635E+04	0.362808E+03	0.128874E+01
1980	0.230388E+04	0.613153E+03	0.132373E+01
1981	0.717188E+02	0.101139E+03	-0.343742E+00
1982	0.804616E+03	0.415633E+03	0.660562E+00
1983	0.926196E+02	0.249712E+03	-0.991806E+00
1984	0.943955E+02	0.188630E+03	-0.692296E+00
1985	0.112715E+04	0.384359E+03	0.107587E+01

1986	0.144120E+03	0.121222E+03	0.173027E+00
1987	0.112018E+02	0.815329E+02	-0.198493E+01
1988	0.273624E+03	0.276951E+03	-0.120861E-01
1989	0.819643E+02	0.106207E+03	-0.259105E+00
1990	0.692735E+03	0.432643E+03	0.470734E+00
1991	0.563368E+03	0.229110E+03	0.899732E+00
1992	0.416652E+02	0.236805E+03	-0.173757E+01
1993	0.136607E+03	0.660536E+02	0.726642E+00
1994	0.225402E+02	0.537923E+02	-0.869831E+00
1995	N/A	0.769469E+02	N/A
1996	N/A	0.540421E+02	N/A
1997	N/A	0.153071E+03	N/A
1998	N/A	0.674813E+02	N/A
1999	N/A	0.515287E+02	N/A
2000	N/A	0.735774E+02	N/A
2001	N/A	0.144823E+03	N/A
2002	N/A	0.671790E+02	N/A
2003	N/A	0.141078E+03	N/A
2004	N/A	0.543551E+02	N/A
2005	N/A	0.378151E+02	N/A
2006	N/A	0.822402E+02	N/A
2007	N/A	0.240314E+02	N/A
2008	N/A	0.259710E+03	N/A

Survey Index: 46 Tag: us5autpr AGE = 6
Time = JAN-1 Type = NUMBER
Catchability = 0.104097E+00 % Variance Contribution = 2.0355
Residual = LN(Observed) - LN(Predicted)

Year	Observed	Predicted	Residual
1978	0.236467E+03	0.131560E+03	0.586346E+00
1979	0.458317E+03	0.169087E+03	0.997149E+00
1980	0.437962E+03	0.236037E+03	0.618143E+00
1981	0.361736E+03	0.359601E+03	0.591760E-02
1982	0.737679E+02	0.675192E+02	0.885110E-01
1983	0.157371E+03	0.209796E+03	-0.287527E+00
1984	0.448071E+02	0.132490E+03	-0.108414E+01
1985	0.330589E+02	0.953821E+02	-0.105960E+01
1986	0.104641E+03	0.174673E+03	-0.512381E+00
1987	0.665277E+02	0.675865E+02	-0.157893E-01
1988	0.382500E+02	0.504070E+02	-0.275986E+00
1989	0.264608E+03	0.120020E+03	0.790594E+00
1990	0.747241E+02	0.662996E+02	0.119619E+00
1991	0.390013E+03	0.204756E+03	0.644364E+00
1992	0.396161E+02	0.867047E+02	-0.783272E+00
1993	0.596973E+02	0.887614E+02	-0.396665E+00
1994	0.345616E+02	0.196490E+02	0.564717E+00
1995	N/A	0.125894E+02	N/A
1996	N/A	0.384119E+02	N/A
1997	N/A	0.280971E+02	N/A
1998	N/A	0.652369E+02	N/A
1999	N/A	0.290896E+02	N/A
2000	N/A	0.229273E+02	N/A
2001	N/A	0.413025E+02	N/A

2002	N/A	0.742061E+02	N/A
2003	N/A	0.306429E+02	N/A
2004	N/A	0.513663E+02	N/A
2005	N/A	0.231623E+02	N/A
2006	N/A	0.228705E+02	N/A
2007	N/A	0.449574E+02	N/A
2008	N/A	0.163806E+02	N/A

Survey Index: 47 Tag: us0autpo AGE = 1
Time = JAN-1 Type = NUMBER
Catchability = 0.201548E-01 % Variance Contribution = 10.2185
Residual = LN(Observed) - LN(Predicted)

Year	Observed	Predicted	Residual
1978	N/A	0.578545E+03	N/A
1979	N/A	0.522867E+03	N/A
1980	N/A	0.461818E+03	N/A
1981	N/A	0.924917E+03	N/A
1982	N/A	0.400333E+03	N/A
1983	N/A	0.227857E+03	N/A
1984	N/A	0.584905E+03	N/A
1985	N/A	0.193794E+03	N/A
1986	N/A	0.897000E+03	N/A
1987	N/A	0.360732E+03	N/A
1988	N/A	0.500935E+03	N/A
1989	N/A	0.359738E+03	N/A
1990	N/A	0.205664E+03	N/A
1991	N/A	0.398989E+03	N/A
1992	N/A	0.150551E+03	N/A
1993	N/A	0.198951E+03	N/A
1994	N/A	0.127290E+03	N/A
1995	0.912536E+02	0.791133E+02	0.142762E+00
1996	0.218435E+03	0.134543E+03	0.484604E+00
1997	0.295071E+02	0.214064E+03	-0.198164E+01
1998	0.874290E+01	0.996501E+02	-0.243342E+01
1999	0.957616E+02	0.246572E+03	-0.945791E+00
2000	0.957616E+02	0.120462E+03	-0.229473E+00
2001	0.266384E+02	0.462563E+02	-0.551843E+00
2002	0.387964E+02	0.854458E+02	-0.789555E+00
2003	0.319661E+03	0.294520E+02	0.238450E+01
2004	0.446569E+03	0.217703E+03	0.718462E+00
2005	0.230224E+04	0.508423E+02	0.381291E+01
2006	0.711723E+02	0.130803E+03	-0.608585E+00
2007	0.135787E+03	0.141827E+03	-0.435200E-01
2008	0.102319E+03	0.982481E+02	0.405978E-01

Survey Index: 48 Tag: us1autpo AGE = 2
Time = JAN-1 Type = NUMBER
Catchability = 0.741493E-01 % Variance Contribution = 2.3641
Residual = LN(Observed) - LN(Predicted)

Year	Observed	Predicted	Residual
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1978	N/A	0.349017E+03	N/A
1979	N/A	0.173248E+04	N/A
1980	N/A	0.155623E+04	N/A
1981	N/A	0.136828E+04	N/A
1982	N/A	0.270432E+04	N/A
1983	N/A	0.115394E+04	N/A
1984	N/A	0.644427E+03	N/A
1985	N/A	0.174298E+04	N/A
1986	N/A	0.571941E+03	N/A
1987	N/A	0.265041E+04	N/A
1988	N/A	0.107961E+04	N/A
1989	N/A	0.148711E+04	N/A
1990	N/A	0.102391E+04	N/A
1991	N/A	0.614670E+03	N/A
1992	N/A	0.118313E+04	N/A
1993	N/A	0.440641E+03	N/A
1994	N/A	0.579230E+03	N/A
1995	0.554079E+03	0.377089E+03	0.384824E+00
1996	0.334278E+03	0.236134E+03	0.347573E+00
1997	0.327721E+03	0.400910E+03	-0.201576E+00
1998	0.322666E+03	0.636283E+03	-0.679026E+00
1999	0.458317E+03	0.295917E+03	0.437482E+00
2000	0.190840E+03	0.739503E+03	-0.135454E+01
2001	0.780027E+03	0.355244E+03	0.786524E+00
2002	0.643420E+02	0.138545E+03	-0.766981E+00
2003	0.652982E+03	0.255121E+03	0.939812E+00
2004	0.227178E+03	0.875738E+02	0.953251E+00
2005	0.101745E+04	0.652361E+03	0.444457E+00
2006	0.755438E+02	0.152318E+03	-0.701258E+00
2007	0.590826E+03	0.391793E+03	0.410787E+00
2008	0.156688E+03	0.426488E+03	-0.100133E+01

Survey Index: 49 Tag: us2autpo AGE = 3
 Time = JAN-1 Type = NUMBER
 Catchability = 0.162972E+00 % Variance Contribution = 1.9241
 Residual = LN(Observed) - LN(Predicted)

Year	Observed	Predicted	Residual
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1978	N/A	0.412850E+04	N/A
1979	N/A	0.566792E+03	N/A
1980	N/A	0.278801E+04	N/A
1981	N/A	0.217898E+04	N/A
1982	N/A	0.188899E+04	N/A
1983	N/A	0.333649E+04	N/A
1984	N/A	0.131936E+04	N/A
1985	N/A	0.932606E+03	N/A
1986	N/A	0.204832E+04	N/A
1987	N/A	0.795518E+03	N/A
1988	N/A	0.360351E+04	N/A
1989	N/A	0.159758E+04	N/A
1990	N/A	0.229297E+04	N/A
1991	N/A	0.103161E+04	N/A
1992	N/A	0.818537E+03	N/A

1993	N/A	0.142583E+04	N/A
1994	N/A	0.568206E+03	N/A
1995	0.907481E+03	0.951967E+03	-0.478571E-01
1996	0.247341E+04	0.582703E+03	0.144568E+01
1997	0.267477E+03	0.382695E+03	-0.358206E+00
1998	0.438372E+03	0.620807E+03	-0.347951E+00
1999	0.140186E+04	0.100998E+04	0.327870E+00
2000	0.210648E+03	0.480132E+03	-0.823872E+00
2001	0.734673E+03	0.119212E+04	-0.484060E+00
2002	0.520200E+03	0.533604E+03	-0.254400E-01
2003	0.965812E+03	0.232692E+03	0.142326E+01
2004	0.422389E+03	0.429482E+03	-0.166521E-01
2005	0.185512E+03	0.147376E+03	0.230138E+00
2006	0.791502E+03	0.112035E+04	-0.347462E+00
2007	0.221030E+03	0.263838E+03	-0.177035E+00
2008	0.282504E+03	0.627721E+03	-0.798405E+00

Survey Index: 50 Tag: us3autpo AGE = 4
Time = JAN-1 Type = NUMBER
Catchability = 0.233271E+00 % Variance Contribution = 2.7971
Residual = LN(Observed) - LN(Predicted)

Year	Observed	Predicted	Residual
1978	N/A	0.178695E+04	N/A
1979	N/A	0.314161E+04	N/A
1980	N/A	0.464468E+03	N/A
1981	N/A	0.202226E+04	N/A
1982	N/A	0.156319E+04	N/A
1983	N/A	0.128762E+04	N/A
1984	N/A	0.208457E+04	N/A
1985	N/A	0.819302E+03	N/A
1986	N/A	0.481224E+03	N/A
1987	N/A	0.144417E+04	N/A
1988	N/A	0.615112E+03	N/A
1989	N/A	0.247508E+04	N/A
1990	N/A	0.123750E+04	N/A
1991	N/A	0.156491E+04	N/A
1992	N/A	0.484161E+03	N/A
1993	N/A	0.482887E+03	N/A
1994	N/A	0.749755E+03	N/A
1995	0.592055E+03	0.344171E+03	0.542461E+00
1996	0.170554E+04	0.816047E+03	0.737165E+00
1997	0.566100E+03	0.476211E+03	0.172910E+00
1998	0.149312E+03	0.291646E+03	-0.669504E+00
1999	0.480584E+03	0.453566E+03	0.578607E-01
2000	0.422936E+03	0.760668E+03	-0.586977E+00
2001	0.963080E+02	0.407336E+03	-0.144209E+01
2002	0.627027E+03	0.839697E+03	-0.292052E+00
2003	0.190704E+04	0.378175E+03	0.161795E+01
2004	0.273897E+03	0.187999E+03	0.376314E+00
2005	0.970047E+03	0.412088E+03	0.856108E+00
2006	0.176087E+03	0.130384E+03	0.300494E+00
2007	0.702434E+03	0.113577E+04	-0.480511E+00
2008	0.688500E+02	0.226345E+03	-0.119013E+01

Survey Index: 51 Tag: us4autpo AGE = 5
Time = JAN-1 Type = NUMBER
Catchability = 0.211986E+00 % Variance Contribution = 3.2650
Residual = LN(Observed) - LN(Predicted)

Year	Observed	Predicted	Residual
1978	N/A	0.628928E+03	N/A
1979	N/A	0.867557E+03	N/A
1980	N/A	0.146619E+04	N/A
1981	N/A	0.241846E+03	N/A
1982	N/A	0.993874E+03	N/A
1983	N/A	0.597117E+03	N/A
1984	N/A	0.451058E+03	N/A
1985	N/A	0.919090E+03	N/A
1986	N/A	0.289869E+03	N/A
1987	N/A	0.194964E+03	N/A
1988	N/A	0.662253E+03	N/A
1989	N/A	0.253965E+03	N/A
1990	N/A	0.103455E+04	N/A
1991	N/A	0.547853E+03	N/A
1992	N/A	0.566254E+03	N/A
1993	N/A	0.157949E+03	N/A
1994	N/A	0.128630E+03	N/A
1995	0.209555E+03	0.183998E+03	0.130065E+00
1996	0.119121E+03	0.129227E+03	-0.814277E-01
1997	0.195348E+03	0.366027E+03	-0.627925E+00
1998	0.176496E+03	0.161363E+03	0.896428E-01
1999	0.561455E+02	0.123217E+03	-0.786000E+00
2000	0.348212E+03	0.175940E+03	0.682665E+00
2001	0.107646E+03	0.346305E+03	-0.116847E+01
2002	0.811446E+02	0.160640E+03	-0.682935E+00
2003	0.222260E+04	0.337349E+03	0.188531E+01
2004	0.212561E+03	0.129976E+03	0.491882E+00
2005	0.344250E+03	0.904246E+02	0.133685E+01
2006	0.239882E+03	0.196655E+03	0.198696E+00
2007	0.461732E+02	0.574644E+02	-0.218767E+00
2008	0.177999E+03	0.621027E+03	-0.124960E+01

Survey Index: 52 Tag: us5autpo AGE = 6
Time = JAN-1 Type = NUMBER
Catchability = 0.253043E+00 % Variance Contribution = 3.6646
Residual = LN(Observed) - LN(Predicted)

Year	Observed	Predicted	Residual
1978	N/A	0.319802E+03	N/A
1979	N/A	0.411024E+03	N/A
1980	N/A	0.573771E+03	N/A
1981	N/A	0.874135E+03	N/A
1982	N/A	0.164129E+03	N/A
1983	N/A	0.509981E+03	N/A

1984	N/A	0.322062E+03	N/A
1985	N/A	0.231859E+03	N/A
1986	N/A	0.424604E+03	N/A
1987	N/A	0.164292E+03	N/A
1988	N/A	0.122532E+03	N/A
1989	N/A	0.291749E+03	N/A
1990	N/A	0.161164E+03	N/A
1991	N/A	0.497729E+03	N/A
1992	N/A	0.210766E+03	N/A
1993	N/A	0.215765E+03	N/A
1994	N/A	0.477637E+02	N/A
1995	0.927563E+02	0.306029E+02	0.110888E+01
1996	0.739045E+02	0.933734E+02	-0.233833E+00
1997	0.815545E+02	0.682996E+02	0.177367E+00
1998	0.663911E+02	0.158581E+03	-0.870701E+00
1999	0.483589E+02	0.707124E+02	-0.379970E+00
2000	0.118985E+03	0.557327E+02	0.758429E+00
2001	0.418018E+02	0.100400E+03	-0.876222E+00
2002	0.745875E+02	0.180383E+03	-0.883112E+00
2003	0.161196E+03	0.744881E+02	0.771984E+00
2004	0.112564E+03	0.124863E+03	-0.103696E+00
2005	0.439192E+03	0.563041E+02	0.205417E+01
2006	0.353813E+02	0.555946E+02	-0.451902E+00
2007	0.170486E+03	0.109285E+03	0.444697E+00
2008	0.874290E+01	0.398186E+02	-0.151609E+01

Bootstrap Summary Report

Number of Bootstrap Repetitions Requested = 1000

Number of Bootstrap Repetitions Completed = 1000

Bootstrap Output Variable: Stock Estimates (2008)

	NLLS Estimate	Bootstrap Mean	Bootstrap Std Error	C.V. For NLLS Soln.
N 1	4875.	6694.	5979.	0.8932
N 2	5752.	6358.	2707.	0.4257
N 3	3852.	4065.	1293.	0.3181
N 4	970.	1003.	303.	0.3015
N 5	2930.	3019.	841.	0.2787
N 6	157.	165.	50.	0.3014
N 7	238.	251.	96.	0.3835
N 8	81.	85.	36.	0.4197

	Bias Estimate	Bias Std. Error	Per Cent Bias	NLLS Estimate Corrected For Bias	C.V. For Corrected Estimate
N 1	1819.	198.	37.3120	3056.	1.9565
N 2	606.	88.	10.5393	5146.	0.5260
N 3	214.	41.	5.5481	3638.	0.3555
N 4	33.	10.	3.4200	937.	0.3228
N 5	89.	27.	3.0394	2841.	0.2961
N 6	7.	2.	4.6315	150.	0.3306
N 7	13.	3.	5.5863	224.	0.4289
N 8	4.	1.	5.4608	76.	0.4682

	LOWER 80. % CI	UPPER 80. % CI
N 1	1954.	13428.
N 2	3484.	9918.
N 3	2596.	5739.
N 4	653.	1395.
N 5	2031.	4074.
N 6	108.	229.
N 7	138.	379.
N 8	44.	130.

Bootstrap Output Variable: Catchability Estimates

	NLLS Estimate	Bootstrap Mean	Bootstrap Std Error	C.V. For NLLS Soln.
Q 1	0.178394E-01	0.187930E-01	0.627300E-02	0.3338
Q 2	0.918544E-01	0.923297E-01	0.108349E-01	0.1174
Q 3	0.168705E+00	0.170720E+00	0.280406E-01	0.1642
Q 4	0.215614E+00	0.218945E+00	0.436434E-01	0.1993
Q 5	0.264241E+00	0.273535E+00	0.598480E-01	0.2188
Q 6	0.278657E+00	0.282841E+00	0.530001E-01	0.1874
Q 7	0.297561E+00	0.304346E+00	0.543058E-01	0.1784
Q 8	0.363074E+00	0.364229E+00	0.660452E-01	0.1813
Q 9	0.292985E-01	0.295983E-01	0.641135E-02	0.2166
Q 10	0.101150E+00	0.101495E+00	0.986629E-02	0.0972
Q 11	0.225276E+00	0.225825E+00	0.266989E-01	0.1182
Q 12	0.506259E+00	0.512075E+00	0.850898E-01	0.1662
Q 13	0.688799E+00	0.698933E+00	0.118738E+00	0.1699
Q 14	0.701770E+00	0.711636E+00	0.121819E+00	0.1712
Q 15	0.723118E+00	0.751632E+00	0.191788E+00	0.2552
Q 16	0.816798E+00	0.830399E+00	0.170318E+00	0.2051
Q 17	0.141338E-01	0.179475E-01	0.154487E-01	0.8608
Q 18	0.899870E-01	0.918702E-01	0.202105E-01	0.2200
Q 19	0.198731E+00	0.204879E+00	0.453433E-01	0.2213
Q 20	0.177261E+00	0.177987E+00	0.220123E-01	0.1237
Q 21	0.216299E+00	0.224095E+00	0.553287E-01	0.2469
Q 22	0.207689E+00	0.210823E+00	0.352334E-01	0.1671
Q 23	0.300243E+00	0.323287E+00	0.122228E+00	0.3781
Q 24	0.291472E+00	0.338867E+00	0.202053E+00	0.5963
Q 25	0.358799E-01	0.376050E-01	0.123109E-01	0.3274
Q 26	0.187587E+00	0.191192E+00	0.383436E-01	0.2006
Q 27	0.324684E+00	0.325478E+00	0.353214E-01	0.1085
Q 28	0.372132E+00	0.373357E+00	0.465633E-01	0.1247
Q 29	0.580779E+00	0.584819E+00	0.673329E-01	0.1151
Q 30	0.555873E+00	0.565143E+00	0.117326E+00	0.2076
Q 31	0.730017E+00	0.755580E+00	0.222638E+00	0.2947
Q 32	0.644843E-03	0.657234E-03	0.169703E-03	0.2582
Q 33	0.158633E-01	0.166693E-01	0.623586E-02	0.3741
Q 34	0.779414E-01	0.816357E-01	0.211843E-01	0.2595
Q 35	0.362628E+00	0.364545E+00	0.524685E-01	0.1439
Q 36	0.888325E+00	0.893783E+00	0.130016E+00	0.1455
Q 37	0.140774E+01	0.141534E+01	0.184223E+00	0.1302
Q 38	0.193422E+01	0.195304E+01	0.293137E+00	0.1501
Q 39	0.190133E+01	0.196087E+01	0.399811E+00	0.2039
Q 40	0.127804E-02	0.129603E-02	0.300947E-03	0.2322
Q 41	0.163752E-01	0.167592E-01	0.307154E-02	0.1833
Q 42	0.811005E-01	0.818014E-01	0.110507E-01	0.1351
Q 43	0.119082E+00	0.120320E+00	0.175370E-01	0.1458
Q 44	0.126944E+00	0.128267E+00	0.225092E-01	0.1755
Q 45	0.886514E-01	0.904213E-01	0.206588E-01	0.2285
Q 46	0.104097E+00	0.105532E+00	0.157620E-01	0.1494
Q 47	0.201548E-01	0.219539E-01	0.100801E-01	0.4591
Q 48	0.741493E-01	0.754117E-01	0.151957E-01	0.2015
Q 49	0.162972E+00	0.163349E+00	0.290142E-01	0.1776

Q 50	0.233271E+00	0.236413E+00	0.505131E-01	0.2137
Q 51	0.211986E+00	0.217195E+00	0.523856E-01	0.2412
Q 52	0.253043E+00	0.262837E+00	0.658035E-01	0.2504

	Bias Estimate	Bias Std. Error	Per Cent Bias	NLLS Estimate Corrected For Bias	C.V. For Corrected Estimate
Q 1	0.9536E-03	0.2007E-03	5.3453	0.1689E-01	0.3715
Q 2	0.4753E-03	0.3430E-03	0.5175	0.9138E-01	0.1186
Q 3	0.2015E-02	0.8890E-03	1.1946	0.1667E+00	0.1682
Q 4	0.3330E-02	0.1384E-02	1.5445	0.2123E+00	0.2056
Q 5	0.9294E-02	0.1915E-02	3.5171	0.2549E+00	0.2347
Q 6	0.4184E-02	0.1681E-02	1.5013	0.2745E+00	0.1931
Q 7	0.6786E-02	0.1731E-02	2.2805	0.2908E+00	0.1868
Q 8	0.1155E-02	0.2089E-02	0.3181	0.3619E+00	0.1825
Q 9	0.2997E-03	0.2030E-03	1.0231	0.2900E-01	0.2211
Q 10	0.3451E-03	0.3122E-03	0.3412	0.1008E+00	0.0979
Q 11	0.5493E-03	0.8445E-03	0.2438	0.2247E+00	0.1188
Q 12	0.5815E-02	0.2697E-02	1.1487	0.5004E+00	0.1700
Q 13	0.1013E-01	0.3768E-02	1.4713	0.6787E+00	0.1750
Q 14	0.9866E-02	0.3865E-02	1.4059	0.6919E+00	0.1761
Q 15	0.2851E-01	0.6132E-02	3.9432	0.6946E+00	0.2761
Q 16	0.1360E-01	0.5403E-02	1.6651	0.8032E+00	0.2121
Q 17	0.3814E-02	0.5032E-03	26.9833	0.1032E-01	1.4970
Q 18	0.1883E-02	0.6419E-03	2.0928	0.8810E-01	0.2294
Q 19	0.6147E-02	0.1447E-02	3.0934	0.1926E+00	0.2354
Q 20	0.7258E-03	0.6965E-03	0.4094	0.1765E+00	0.1247
Q 21	0.7796E-02	0.1767E-02	3.6042	0.2085E+00	0.2654
Q 22	0.3133E-02	0.1119E-02	1.5087	0.2046E+00	0.1722
Q 23	0.2304E-01	0.3933E-02	7.6749	0.2772E+00	0.4409
Q 24	0.4740E-01	0.6563E-02	16.2606	0.2441E+00	0.8278
Q 25	0.1725E-02	0.3931E-03	4.8079	0.3415E-01	0.3604
Q 26	0.3605E-02	0.1218E-02	1.9216	0.1840E+00	0.2084
Q 27	0.7940E-03	0.1117E-02	0.2446	0.3239E+00	0.1091
Q 28	0.1225E-02	0.1473E-02	0.3292	0.3709E+00	0.1255
Q 29	0.4040E-02	0.2133E-02	0.6956	0.5767E+00	0.1167
Q 30	0.9271E-02	0.3722E-02	1.6678	0.5466E+00	0.2146
Q 31	0.2556E-01	0.7087E-02	3.5017	0.7045E+00	0.3160
Q 32	0.1239E-04	0.5381E-05	1.9215	0.6325E-03	0.2683
Q 33	0.8060E-03	0.1988E-03	5.0809	0.1506E-01	0.4141
Q 34	0.3694E-02	0.6800E-03	4.7399	0.7425E-01	0.2853
Q 35	0.1917E-02	0.1660E-02	0.5286	0.3607E+00	0.1455
Q 36	0.5458E-02	0.4115E-02	0.6144	0.8829E+00	0.1473
Q 37	0.7601E-02	0.5831E-02	0.5400	0.1400E+01	0.1316
Q 38	0.1883E-01	0.9289E-02	0.9734	0.1915E+01	0.1530
Q 39	0.5954E-01	0.1278E-01	3.1314	0.1842E+01	0.2171
Q 40	0.1799E-04	0.9534E-05	1.4075	0.1260E-02	0.2388
Q 41	0.3840E-03	0.9789E-04	2.3450	0.1599E-01	0.1921
Q 42	0.7009E-03	0.3502E-03	0.8643	0.8040E-01	0.1374
Q 43	0.1238E-02	0.5560E-03	1.0399	0.1178E+00	0.1488
Q 44	0.1324E-02	0.7130E-03	1.0429	0.1256E+00	0.1792
Q 45	0.1770E-02	0.6557E-03	1.9965	0.8688E-01	0.2378
Q 46	0.1435E-02	0.5005E-03	1.3789	0.1027E+00	0.1535
Q 47	0.1799E-02	0.3238E-03	8.9262	0.1836E-01	0.5492

Q 48	0.1262E-02	0.4822E-03	1.7024	0.7289E-01	0.2085
Q 49	0.3777E-03	0.9176E-03	0.2318	0.1626E+00	0.1784
Q 50	0.3142E-02	0.1600E-02	1.3470	0.2301E+00	0.2195
Q 51	0.5210E-02	0.1665E-02	2.4576	0.2068E+00	0.2533
Q 52	0.9794E-02	0.2104E-02	3.8705	0.2432E+00	0.2705

	LOWER 80. % CI	UPPER 80. % CI
Q 1	0.119738E-01	0.268905E-01
Q 2	0.787491E-01	0.106205E+00
Q 3	0.135282E+00	0.208162E+00
Q 4	0.166710E+00	0.276879E+00
Q 5	0.203211E+00	0.354625E+00
Q 6	0.218803E+00	0.351076E+00
Q 7	0.241163E+00	0.376140E+00
Q 8	0.284267E+00	0.450136E+00
Q 9	0.220487E-01	0.382057E-01
Q 10	0.891654E-01	0.113979E+00
Q 11	0.192796E+00	0.260044E+00
Q 12	0.409531E+00	0.630641E+00
Q 13	0.555093E+00	0.868470E+00
Q 14	0.565726E+00	0.881835E+00
Q 15	0.525975E+00	0.100552E+01
Q 16	0.625795E+00	0.105897E+01
Q 17	0.527488E-02	0.362726E-01
Q 18	0.675451E-01	0.119442E+00
Q 19	0.151073E+00	0.264704E+00
Q 20	0.151667E+00	0.207328E+00
Q 21	0.161290E+00	0.297728E+00
Q 22	0.169228E+00	0.257906E+00
Q 23	0.185918E+00	0.486119E+00
Q 24	0.144110E+00	0.577096E+00
Q 25	0.243866E-01	0.536093E-01
Q 26	0.145636E+00	0.242102E+00
Q 27	0.281805E+00	0.374254E+00
Q 28	0.316473E+00	0.434718E+00
Q 29	0.500193E+00	0.674773E+00
Q 30	0.428176E+00	0.724742E+00
Q 31	0.504484E+00	0.106412E+01
Q 32	0.450307E-03	0.895896E-03
Q 33	0.972364E-02	0.248184E-01
Q 34	0.569554E-01	0.110027E+00
Q 35	0.302125E+00	0.435224E+00
Q 36	0.731529E+00	0.106845E+01
Q 37	0.117973E+01	0.165983E+01
Q 38	0.159058E+01	0.233071E+01
Q 39	0.149533E+01	0.249015E+01
Q 40	0.931809E-03	0.169488E-02
Q 41	0.130108E-01	0.207385E-01
Q 42	0.679859E-01	0.963778E-01
Q 43	0.999247E-01	0.142363E+00
Q 44	0.100339E+00	0.158053E+00
Q 45	0.657883E-01	0.117191E+00
Q 46	0.873508E-01	0.126044E+00
Q 47	0.115838E-01	0.346139E-01
Q 48	0.573770E-01	0.959451E-01

Q 49	0.128922E+00	0.202014E+00
Q 50	0.177210E+00	0.303958E+00
Q 51	0.157548E+00	0.286259E+00
Q 52	0.185426E+00	0.355102E+00

Bootstrap Output Variable: Fishing Mortality (2007)

	NLLS Estimate	Bootstrap Mean	Bootstrap Std Error	C.V. For NLLS Soln.
AGE 1	0.0017	0.0018	0.000727	0.4096
AGE 2	0.1161	0.1200	0.034663	0.2889
AGE 3	0.3119	0.3232	0.081705	0.2528
AGE 4	0.3080	0.3172	0.074404	0.2345
AGE 5	0.3439	0.3520	0.086883	0.2468
AGE 6	0.3973	0.4208	0.140749	0.3345
AGE 7	0.1662	0.1848	0.079164	0.4283
AGE 8	0.3025	0.3192	0.065865	0.2063
AGE 9	0.3025	0.3192	0.065865	0.2063
AGE 10	0.3025	0.3192	0.065865	0.2063

	Bias Estimate	Bias Std. Error	Per Cent Bias	NLLS Estimate Corrected For Bias	C.V. For Corrected Estimate
AGE 1	0.000111	0.000023	6.6776	0.0016	0.4682
AGE 2	0.003842	0.001103	3.3082	0.1123	0.3087
AGE 3	0.011255	0.002608	3.6084	0.3006	0.2718
AGE 4	0.009239	0.002371	2.9997	0.2988	0.2490
AGE 5	0.008150	0.002760	2.3699	0.3357	0.2588
AGE 6	0.023443	0.004512	5.8998	0.3739	0.3764
AGE 7	0.018574	0.002571	11.1729	0.1477	0.5361
AGE 8	0.016722	0.002149	5.5282	0.2858	0.2305
AGE 9	0.016722	0.002149	5.5282	0.2858	0.2305
AGE 10	0.016722	0.002149	5.5282	0.2858	0.2305

	LOWER 80. % CI	UPPER 80. % CI
AGE 1	0.000962	0.002744
AGE 2	0.079354	0.167325
AGE 3	0.226352	0.433711
AGE 4	0.230071	0.417925
AGE 5	0.248083	0.468221
AGE 6	0.267313	0.606938
AGE 7	0.105918	0.284319
AGE 8	0.241887	0.406217
AGE 9	0.241887	0.406217
AGE 10	0.241887	0.406217

Bootstrap Output Variable: Average F (2007) AGES 5 - 8

	NLLS Estimate	Bootstrap Mean	Bootstrap Std Error	C.V. For NLLS Soln.
AVG F	0.3025	0.3192	0.065865	0.2063
N WTD	0.3446	0.3486	0.075233	0.2158
B WTD	0.3356	0.3403	0.074416	0.2187
C WTD	0.3597	0.3776	0.090018	0.2384

	Bias Estimate	Bias Std. Error	Per Cent Bias	NLLS Estimate Corrected For Bias	C.V. For Corrected Estimate
AVG F	0.016722	0.002149	5.5282	0.2858	0.2305
N WTD	0.003978	0.002382	1.1545	0.3406	0.2209
B WTD	0.004673	0.002358	1.3925	0.3309	0.2249
C WTD	0.017960	0.002903	4.9933	0.3417	0.2634

	LOWER 80. % CI	UPPER 80. % CI
AVG F	0.241887	0.406217
N WTD	0.257390	0.443835
B WTD	0.250281	0.437768
C WTD	0.273103	0.493857

Bootstrap Output Variable: Biomass

JAN-1 Biomass (2008) Mean Biomass & SSB (2007)

	NLLS Estimate	Bootstrap Mean	Bootstrap Std Error	C.V. For NLLS Soln.
JAN-1	27315.	29117.	4850.	0.1666
MEAN	25760.	26854.	3963.	0.1476
SSB	17672.	18172.	2716.	0.1494

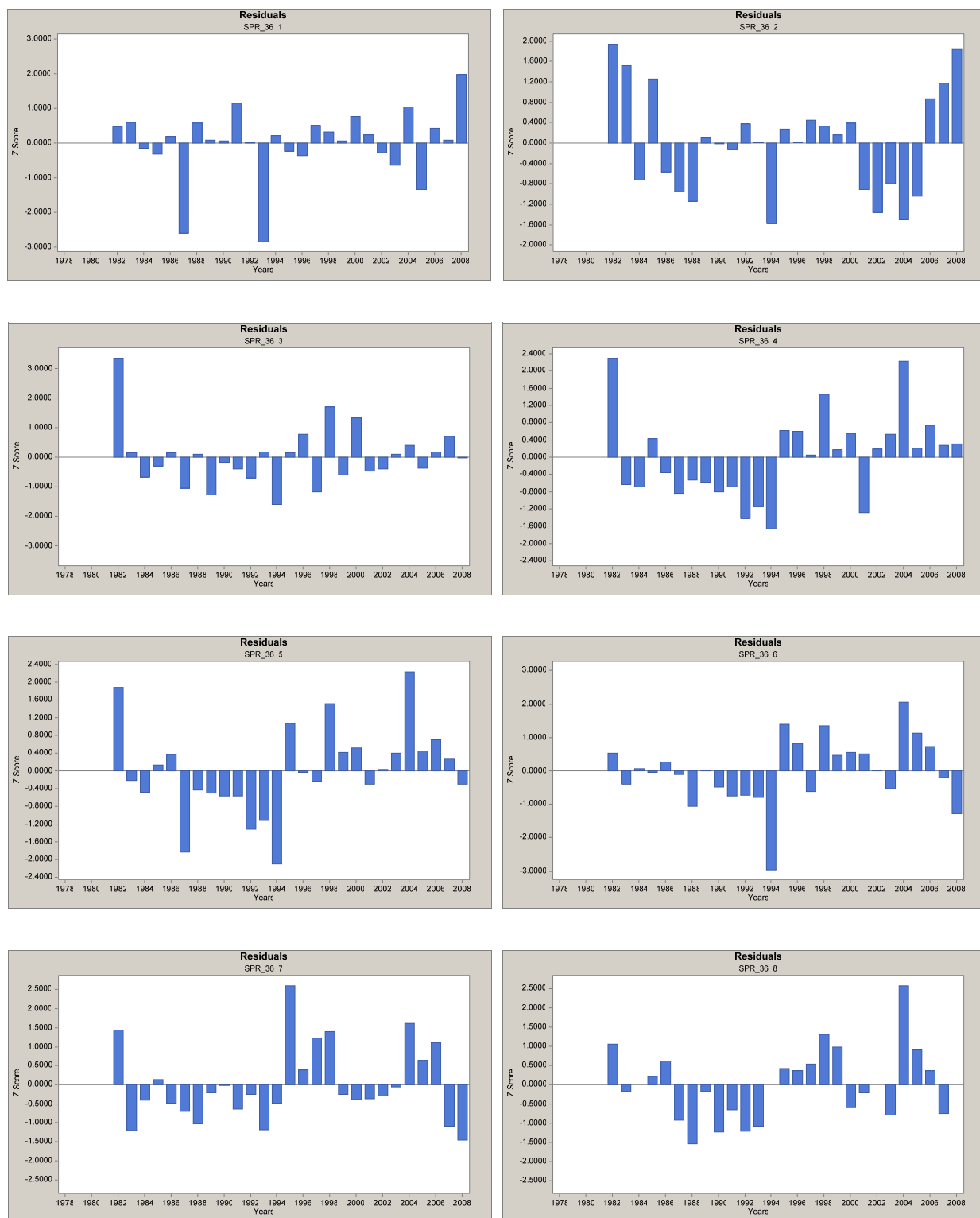
	Bias Estimate	Bias Std. Error	Per Cent Bias	NLLS Estimate Corrected For Bias	C.V. For Corrected Estimate
JAN-1	1802.	164.	6.5972	25513.	0.1901
MEAN	1094.	130.	4.2465	24666.	0.1607
SSB	500.	87.	2.8292	17172.	0.1581

	LOWER 80. % CI	UPPER 80. % CI
JAN-1	22993.	35591.
MEAN	21852.	32188.
SSB	14956.	21655.

Plus Group Diagnostic Report

Calculation Method Selected = Backward

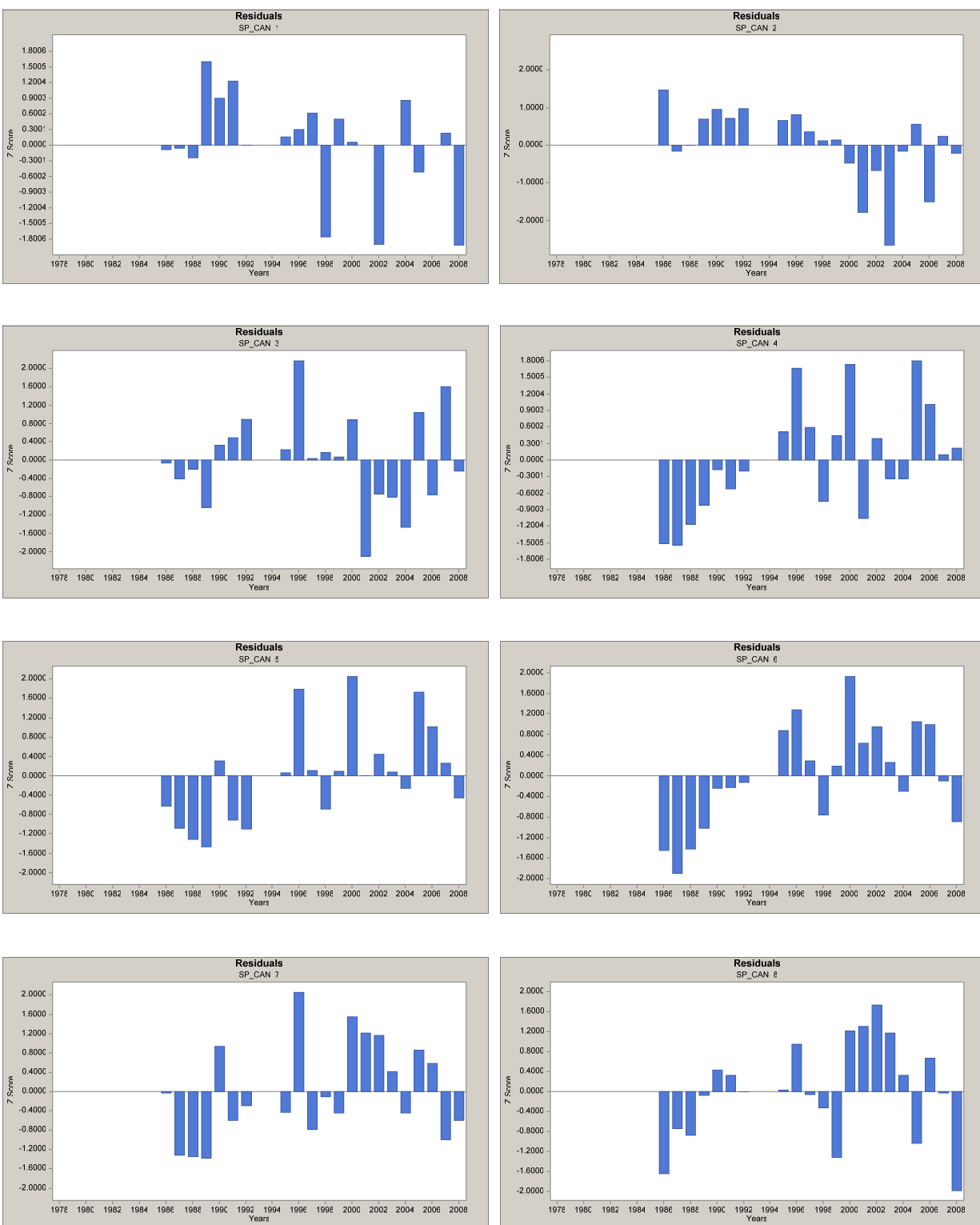
Year	Population Backward	Population Forward	F Forward	F Backward	Ratio
1978	44.	44.	0.308259	0.308259	1.000000
1979	127.	131.	0.345514	0.359798	1.041340
1980	37.	103.	0.164657	0.541372	3.287884
1981	173.	244.	0.353951	0.544585	1.538590
1982	192.	333.	0.327151	0.655849	2.004726
1983	288.	268.	0.613105	0.558734	0.911319
1984	283.	200.	1.129093	0.657374	0.582214
1985	182.	213.	0.614331	0.772297	1.257135
1986	76.	116.	0.306033	0.510817	1.669156
1987	75.	145.	0.219497	0.475565	2.166618
1988	105.	149.	0.488757	0.781517	1.598990
1989	54.	110.	0.240156	0.559488	2.329684
1990	88.	142.	0.372457	0.689139	1.850248
1991	47.	101.	0.330946	0.908106	2.743972
1992	19.	76.	0.162996	0.926066	5.681536
1993	34.	74.	0.376025	1.153756	3.068296
1994	9.	59.	0.109817	1.238415	11.277052
1995	3.	55.	0.028725	0.615929	21.442171
1996	1.	50.	0.006628	0.654373	98.725815
1997	7.	52.	0.086811	0.851678	9.810757
1998	6.	45.	0.072847	0.743661	10.208472
1999	7.	39.	0.100541	0.779848	7.756524
2000	3.	33.	0.034234	0.548413	16.019363
2001	3.	31.	0.047227	0.653113	13.829337
2002	13.	39.	0.204668	0.798154	3.899747
2003	5.	34.	0.100203	0.957827	9.558863
2004	10.	28.	0.215770	0.841706	3.900942
2005	8.	27.	0.165477	0.694653	4.197875
2006	8.	26.	0.152554	0.600590	3.936897
2007	4.	23.	0.054852	0.357014	6.508634
2008	20.	35.	N/A	N/A	



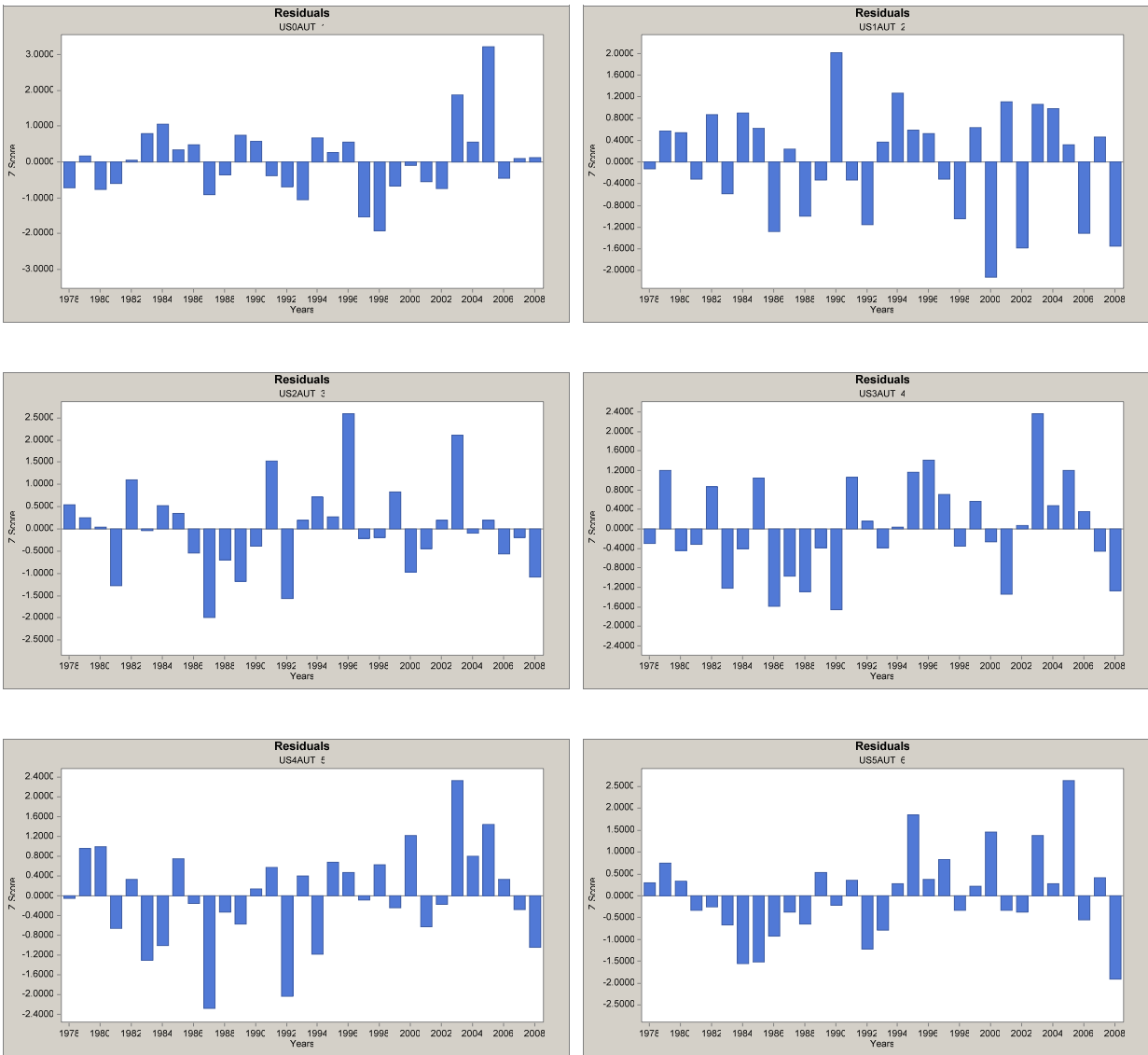
Appendix A. Figure A1a. Base VPA residuals for ages 1-8 for NEFSC spring survey, 1978-2008.



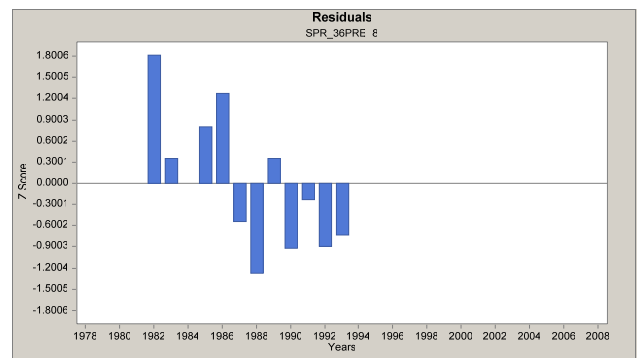
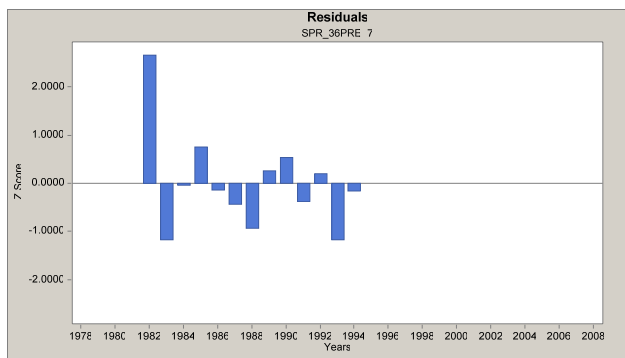
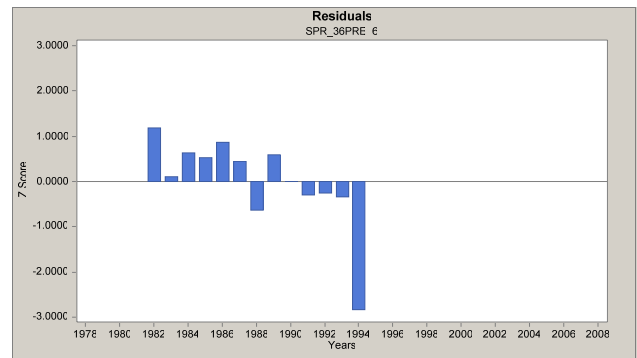
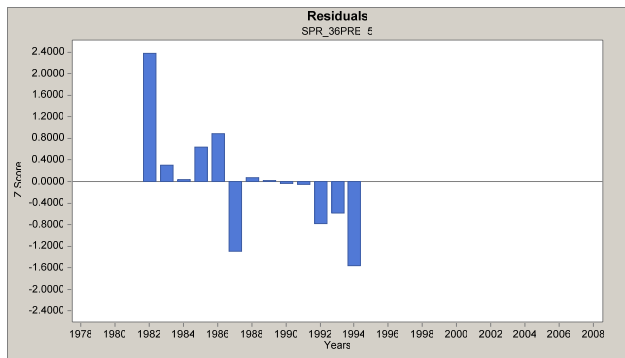
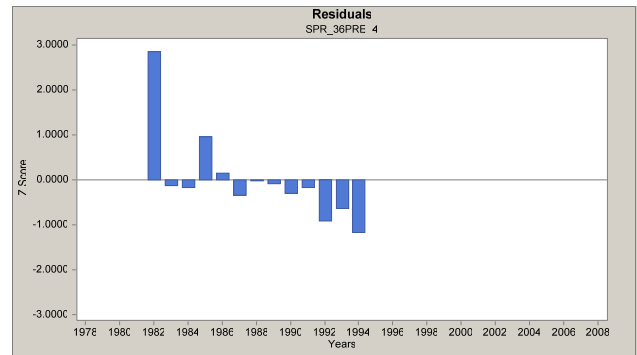
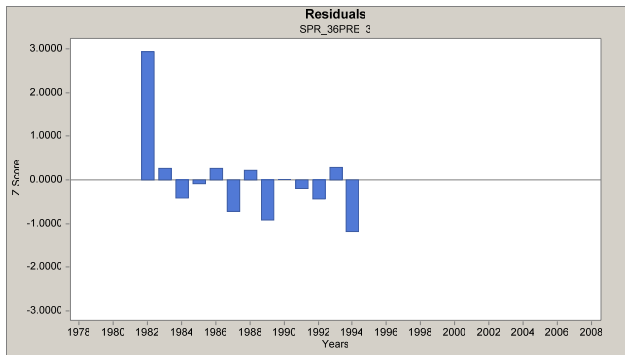
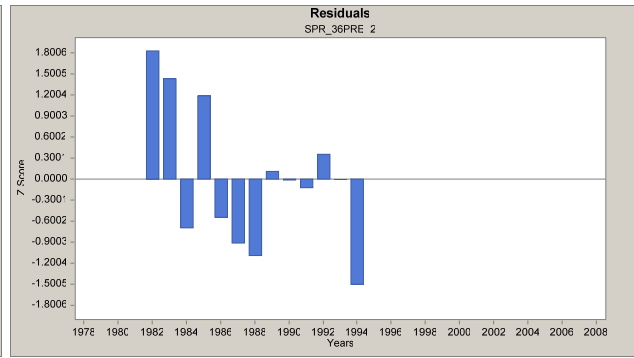
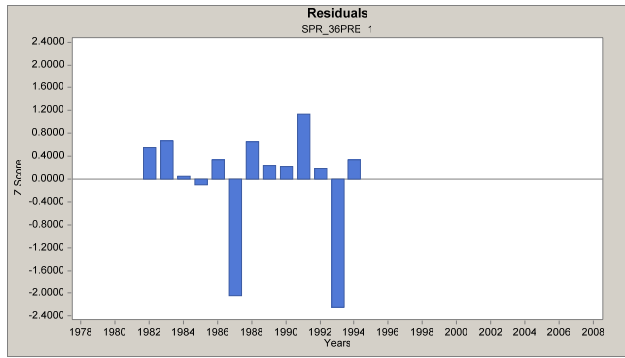
Appendix A. Figure A1b. Base VPA residuals for ages 1-8 for NEFSC spring survey, 1978-1981



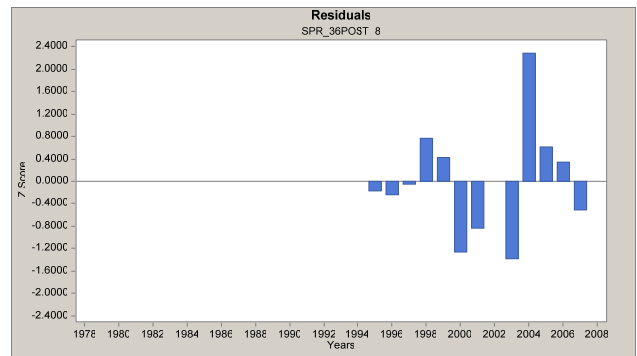
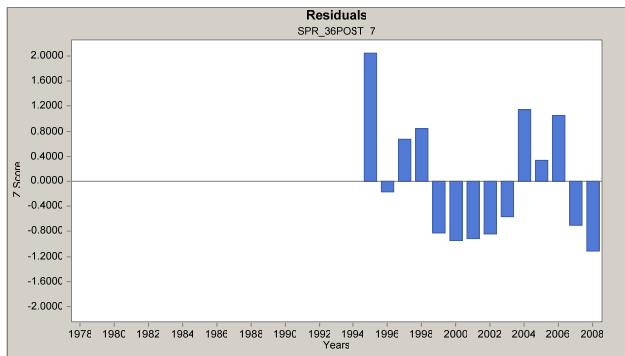
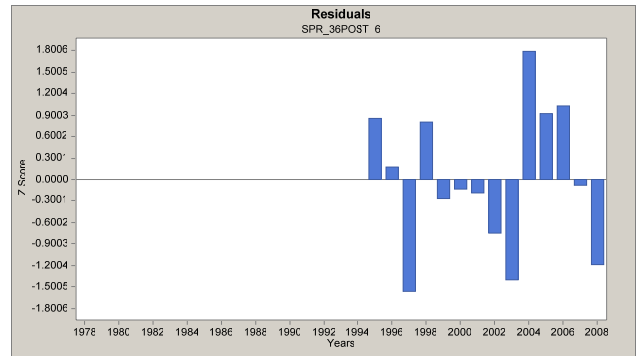
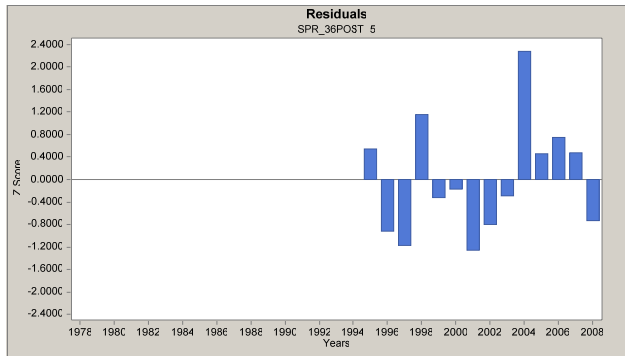
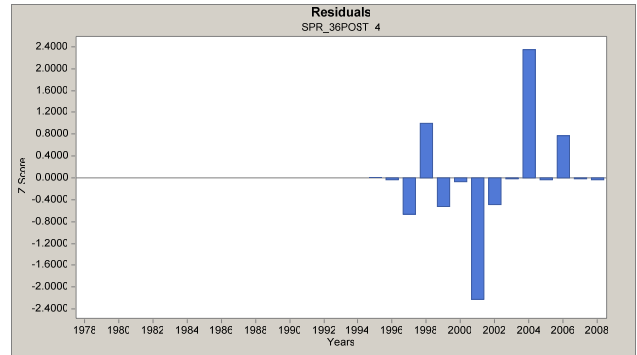
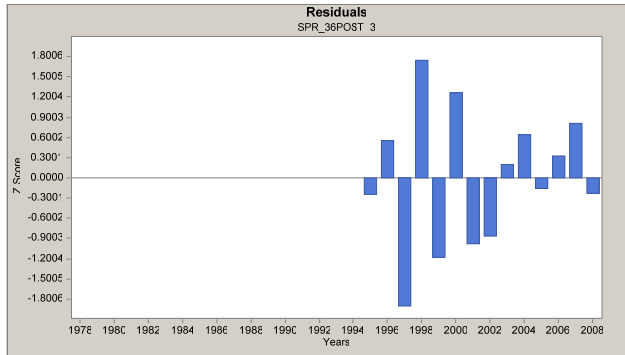
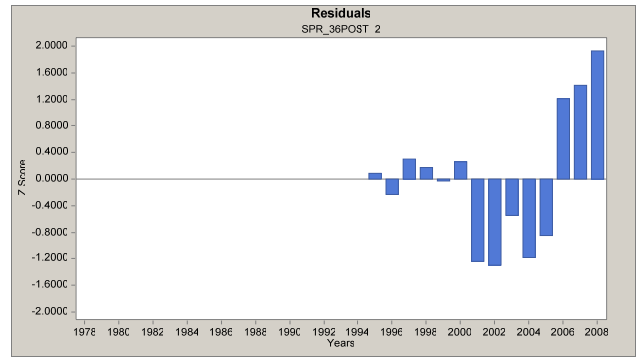
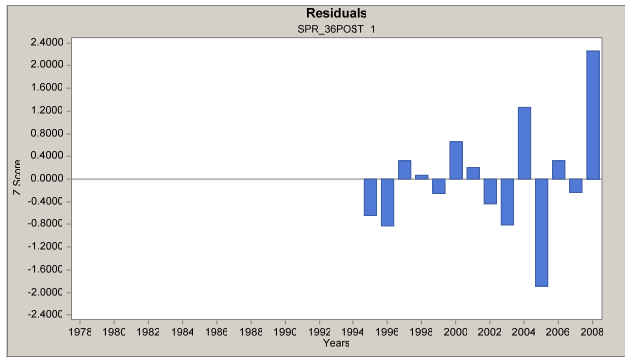
Appendix A. Figure A1c. Base VPA residuals for ages 1-8 for DFO spring survey, 1986-2008



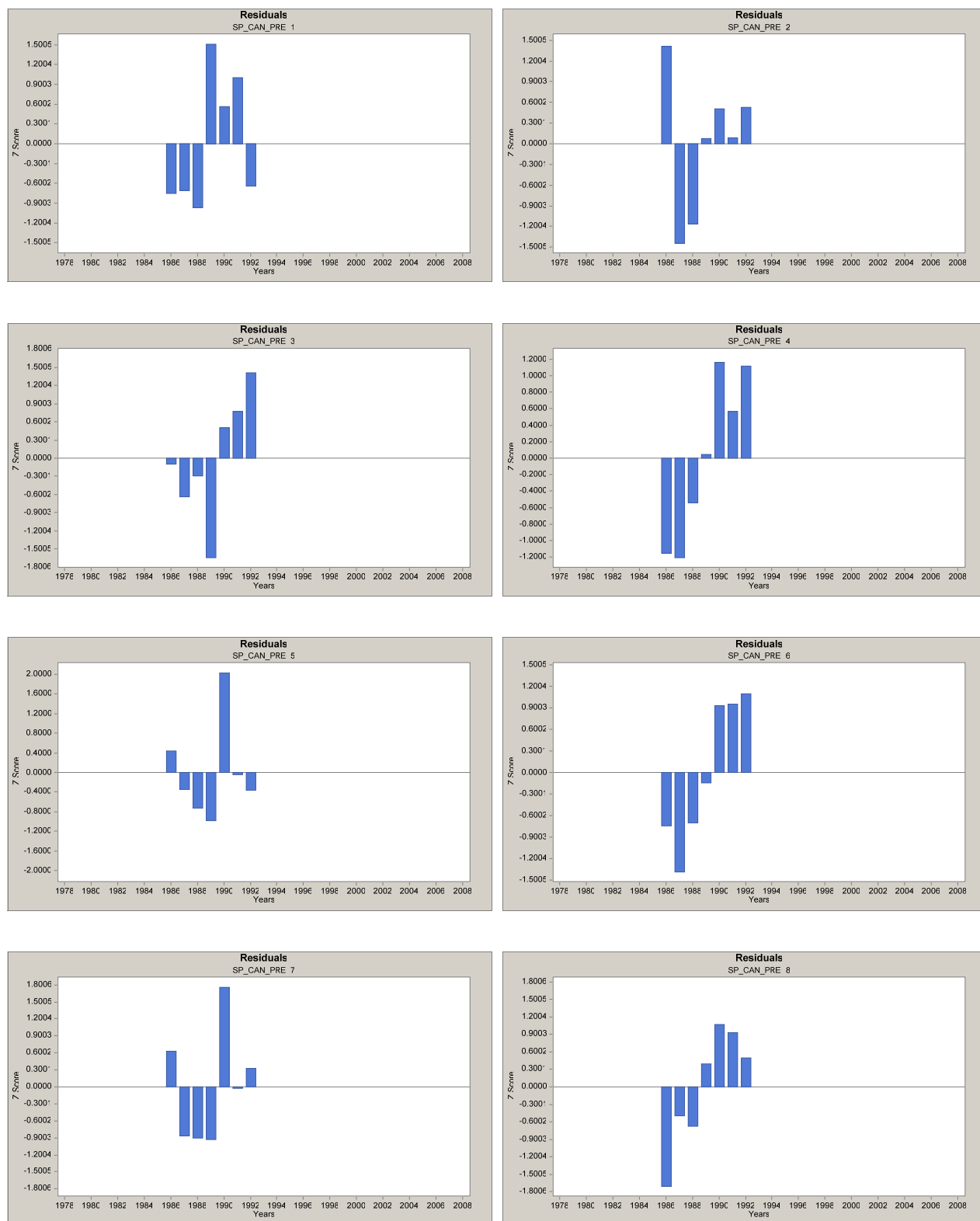
Appendix A. Figure A1d. Base VPA residuals for ages 1-6 for NEFSC autumn survey, 1978-2008.



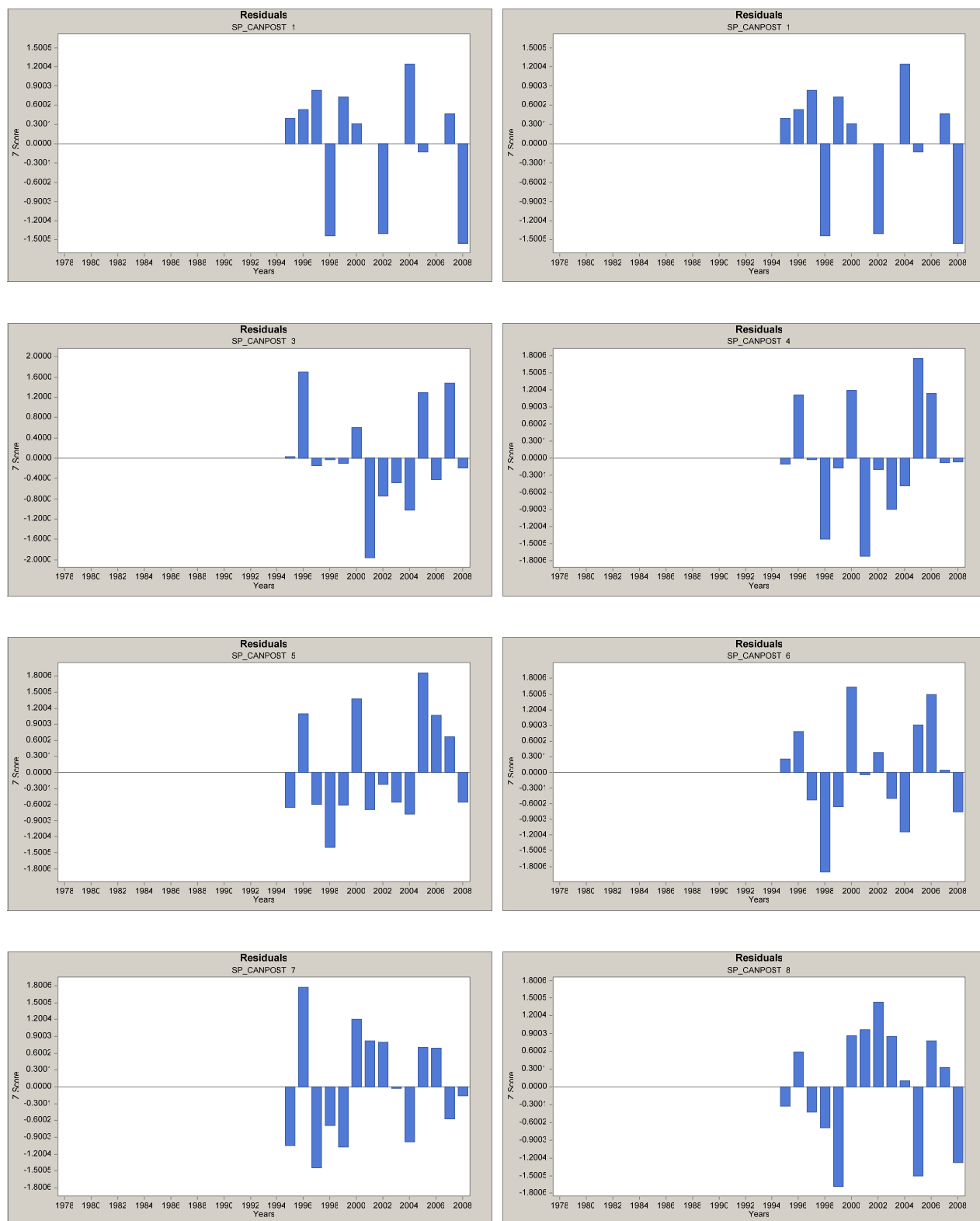
Appendix A. Figure A2a. Split survey VPA residual for ages 1-8 for NEFSC spring survey, 1982-1994.



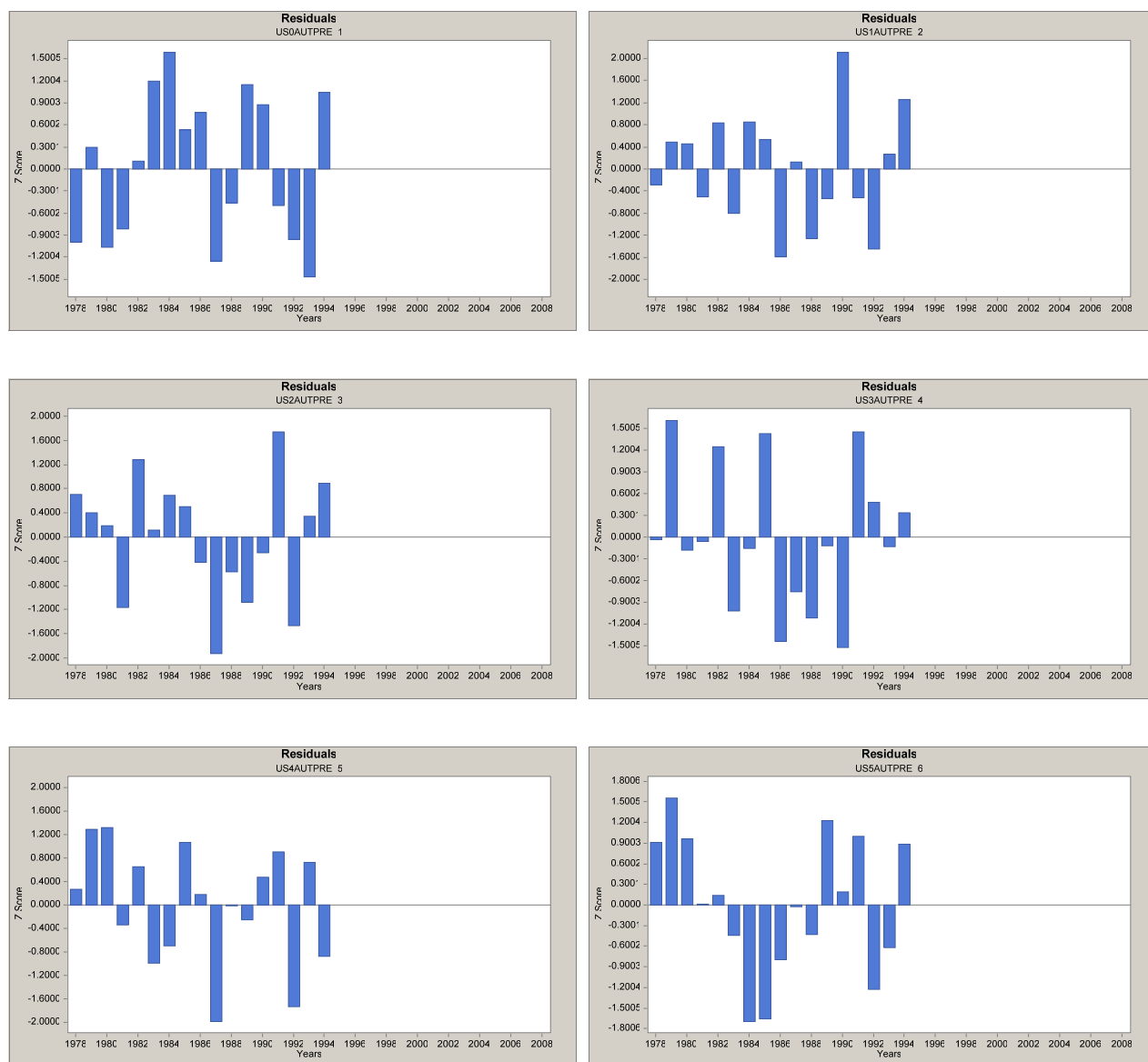
Appendix A. Figure A2b. Split survey VPA residual for ages 1-8 for NEFSC spring survey, 1995-2007.



Appendix A. Figure A2c. Split survey VPA residual for ages 1-8 for DFO spring survey, 1986-1994.



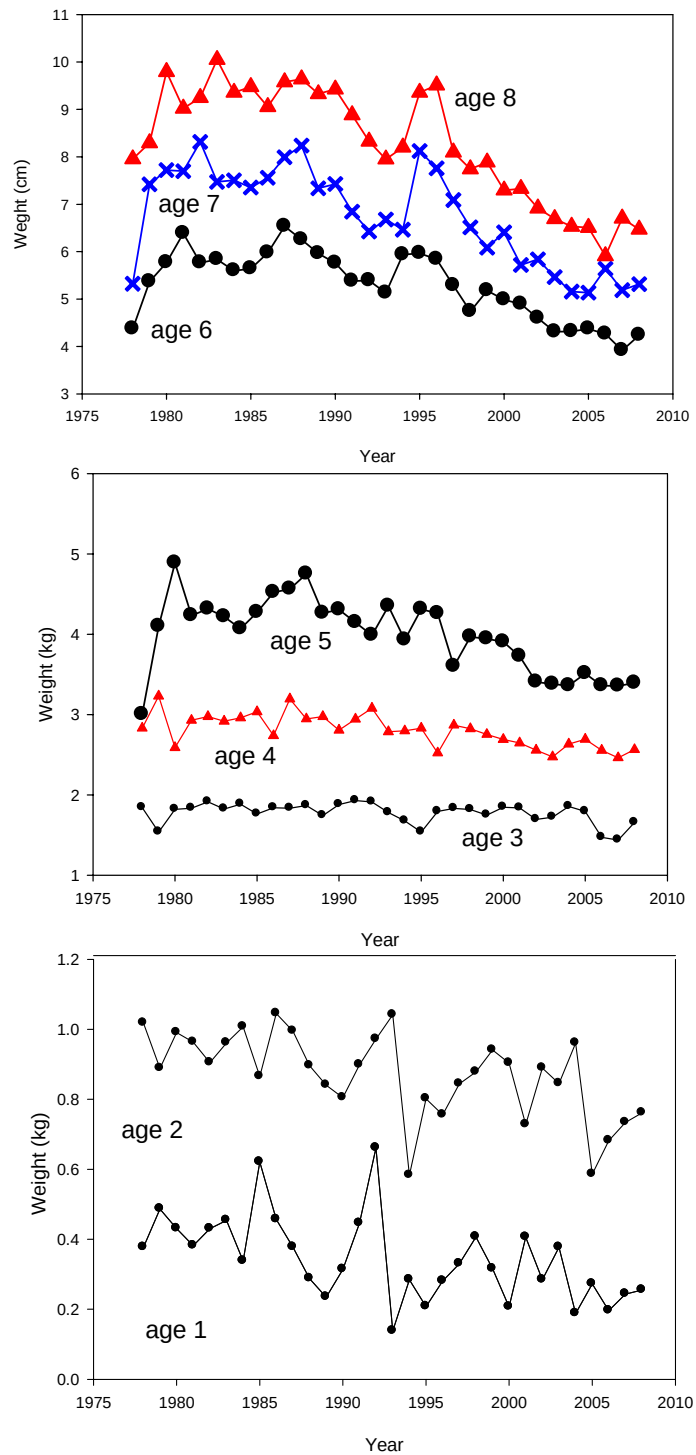
Appendix A. Figure A2d. Split survey VPA residual for ages 1-8 for DFO spring survey, 1995-2007.



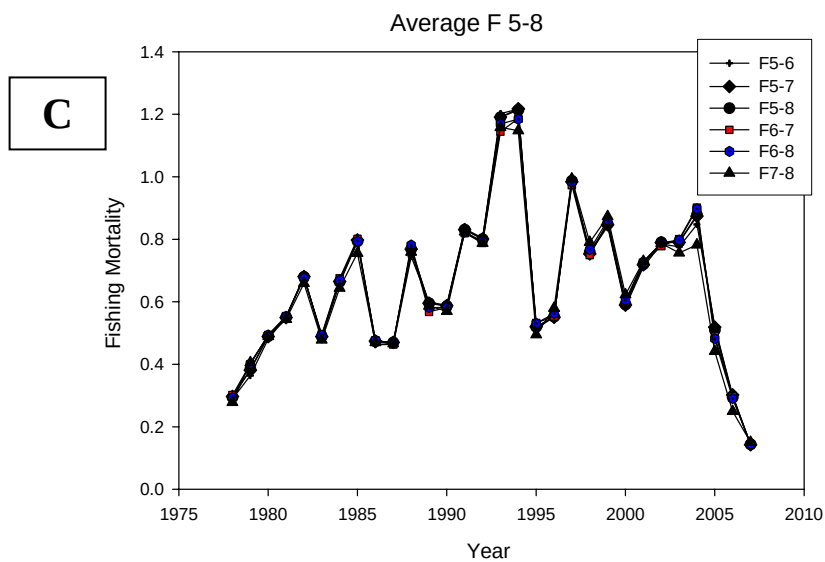
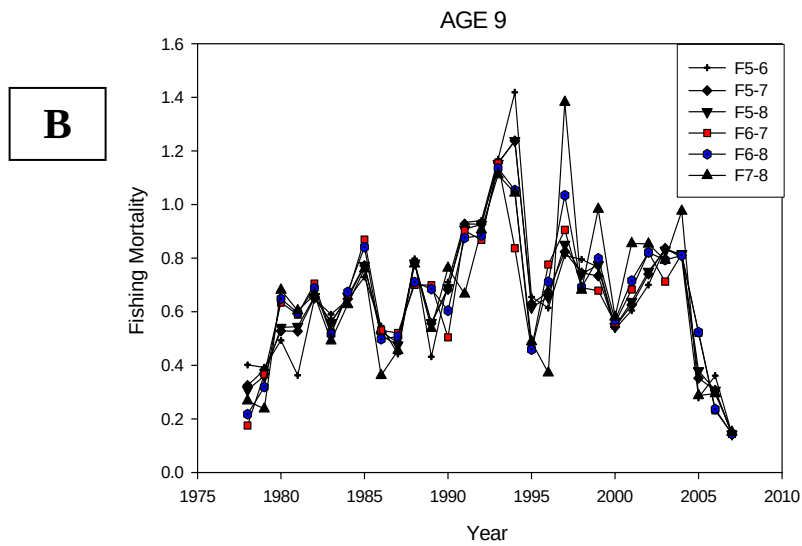
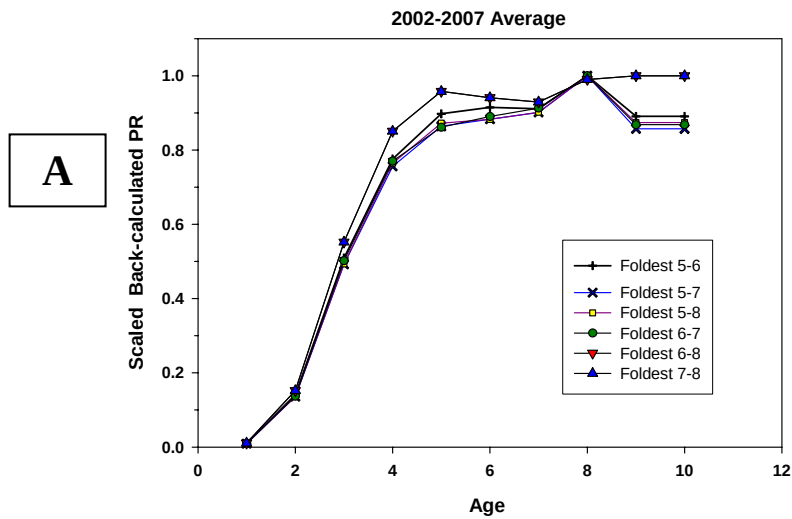
Appendix A. Figure A2e. Split survey VPA residual for ages 1-8 for NEFSC autumn survey, 1978-1994.



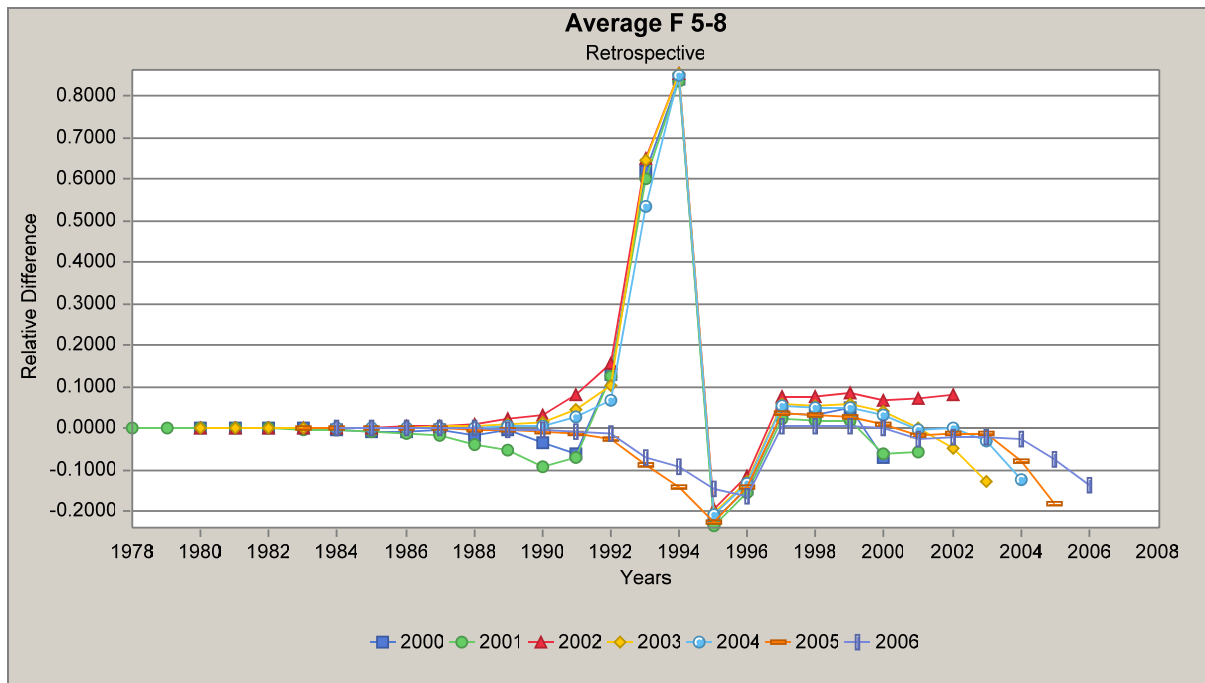
Appendix A. Figure A2f. Split survey VPA residual for ages 1-8 for NEFSC autumn survey, 1995-2007.



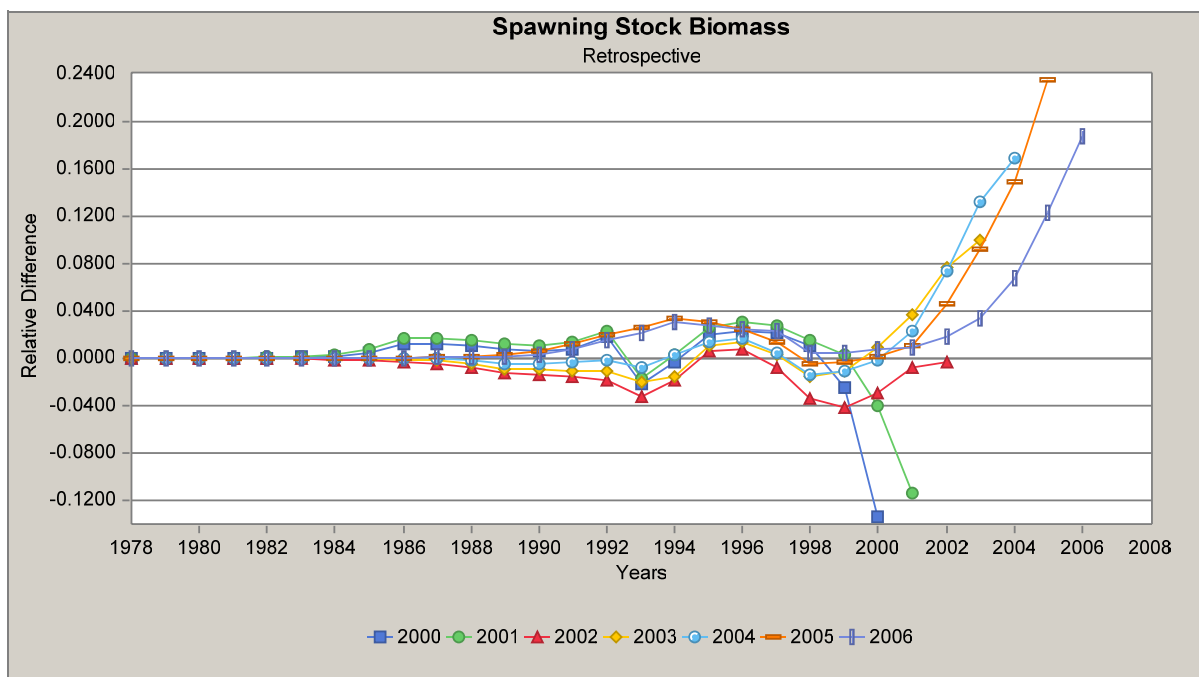
Appendix A. Figure A3. Stock mean weights for ages 1-8 for Georges Bank cod, 1978-2008, from revised August VPA.



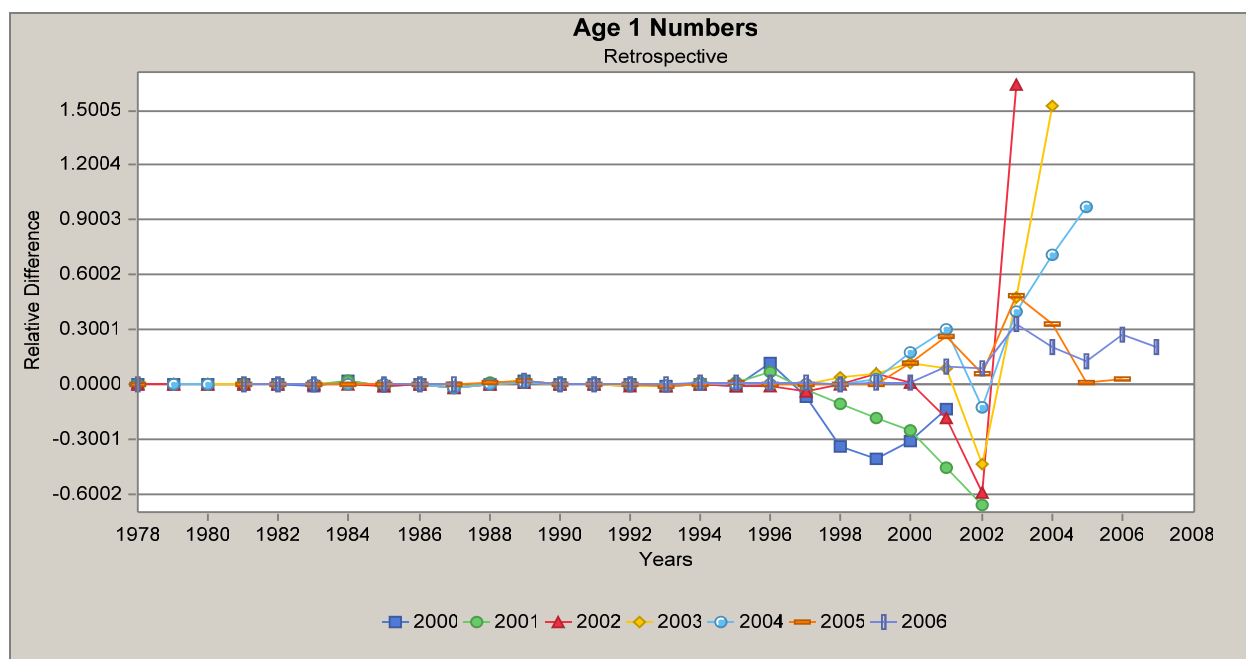
Appendix A. Figure A4. Sensitivity runs of BASE Model, with F on oldest age (9) estimated by averaging different age groups (5-6, 5-7, 5-8, 6-7, 6-8, and 7-8) and the effect on the partial recruitment (A), F on age 9 (B), and F averaged over ages 5-8 (C), for each scenario.



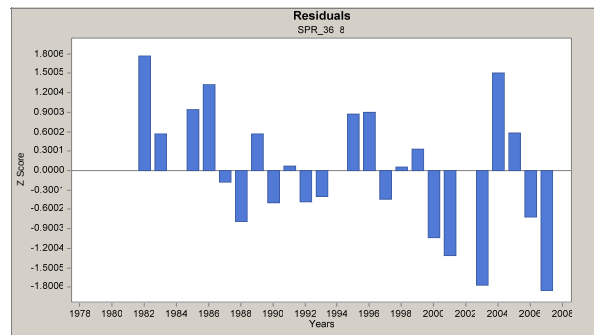
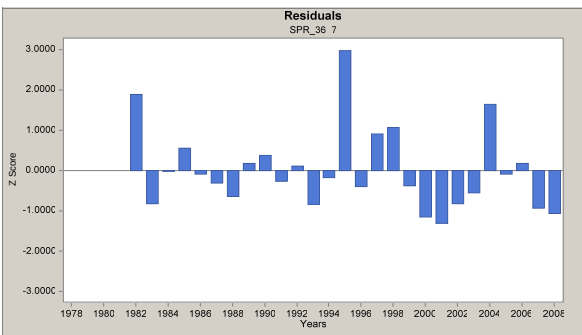
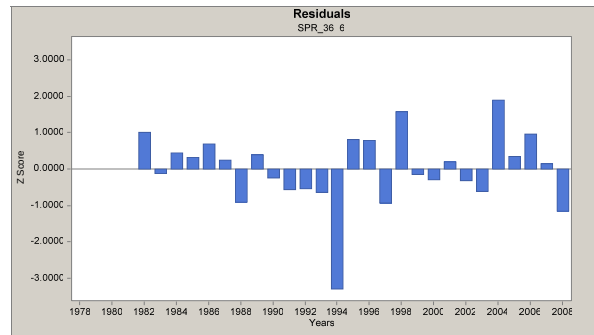
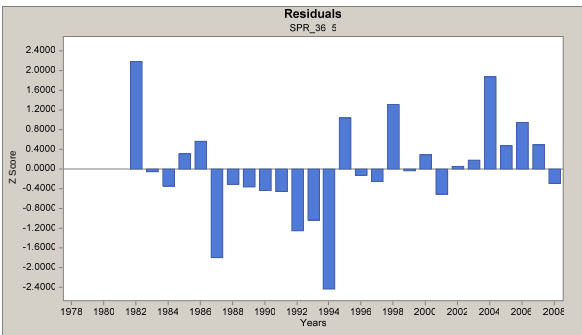
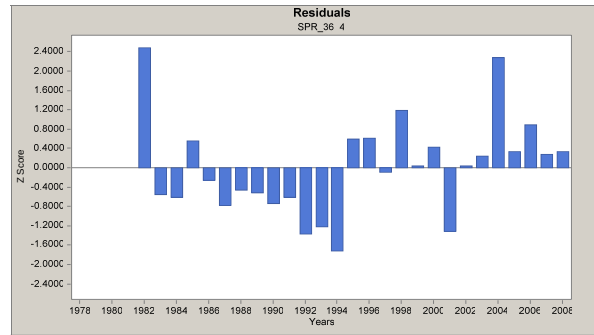
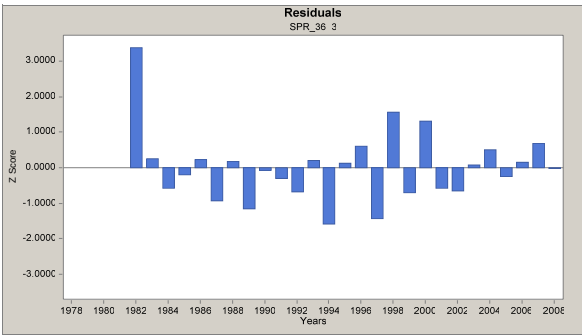
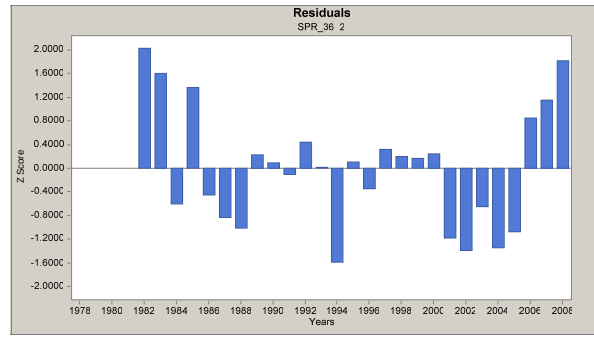
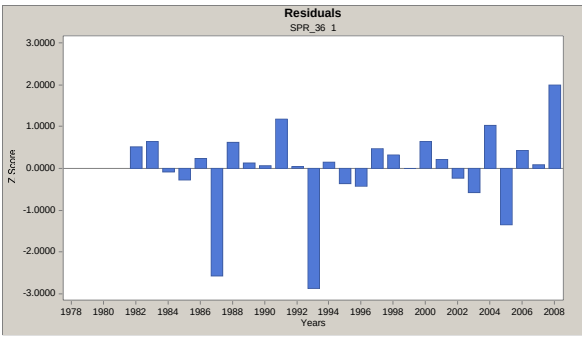
Appendix A. Figure A5a. Retrospective analysis of relative difference to terminal year 2007 of Georges Bank Atlantic cod fishing mortality (ages 5-8, unweighted), based on around the corner ADAPT VPA, 2000-2007.



Appendix A. Figure A5b. Retrospective analysis of relative difference to terminal year 2007 of Georges Bank Atlantic cod spawning stock biomass, based on around the corner ADAPT VPA, 2000-2007



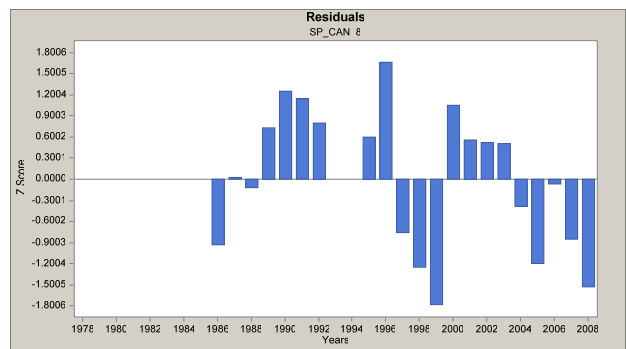
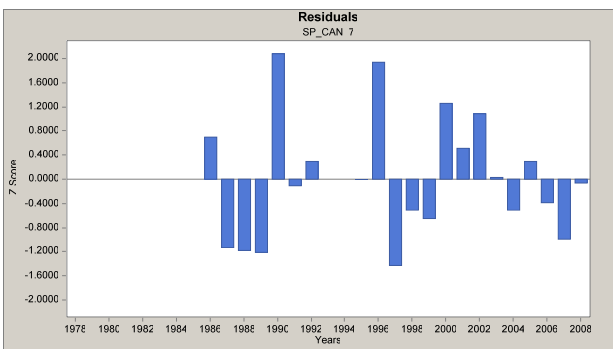
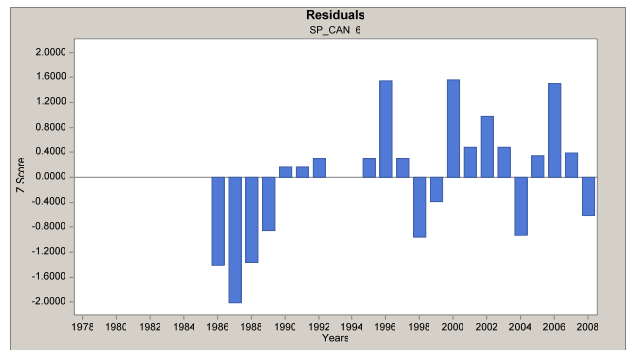
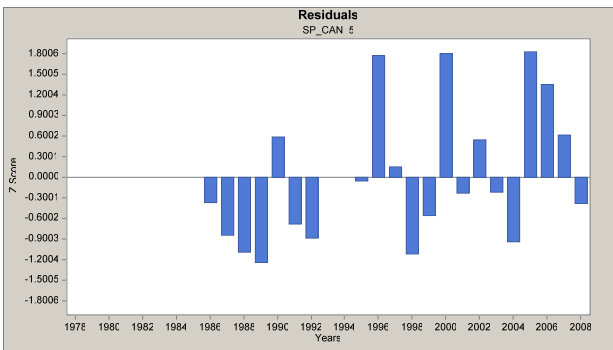
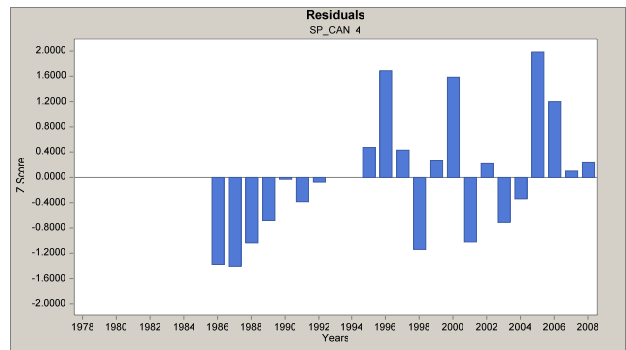
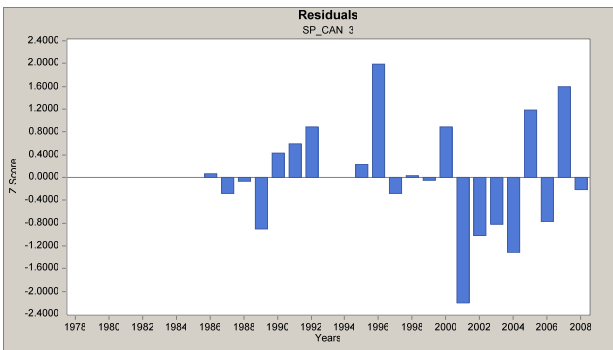
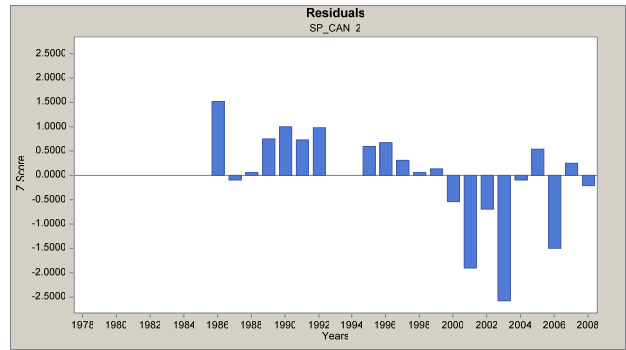
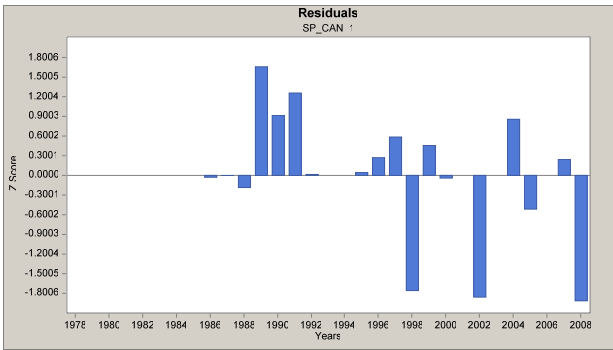
Appendix A. Figure A5c. Retrospective analysis of relative difference to terminal year 2007 of Georges Bank Atlantic cod age 1 recruitment based on around the corner ADAPT VPA, 2000-2007.



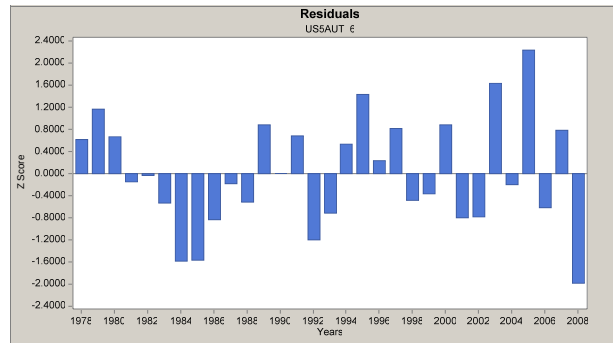
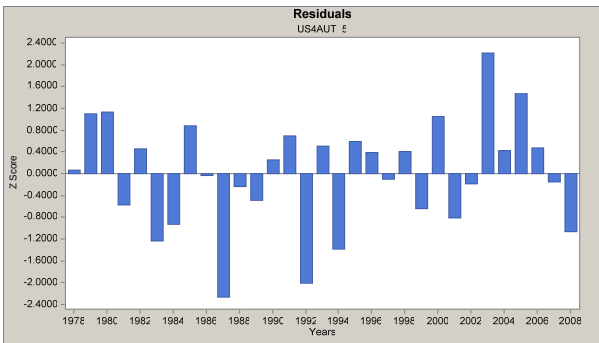
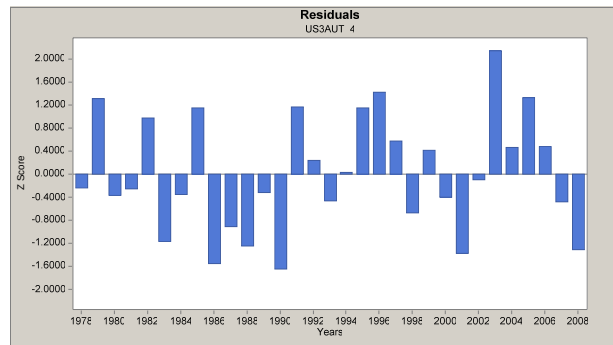
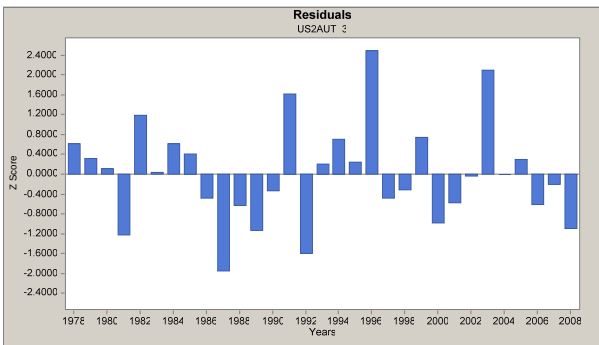
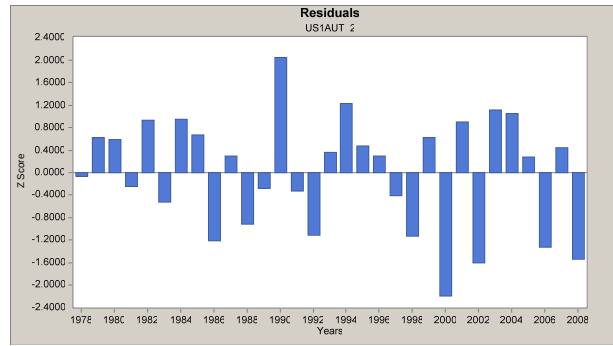
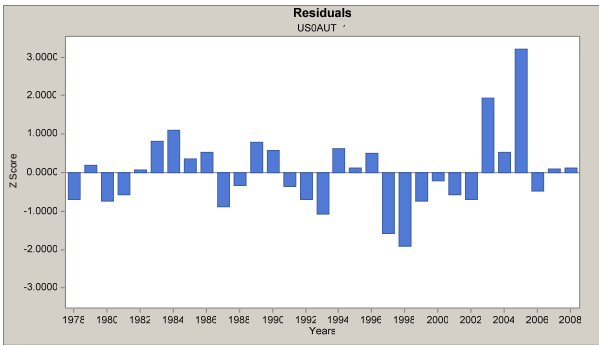
Appendix A. Figure A6a. Around the corner VPA residual for ages 1-8 for NEFSC spring survey, 1982-2008.



Appendix A. Figure A6b. Around the corner VPA residual for ages 1-8 for NEFSC spring survey, 1978-1981.



Appendix A. Figure A6c. Around the corner VPA residual for ages 1-8 for DFO spring survey, 1986-2008



Appendix A. Figure A6d. Around the corner VPA residual for ages 1-8 for NEFSC autumn survey, 1978-2008.

Appendix B. Georges Bank haddock

by Elizabeth N. Brooks, Michele L. Traver, Sandy Sutherland, L. Van Eeckhaute and Laurel Col

Appendix Contents

- VPA input and output
- YPR input and output

VPA input GB haddock								
VPA/ADAPT V	2.8							
##								
MODEL ID								
garm3-rev-base	F5to7	backward	1931	to	2007	data		
PARAM								
77	9	30	30	9	1931	1	0	123456
PARTIAL RECRUIT								
0.001	0.41	0.84	1	1	1	1	1	
AGE ESTIMATE								
1	2	3	4	5	6	7	8	9
STOCK ESTIMATE								
10000	1000	10000	5000	15000	1000	500	300	300
STOCK MIN-MAX								
1	1000000000							
F-PLUS								
1.0000*77								
OMEGA								
1.0000*78								
WTF SURV								
1.0000*30								
AGES-F								
7-May								
AGES-SUMMARY								
7-May								
MFSPAWN								
0.25	0.25							
CATCH AT	AGE							
1755	8801	2041	5785	9100	6045	3380	1794	559
118	2084	25871	2421	3676	2894	1320	664	391
244	8476	6023	10046	2092	1579	1210	538	647
341	4454	5414	3734	3149	1051	619	250	168
1197	11872	8819	3706	2944	2458	499	442	109
880	12327	11486	5431	2141	1377	1362	259	124
1288	11034	10910	5629	4143	1875	952	481	222
1030	20199	7755	3755	2113	1600	945	327	173
607	13937	19617	5163	2152	967	837	326	239
2040	7254	12317	8253	2510	1479	752	222	136
780	23464	9808	8033	5764	1781	941	307	384
310	14307	16348	6531	3996	2331	1036	227	176
19	4191	17738	8364	3102	2693	790	354	178
64	761	8437	14843	5689	2281	497	469	108
121	8522	2029	6386	5795	2315	914	265	205
209	7466	15213	2738	5785	3840	1827	272	23
90	16621	10334	7181	2127	2739	1501	745	457
80	11227	19237	5116	2744	1157	780	450	369
328	6472	12479	9608	2347	1061	624	409	353
88	28971	4107	4272	3315	1131	520	225	250
645	8266	26472	2177	2448	2138	740	297	215
0	25120	8892	8485	1361	944	530	182	107
1083	1807	17588	5726	3757	1012	542	337	152
108	31858	5107	5611	2315	2131	720	353	98
90	3941	19251	3316	3278	1649	1068	320	173
52	11948	6698	12066	3405	3378	1348	563	201
35	6594	14046	4523	5822	2357	1630	473	366
125	5571	7088	6665	3784	2366	903	442	142
94	5716	7994	5169	3934	1758	1172	424	334
258	16010	6122	4562	3067	1792	787	406	348
62	10689	14927	4198	2917	1856	1266	496	674
74	4455	16245	10440	3448	2089	1566	1185	898
2910	4047	7418	11152	8198	2205	1405	721	1096
10101	15935	4554	4776	8722	5794	2082	1028	1332
9601	125818	44496	5356	4391	6690	3772	1094	1366
114	6843	100810	19167	2768	2591	2332	1268	867
1150	168	2891	20667	10338	1209	993	917	698
8	2994	709	1921	14519	3499	667	453	842
2	11	1698	448	654	5954	1574	225	570
46	158	16	570	186	214	2308	746	464
1	1375	223	40	289	246	285	1469	928
160	2	460	83	33	123	80	68	1265
2607	2113	3	393	54	31	78	15	455

48	4481	682	2	73	2	2	55	258
199	1070	1928	388	4	43	4	4	91
149	491	570	913	224	0	24	4	116
1	19858	190	690	522	362	4	40	113
1	767	14509	307	572	521	140	14	68
1	26	1743	7238	530	414	318	97	46
8	31170	349	980	6087	597	549	154	81
1	1755	11076	837	944	2590	333	159	95
1	1174	1645	3761	394	573	1127	107	111
0	216	821	697	2261	275	188	808	77
0	94	301	736	402	1500	237	270	550
0	2464	563	199	472	234	539	80	156
6	55	2848	226	148	175	152	270	61
0	2035	132	1646	125	75	91	108	138
4	53	2439	137	953	152	56	66	108
2	1462	123	1019	217	478	62	37	57
63	12	1697	269	1124	154	218	55	49
7	486	123	2370	144	518	128	172	65
84	265	408	197	1960	181	426	47	100
33	363	439	340	120	741	63	169	82
27	538	1192	242	142	73	313	55	110
17	94	614	471	59	29	9	61	16
7	56	566	919	450	66	22	7	78
15	143	273	745	561	218	18	18	49
6	230	471	558	767	571	169	23	49
3	43	906	541	606	566	384	163	48
2	407	626	1571	588	528	377	258	99
14	145	2393	996	1281	656	438	359	262
3	397	345	3177	926	1105	402	306	551
5	18	1943	461	2686	605	719	212	389
646	33	122	5116	729	2935	687	563	408
20	612	42	339	8505	778	1843	315	343
164	18	3164	71	375	5418	327	842	228
13	175	240	11216	194	311	2512	229	564
WEIGHT	AT	AGE						
0.75	0.78	1.18	1.37	1.65	2.01	2.31	2.54	3.03
0.64	0.85	1.09	1.82	1.89	2.19	2.74	2.93	3.20
0.54	0.73	1.35	1.42	1.73	2.39	2.46	2.59	2.60
0.42	0.73	1.13	1.49	1.75	2.11	2.54	2.85	2.98
0.46	0.87	1.22	1.60	1.79	1.98	2.56	2.79	3.42
0.51	0.81	1.19	1.56	1.72	2.09	2.35	2.63	3.32
0.48	0.87	1.24	1.52	1.94	2.19	2.82	3.08	3.56
0.56	0.87	1.37	1.76	2.16	2.30	2.67	2.75	3.71
0.57	0.82	1.18	1.64	1.98	2.48	2.66	2.96	3.42
0.56	0.89	1.27	1.59	1.87	2.34	2.90	3.10	3.87
0.52	0.79	1.20	1.57	1.87	2.31	2.67	2.93	3.52
0.52	0.79	1.15	1.46	1.71	2.03	2.64	3.15	3.38
0.52	0.73	0.99	1.43	1.69	1.89	2.34	2.84	3.37
0.62	0.80	1.09	1.40	1.87	2.31	2.61	3.07	3.68
0.58	0.84	1.24	1.57	1.93	2.37	2.69	3.23	3.35
0.52	0.78	1.20	1.63	1.83	2.22	2.70	3.28	4.18
0.58	0.73	1.15	1.61	2.02	2.36	2.79	3.06	3.32
0.52	0.67	1.04	1.54	1.94	2.35	2.69	3.16	3.50
0.54	0.73	0.99	1.44	1.94	2.40	2.72	3.20	3.69
0.43	0.68	1.07	1.33	1.80	2.24	2.60	3.26	3.42
0.53	0.70	0.95	1.40	1.79	2.34	2.81	3.11	3.30
0.49	0.69	0.94	1.29	1.71	2.22	2.54	3.13	3.49
0.55	0.64	0.94	1.19	1.62	2.02	2.37	2.71	3.31
0.44	0.77	0.90	1.27	1.49	1.82	2.24	2.43	3.08
0.58	0.83	1.08	1.29	1.67	1.95	2.32	2.53	2.96
0.42	0.84	1.04	1.38	1.70	2.13	2.43	2.88	3.62
0.54	0.80	1.11	1.41	1.77	2.08	2.41	2.77	3.11
0.67	0.82	1.12	1.35	1.77	2.25	2.63	2.93	3.39
0.56	0.85	1.15	1.45	1.80	2.18	2.57	3.05	3.52
0.60	0.81	1.22	1.55	1.92	2.47	2.94	3.26	3.78
0.52	0.84	1.11	1.54	1.87	2.26	2.54	2.88	3.24
0.54	0.85	1.07	1.41	1.77	2.14	2.47	2.62	3.29
0.57	0.87	1.18	1.47	1.68	2.15	2.35	3.04	3.10
0.50	0.83	1.12	1.43	1.64	2.01	2.40	2.64	2.97
0.58	0.69	1.03	1.35	1.67	1.99	2.26	2.66	3.11
0.58	0.73	0.89	1.26	1.70	2.07	2.28	2.87	3.18
0.66	0.70	0.95	1.18	1.42	2.05	2.31	2.66	3.10
0.59	0.81	1.05	1.32	1.57	2.10	2.32	2.62	2.86
0.52	0.78	1.10	1.69	1.75	1.99	2.52	2.99	3.63
0.71	1.27	1.22	1.93	2.19	2.39	2.58	3.23	3.75
0.67	1.03	1.31	1.74	2.39	2.81	2.92	3.10	3.72
0.62	1.03	1.74	2.04	2.42	2.92	3.06	3.44	3.66
0.60	1.03	1.58	2.13	2.41	3.29	3.42	3.86	3.94
0.72	1.06	1.82	2.32	2.83	3.76	4.05	3.92	4.26
0.62	0.98	1.63	2.21	2.20	2.94	4.00	4.05	4.33
0.50	0.99	1.39	1.99	2.66	3.08	3.69	4.67	4.94
0.53	1.07	1.44	2.17	2.73	3.21	4.15	4.00	4.99
0.53	0.94	1.50	2.04	2.79	3.19	3.37	3.61	5.11
0.53	1.00	1.28	2.02	2.51	3.14	3.78	3.79	4.87
0.55	0.94	1.21	1.73	2.17	2.82	3.60	3.56	3.87
0.39	0.87	1.24	1.83	2.30	2.72	3.71	4.04	4.44
0.22	0.97	1.45	1.88	2.37	2.76	3.24	3.96	4.09
0.33	1.02	1.37	1.83	2.21	2.65	3.25	3.36	4.27
0.33	0.92	1.32	1.83	2.20	2.67	2.96	3.41	3.72
0.33	0.99	1.39	1.98	2.46	2.72	3.06	3.72	3.80
0.45	0.94	1.36	1.83	2.56	2.83	2.96	3.46	3.78
0.43	0.83	1.43	2.00	2.25	2.63	3.02	3.77	4.29
0.42	0.98	1.34	1.68	2.06	2.45	2.97	3.49	3.96
0.53	0.89	1.48	1.79	2.21	2.57	3.24	3.56	3.82
0.64	0.97	1.48	1.78	2.12	2.55	2.81	2.99	4.16

0.58	1.20	1.31	1.82	2.18	2.65	2.85	3.05	4.34
0.54	1.18	1.64	1.77	2.19	2.52	2.97	3.37	4.27
0.66	1.17	1.73	2.17	2.12	2.63	2.65	3.12	4.01
0.45	1.09	1.64	2.21	2.63	2.73	2.90	3.78	4.55
0.43	0.97	1.49	2.03	2.54	2.82	3.28	3.09	3.98
0.46	1.10	1.50	1.84	2.33	2.54	3.42	3.52	3.71
0.42	1.00	1.69	1.89	2.21	2.55	3.14	3.38	3.66
0.51	0.97	1.49	1.92	2.33	2.69	3.03	3.04	4.07
0.68	1.10	1.53	1.83	2.11	2.34	2.70	2.97	3.68
0.66	1.13	1.46	1.89	2.25	2.37	2.73	2.99	3.30
0.36	1.17	1.46	1.75	2.16	2.53	2.63	2.73	3.41
0.31	0.91	1.34	1.74	1.95	2.47	3.13	3.07	3.34
0.26	0.65	1.36	1.61	1.86	2.05	2.52	3.09	3.17
0.21	0.39	1.00	1.50	1.67	1.95	2.07	2.47	2.91
0.18	0.57	1.05	1.45	1.67	1.83	2.03	2.13	2.63
0.19	0.48	0.95	1.06	1.61	1.78	1.89	2.06	2.31
0.15	0.88	1.09	1.26	1.48	1.83	1.93	2.02	2.18
BIOMASS								
0.70	0.66	0.95	1.17	1.43	1.72	2.05	2.42	3.03
0.60	0.80	0.92	1.47	1.61	1.90	2.35	2.60	3.20
0.46	0.68	1.07	1.24	1.77	2.13	2.32	2.66	2.60
0.29	0.63	0.91	1.42	1.58	1.91	2.46	2.65	2.98
0.35	0.60	0.94	1.34	1.63	1.86	2.32	2.66	3.42
0.39	0.61	1.02	1.38	1.66	1.93	2.16	2.59	3.32
0.36	0.67	1.00	1.34	1.74	1.94	2.43	2.69	3.56
0.46	0.65	1.09	1.48	1.81	2.11	2.42	2.78	3.71
0.46	0.68	1.01	1.50	1.87	2.31	2.47	2.81	3.42
0.47	0.71	1.02	1.37	1.75	2.15	2.68	2.87	3.87
0.42	0.67	1.03	1.41	1.72	2.08	2.50	2.92	3.52
0.44	0.64	0.95	1.32	1.64	1.95	2.47	2.90	3.38
0.42	0.62	0.88	1.28	1.57	1.80	2.18	2.74	3.37
0.53	0.65	0.89	1.18	1.64	1.98	2.22	2.68	3.68
0.50	0.72	1.00	1.31	1.64	2.11	2.49	2.90	3.35
0.44	0.67	1.00	1.42	1.70	2.07	2.53	2.97	4.18
0.54	0.62	0.95	1.39	1.81	2.08	2.49	2.87	3.32
0.44	0.62	0.87	1.33	1.77	2.18	2.52	2.97	3.50
0.48	0.62	0.81	1.22	1.73	2.16	2.53	2.93	3.69
0.34	0.61	0.88	1.15	1.61	2.08	2.50	2.98	3.42
0.46	0.55	0.80	1.22	1.54	2.05	2.51	2.84	3.30
0.43	0.60	0.81	1.11	1.55	1.99	2.44	2.97	3.49
0.46	0.56	0.81	1.06	1.45	1.86	2.29	2.62	3.31
0.32	0.65	0.76	1.09	1.33	1.72	2.13	2.40	3.08
0.48	0.60	0.91	1.08	1.46	1.70	2.05	2.38	2.96
0.30	0.70	0.93	1.22	1.48	1.89	2.18	2.58	3.62
0.44	0.58	0.97	1.21	1.56	1.88	2.27	2.59	3.11
0.59	0.67	0.95	1.22	1.58	2.00	2.34	2.66	3.39
0.47	0.75	0.97	1.27	1.56	1.96	2.40	2.83	3.52
0.51	0.67	1.02	1.34	1.67	2.11	2.53	2.89	3.78
0.41	0.71	0.95	1.37	1.70	2.08	2.50	2.91	3.24
0.43	0.66	0.95	1.25	1.65	2.00	2.36	2.58	3.29
0.47	0.69	1.00	1.25	1.54	1.95	2.24	2.74	3.10
0.43	0.69	0.99	1.30	1.55	1.84	2.27	2.49	2.97
0.52	0.59	0.92	1.23	1.55	1.81	2.13	2.53	3.11
0.53	0.65	0.78	1.14	1.51	1.86	2.13	2.55	3.18
0.60	0.64	0.83	1.02	1.34	1.87	2.19	2.46	3.10
0.51	0.73	0.86	1.12	1.36	1.73	2.18	2.46	2.86
0.33	0.68	0.94	1.33	1.52	1.77	2.30	2.63	3.63
0.59	0.81	0.98	1.46	1.92	2.05	2.27	2.85	3.75
0.54	0.86	1.29	1.46	2.15	2.48	2.64	2.83	3.72
0.48	0.83	1.34	1.63	2.05	2.64	2.93	3.17	3.66
0.45	0.80	1.28	1.93	2.22	2.82	3.16	3.44	3.94
0.62	0.80	1.37	1.91	2.46	3.01	3.65	3.66	4.26
0.49	0.84	1.31	2.01	2.26	2.88	3.88	4.05	4.33
0.34	0.78	1.17	1.80	2.42	2.60	3.29	4.32	4.94
0.40	0.73	1.19	1.74	2.33	2.92	3.58	3.84	4.99
0.39	0.71	1.27	1.71	2.46	2.95	3.29	3.87	5.11
0.40	0.73	1.10	1.74	2.26	2.96	3.47	3.57	4.87
0.44	0.71	1.10	1.49	2.09	2.66	3.36	3.67	3.87
0.25	0.69	1.08	1.49	1.99	2.43	3.23	3.81	4.44
0.10	0.62	1.12	1.53	2.08	2.52	2.97	3.83	4.09
0.20	0.47	1.15	1.63	2.04	2.51	3.00	3.30	4.27
0.19	0.55	1.16	1.58	2.01	2.43	2.80	3.33	3.72
0.20	0.57	1.13	1.62	2.12	2.45	2.86	3.32	3.80
0.33	0.56	1.16	1.59	2.25	2.64	2.84	3.25	3.78
0.28	0.61	1.16	1.65	2.03	2.59	2.92	3.34	4.29
0.29	0.65	1.05	1.55	2.03	2.35	2.79	3.25	3.96
0.39	0.61	1.20	1.55	1.93	2.30	2.82	3.25	3.82
0.47	0.72	1.15	1.62	1.95	2.37	2.69	3.11	4.16
0.41	0.88	1.13	1.64	1.97	2.37	2.70	2.93	4.34
0.37	0.83	1.40	1.52	1.99	2.35	2.80	3.10	4.27
0.51	0.79	1.42	1.89	1.94	2.40	2.58	3.04	4.01
0.30	0.85	1.39	1.95	2.39	2.40	2.76	3.17	4.55
0.27	0.66	1.28	1.82	2.37	2.72	2.99	3.00	3.98
0.31	0.69	1.20	1.65	2.17	2.54	3.10	3.39	3.71
0.27	0.67	1.36	1.68	2.02	2.43	2.83	3.40	3.66
0.35	0.63	1.22	1.80	2.10	2.44	2.78	3.09	4.07
0.52	0.75	1.22	1.65	2.01	2.34	2.69	3.00	3.68
0.50	0.88	1.27	1.70	2.03	2.24	2.53	2.84	3.30
0.22	0.88	1.29	1.60	2.02	2.39	2.50	2.73	3.41
0.21	0.57	1.25	1.59	1.85	2.31	2.81	2.84	3.34
0.21	0.44	1.11	1.47	1.79	2.00	2.50	3.11	3.17
0.13	0.32	0.80	1.43	1.64	1.90	2.06	2.49	2.91
0.11	0.35	0.64	1.21	1.58	1.75	1.99	2.10	2.63
0.09	0.29	0.73	1.06	1.53	1.72	1.86	2.05	2.31
0.02	0.41	0.72	1.09	1.26	1.72	1.86	1.95	2.18

Appendix to the GARM III Report

	US_Sp US_S41 Can_Sp	US_Sp US_S41 Can_Sp	US_Sp US_S41 Can_Sp	US_Sp US_Au0 Can_Sp	US_Sp US_Au1 Can_Sp	US_Sp US_Au2	US_Sp US_Au3	US_S41 US_Au4	US_S41 US_Au5	US_S41 Can_Sp	US_S41 Can_Sp	US_S41 Can_Sp
1	2	3	4	5	6	7	8	1	2	3	4	5
	6	7	8	1	2	3	4	5	6	1	2	3
	4	5	6	7	8							
1-Jan	1-Jan	1-Jan	1-Jan	1-Jan	1-Jan	1-Jan	1-Jan	1-Jan	1-Jan	1-Jan	1-Jan	1-Jan
	1-Jan	1-Jan	1-Jan	1-Jan	1-Jan	1-Jan	1-Jan	1-Jan	1-Jan	1-Jan	1-Jan	1-Jan
	1-Jan	1-Jan	1-Jan	1-Jan	1-Jan							
number	number	number	number	number	number	number	number	number	number	number	number	number
	number	number	number	number	number							
0	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0							
0	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0							
0	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0							
0	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0							
0	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0							
0	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0							
0	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0							
0	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0							
0	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0							
0	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0							

Appendix to the GARM III Report

0	0	0	0	0	0	0	0	99579	15709	0	1753	292
	0	584	32	21908	8173	0	1693	290	0	0	0	0
	0	0	0	0	0							
0	0	0	0	0	0	0	0	6913	43136	9283	0	779
	0	32	325	10494	29210	5223	0	629	145	0	0	0
	0	0	0	0	0	0	0					
0	0	0	0	0	0	0	0	3051	3148	10776	2045	0
	422	292	32	2418	5755	3192	1016	0	48	0	0	0
	0	0	0	0	0	0	0					
0	0	0	0	0	0	0	0	262221	974	1947	2986	1396
	0	130	0	76217	2031	2321	15766	2998	0	0	0	0
	0	0	0	0	0	0	0					
0	0	0	0	0	0	0	0	1980	108439	1363	3960	1947
	1461	0	130	14025	208291	1693	1741	2660	967	0	0	0
	0	0	0	0	0	0	0					
0	0	0	0	0	0	0	0	227	3148	51704	1168	3051
	2661	519	195	436	6941	60803	1824	1864	2062	0	0	0
	0	0	0	0	0	0	0					
0	0	0	0	0	0	0	0	117235	5128	3668	18533	1071
	519	1201	195	42915	2737	3371	30104	595	833	0	0	0
	0	0	0	0	0	0	0					
0	0	0	0	0	0	0	0	16878	151575	1655	3376	15807
	2175	1201	1493	4284	147902	119	2935	12375	833	0	0	0
	0	0	0	0	0	0	0					
0	0	0	0	0	0	0	0	10711	10678	63259	7108	2467
	5777	779	357	37917	8805	41289	1467	595	5513	0	0	0
	0	0	0	0	0	0	0					
2467	4966	3051	13210	1363	909	1980	0	0	0	0	0	0
	0	0	0	1229	19911	6743	12018	674	1349	0	0	0
	0	0	0	0	0	0	0					
1396	1785	1883	714	7822	32	130	3765	0	0	0	0	0
	0	0	0	4401	0	4304	1112	4546	435	0	0	0
	0	0	0	0	0	0	0					
6784	3830	2077	2045	1883	2337	227	130	0	0	0	0	0
	0	0	0	18812	774	677	871	967	3047	0	0	0
	0	0	0	0	0	0	0					
0	16099	2467	1298	2824	1104	3797	325	0	0	0	0	0
	0	0	0	97	10785	2853	774	919	193	0	0	0
	0	0	0	0	0	0	0					
8082	584	6686	779	357	682	389	1071	0	0	0	0	0
	0	0	0	36839	2110	4966	714	162	325	5714	310	8515
	1506	267	408	479	521							
0	11749	195	2629	260	325	162	714	0	0	0	0	0
	0	0	0	0	16586	292	3927	195	422	42	4278	971
	3533	943	113	422	141							
5031	130	3213	422	1039	389	357	389	0	0	0	0	0
	0	0	0	5842	0	2564	325	2499	195	2069	70	12005
	239	4011	253	239	155							
65	11328	1461	2304	454	1331	195	162	0	0	0	0	0
	0	0	0	227	9802	584	4219	389	1298	42	7515	1013
	2984	267	591	42	42							
2791	0	18565	1071	1883	195	422	0	0	0	0	0	0
	0	0	0	1517	160	8783	639	2156	293	1309	155	13891
	183	4729	324	1534	183							
1753	3473	779	6005	292	325	65	130	0	0	0	0	0
	0	0	0	2502	2182	80	3859	160	559	1056	2350	197
	12652	155	2252	127	619							
1298	584	357	227	1071	97	97	97	0	0	0	0	0
	0	0	0	7000	665	772	160	719	53	4644	4152	1590
	239	5376	42	1492	56							
3797	2110	584	454	389	1201	195	65	0	0	0	0	0
	0	0	0	9250	6751	747	779	0	1525	5573	3040	774
	633	56	1801	28	450							
2269	8708	3254	481	330	214	503	49	0	0	0	0	0
	0	0	0	4924	13121	6521	985	0	186	4673	16213	5742
	591	338	28	985	14							
1627	4172	7528	2969	536	370	93	578	0	0	0	0	0
	0	0	0	2955	2506	2622	2166	402	147	2730	3687	6052
	3124	788	42	0	676							
3525	14908	28744	16894	8497	1133	237	243	0	0	0	0	0
	0	0	0	7377	23168	15917	7519	1222	39	8599	4067	6812
	7093	4110	366	338	56							
5826	3319	10885	11871	6522	2887	409	228	0	0	0	0	0
	0	0	0	4256	1765	3005	3370	1583	463	2449	1633	1393
	3293	3336	2393	324	127							
2673	9582	4049	3437	2773	696	196	18	0	0	0	0	0
	0	0	0	1049	8003	4762	2431	1777	1056	3392	11512	4335
	3617	5292	5165	2787	338							
33135	6581	6950	2328	2085	1646	663	652	0	0	0	0	0
	0	0	0	14008	9050	8028	2348	1338	571	27796	4799	10077
	3110	1970	1900	1773	464							
5937	7692	13322	6521	3604	3591	3292	1543	0	0	0	0	0
	0	0	0	5922	2728	10934	26130	11429	7536	25797	96547	13117
	12540	2970	2181	2730	1604							
32502	2789	7910	2707	977	682	374	265	0	0	0	0	0
	0	0	0	13433	9161	17791	10077	3562	2143	31357	3983	15312
	4349	5813	1816	1618	1984							
593	62469	21807	10459	3546	1548	1969	552	0	0	0	0	0
	0	0	0	2774	28471	5459	24147	6877	3774	2787	44614	9359
	21617	6080	7487	2238	1858							
32	811	17689	3927	15742	3116	3700	2791	0	0	0	0	0
	0	0	0	377	6203	72276	17673	27709	6075	1922	3582	97567
	7229	18640	4133	3779	1697							

363974	6005	3895	29406	7076	8666	1396	3116	0	0	0	0	0
	0	0	0	501602	231	1464	27761	5759	10893	207872	580	2807
	55692	5541	10384	1739	1023							
2597	173126	519	1233	10873	1461	3278	617	0	0	0	0	0
	0	0	0	5288	531168	711	2741	44206	3814	0	0	0
	0	0	0	0	0							
6532	1850	93249	1644	2058	12006	1684	1537	0	0	0	0	0
	0	0	0	13818	5745	250707	904	2260	15370	0	0	0
	0	0	0	0	0							
2789	22744	5937	146687	1113	792	4528	431	0	0	0	0	0
	0	0	0	3051	14742	2374	156979	1282	1404	4215	15001	4419
	80460	1121	178	4177	299							
5979	2842	8374	712	65850	1275	553	2920	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	3923	1248	4813
	5204	109124	1009	195	8595							
CHECKED	INDEX											

1	2	3	4	5	6	7	8	9	10	11	12	13
	14	15	16	17	18	19	20	21	22	23	24	25
	26	27	28	29	30							

OPTIONS

0	1	0	0	1	1	0	0	1	1	5		
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CHECKED RETRO

1	1	1	1	1	1	1	1	1	1	1	1	1
	1	1	1	1	1	1	1	1	1	1	1	1
	1	1	1	1	1	1	1	1	1	1	1	1

VPA output GB haddock

VPA Version 2.8.0

Model ID: garm3-rev-base F5to7 backward 1931 to 2007 data

Input File: C:\X-APPS\ADAPT\VPA280\GARM3_REVIEW\BASE_CASE\31T007_BOOTRUN\GARM3_REV_31T007.DA
Date of Run: 14-JUL-2008 Time of Run: 12:20

Levenburg-Marquardt Algorithm Completed 9 Iterations
Residual Sum of Squares = 475.995
Number of Residuals = 730
Number of Parameters = 9
Degrees of Freedom = 721
Mean Squared Residual = 0.660188
Standard Deviation = 0.812519

Number of Years = 77
Number of Ages = 9
First Year = 1931
Youngest Age = 1
Oldest True Age = 8

Number of Survey Indices Available = 30
Number of Survey Indices Used in Estimate = 30

VPA Classic Method - Auto Estimated Q's

Stock Numbers Predicted in Terminal Year Plus One (2008)

Age	Stock Predicted	Std. Error	CV
1	16376.323	0.747071E-02	0.456190E-06
2	6063.866	0.154433E-01	0.254678E-05
3	17450.483	0.987350E-02	0.565801E-06
4	4174.856	0.211557E-01	0.506740E-05
5	209204.143	0.320218E-02	0.153065E-07
6	790.289	0.507316E-01	0.641937E-04
7	910.624	0.449378E-01	0.493483E-04
8	9298.882	0.134804E-01	0.144968E-05
9	300.000	0.000000E+00	0.000000E+00

Catchability Values for Each Survey Used in Estimate

INDEX	Catchability	Std. Error	CV
1	0.309573E+00	0.617671E-01	0.199524E+00
2	0.559059E+00	0.792243E-01	0.141710E+00
3	0.633341E+00	0.869441E-01	0.137278E+00
4	0.572417E+00	0.571733E-01	0.998804E-01
5	0.634646E+00	0.795321E-01	0.125317E+00
6	0.540223E+00	0.879206E-01	0.162749E+00
7	0.535573E+00	0.783308E-01	0.146256E+00
8	0.623145E+00	0.105493E+00	0.169291E+00

9	0.721024E+00	0.367805E+00	0.510115E+00
10	0.898814E+00	0.314331E+00	0.349718E+00
11	0.775702E+00	0.244101E+00	0.314684E+00
12	0.838990E+00	0.183046E+00	0.218174E+00
13	0.888891E+00	0.146199E+00	0.164473E+00
14	0.884529E+00	0.245112E+00	0.277110E+00
15	0.911762E+00	0.236731E+00	0.259641E+00
16	0.861378E+00	0.271423E+00	0.315103E+00
17	0.433137E+00	0.621932E-01	0.143588E+00
18	0.688246E+00	0.103249E+00	0.150018E+00
19	0.572374E+00	0.710432E-01	0.124120E+00
20	0.653808E+00	0.640887E-01	0.980236E-01
21	0.571735E+00	0.623636E-01	0.109078E+00
22	0.560770E+00	0.664267E-01	0.118456E+00
23	0.282518E+00	0.659275E-01	0.233357E+00
24	0.399130E+00	0.834303E-01	0.209030E+00
25	0.655467E+00	0.829613E-01	0.126568E+00
26	0.620509E+00	0.830449E-01	0.133834E+00
27	0.707918E+00	0.992401E-01	0.140186E+00
28	0.523142E+00	0.988187E-01	0.188895E+00
29	0.679959E+00	0.121998E+00	0.179420E+00
30	0.620286E+00	0.997301E-01	0.160781E+00

-- Non-Linear Least Squares Fit --

Default Tolerances Used

Scaled Gradient Tolerance = 6.055454E-06
 Scaled Step Tolerance = 3.666853E-11
 Relative Function Tolerance = 3.666853E-11
 Absolute Function Tolerance = 4.930381E-32

VPA Method Options

- Catchability Values Estimated as an Analytic Function of N
- Catch Equation Used in Cohort Solution
- Plus Group Backward Calculation Method Used
- Rivard Weights Used for JAN-1 Biomass
- Rivard Weights Used for SSB Biomass
- Rivard Weights Calculation Used 5 Years for Terminal Year Plus One
- Arithmetic Average Used in F-Oldest Calculation
- F-Oldest Calculation in Years Prior to Terminal Year
- Uses Fishing Mortality in Ages 5 to 7
- Calculation of Population of Age 1 in Year 2008
- = Stock Estimate

Stock Estimates

Age 1
 Age 2
 Age 3
 Age 4
 Age 5
 Age 6
 Age 7
 Age 8
 Age 9

Full F in Terminal Year = 0.1832

F in Oldest True Age in Terminal Year = 0.2285

Full F Calculated Using Classic Method

F in Oldest True Age in Terminal Year has been
 Calculated in Same Manner as in All Other Years

Age	Input Partial Recruitment	Calc Partial Recruitment	Fishing Mortality	Used In Full F	Comments
1	0.001	0.007	0.0019	NO	Stock Estimate in T+1
2	0.410	0.034	0.0090	NO	Stock Estimate in T+1
3	0.840	0.189	0.0506	NO	Stock Estimate in T+1
4	1.000	0.176	0.0473	YES	Stock Estimate in T+1
5	1.000	0.745	0.1999	YES	Stock Estimate in T+1
6	1.000	1.000	0.2681	YES	Stock Estimate in T+1
7	1.000	0.812	0.2176	YES	Stock Estimate in T+1
8	1.000	0.852	0.2285		F-oldest

Catch At Age - Input Data

AGE	1931	1932	1933	1934	1935
1	1755.0	118.0	244.0	341.0	1197.0
2	8801.0	2084.0	8476.0	4454.0	11872.0
3	2041.0	25871.0	6023.0	5414.0	8819.0
4	5785.0	2421.0	10046.0	3734.0	3706.0
5	9100.0	3676.0	2092.0	3149.0	2944.0
6	6045.0	2894.0	1579.0	1051.0	2458.0
7	3380.0	1320.0	1210.0	619.0	499.0
8	1794.0	664.0	538.0	250.0	442.0
9	559.0	391.0	647.0	168.0	109.0
AGE	1936	1937	1938	1939	1940
1	880.0	1288.0	1030.0	607.0	2040.0
2	12327.0	11034.0	20199.0	13937.0	7254.0
3	11486.0	10910.0	7755.0	19617.0	12317.0
4	5431.0	5629.0	3755.0	5163.0	8253.0
5	2141.0	4143.0	2113.0	2152.0	2510.0
6	1377.0	1875.0	1600.0	967.0	1479.0
7	1362.0	952.0	945.0	837.0	752.0
8	259.0	481.0	327.0	326.0	222.0
9	124.0	222.0	173.0	239.0	136.0
AGE	1941	1942	1943	1944	1945
1	780.0	310.0	19.0	64.0	121.0
2	23464.0	14307.0	4191.0	761.0	8522.0

3	9808.0	16348.0	17738.0	8437.0	2029.0
4	8033.0	6531.0	8364.0	14843.0	6386.0
5	5764.0	3996.0	3102.0	5689.0	5795.0
6	1781.0	2331.0	2693.0	2281.0	2315.0
7	941.0	1036.0	790.0	497.0	914.0
8	307.0	227.0	354.0	469.0	265.0
9	384.0	176.0	178.0	108.0	205.0
AGE	1946	1947	1948	1949	1950

1	209.0	90.0	80.0	328.0	88.0
2	7466.0	16621.0	11227.0	6472.0	28971.0
3	15213.0	10334.0	19237.0	12479.0	4107.0
4	2738.0	7181.0	5116.0	9608.0	4272.0
5	5785.0	2127.0	2744.0	2347.0	3315.0
6	3840.0	2739.0	1157.0	1061.0	1131.0
7	1827.0	1501.0	780.0	624.0	520.0
8	272.0	745.0	450.0	409.0	225.0
9	23.0	457.0	369.0	353.0	250.0

Catch At Age - Input Data

AGE	1951	1952	1953	1954	1955
-----	------	------	------	------	------

1	645.0	0.0	1083.0	108.0	90.0
2	8266.0	25120.0	1807.0	31858.0	3941.0
3	26472.0	8892.0	17588.0	5107.0	19251.0
4	2177.0	8485.0	5726.0	5611.0	3316.0
5	2448.0	1361.0	3757.0	2315.0	3278.0
6	2138.0	944.0	1012.0	2131.0	1649.0
7	740.0	530.0	542.0	720.0	1068.0
8	297.0	182.0	337.0	353.0	320.0
9	215.0	107.0	152.0	98.0	173.0
AGE	1956	1957	1958	1959	1960

1	52.0	35.0	125.0	94.0	258.0
2	11948.0	6594.0	5571.0	5716.0	16010.0
3	6698.0	14046.0	7088.0	7994.0	6122.0
4	12066.0	4523.0	6665.0	5169.0	4562.0
5	3405.0	5822.0	3784.0	3934.0	3067.0
6	3378.0	2357.0	2366.0	1758.0	1792.0
7	1348.0	1630.0	903.0	1172.0	787.0
8	563.0	473.0	442.0	424.0	406.0
9	201.0	366.0	142.0	334.0	348.0
AGE	1961	1962	1963	1964	1965

1	62.0	74.0	2910.0	10101.0	9601.0
2	10689.0	4455.0	4047.0	15935.0	125818.0
3	14927.0	16245.0	7418.0	4554.0	44496.0
4	4198.0	10440.0	11152.0	4776.0	5356.0
5	2917.0	3448.0	8198.0	8722.0	4391.0
6	1856.0	2089.0	2205.0	5794.0	6690.0
7	1266.0	1566.0	1405.0	2082.0	3772.0
8	496.0	1185.0	721.0	1028.0	1094.0
9	674.0	898.0	1096.0	1332.0	1366.0
AGE	1966	1967	1968	1969	1970

1	114.0	1150.0	8.0	2.0	46.0
2	6843.0	168.0	2994.0	11.0	158.0
3	100810.0	2891.0	709.0	1698.0	16.0
4	19167.0	20667.0	1921.0	448.0	570.0
5	2768.0	10338.0	14519.0	654.0	186.0
6	2591.0	1209.0	3499.0	5954.0	214.0
7	2332.0	993.0	667.0	1574.0	2308.0
8	1268.0	917.0	453.0	225.0	746.0
9	867.0	698.0	842.0	570.0	464.0

Catch At Age - Input Data

AGE	1971	1972	1973	1974	1975
1	1.0	159.6	2607.1	47.7	198.6
2	1375.0	2.0	2113.1	4481.1	1069.5
3	223.0	460.4	3.1	681.5	1928.0
4	40.0	82.9	393.1	2.1	387.9
5	289.0	32.7	54.0	72.6	4.1
6	246.0	122.8	30.6	2.1	43.4
7	285.0	79.8	78.4	2.1	4.1
8	1469.0	67.5	15.3	55.0	4.1
9	928.0	1264.7	455.2	258.3	91.0
AGE	1976	1977	1978	1979	1980
1	149.3	1.0	1.0	1.0	8.0
2	490.5	19857.7	767.0	26.2	31170.3
3	570.4	189.6	14509.1	1742.5	348.9
4	912.6	689.5	307.4	7237.5	980.4
5	224.0	522.2	571.5	530.0	6087.3
6	0.0	362.0	521.1	413.9	597.3
7	23.9	4.1	140.1	318.0	549.0
8	4.1	39.5	14.1	96.9	153.8
9	116.1	112.5	67.5	46.4	81.4
AGE	1981	1982	1983	1984	1985
1	1.0	1.0	0.0	0.0	0.0
2	1755.4	1173.7	216.1	94.1	2463.7
3	11076.4	1645.1	821.1	300.6	563.2
4	836.9	3760.7	696.9	735.8	198.7
5	943.7	393.9	2261.4	401.8	472.1
6	2590.3	573.2	274.7	1499.9	233.5
7	333.4	1127.3	187.9	236.8	538.6
8	159.1	106.8	808.0	270.2	79.9
9	94.7	110.8	76.8	549.6	155.6
AGE	1986	1987	1988	1989	1990
1	6.1	0.0	4.1	1.9	62.9
2	54.7	2035.1	53.2	1462.2	11.6
3	2848.3	131.6	2439.1	122.5	1697.0
4	226.0	1645.5	137.1	1018.7	268.9
5	148.0	124.5	952.5	217.3	1124.1
6	175.4	74.5	152.4	477.8	154.3
7	152.0	90.8	56.3	61.7	217.6
8	269.6	108.1	65.5	37.0	55.4
9	60.8	137.7	108.4	56.7	48.9

Catch At Age - Input Data

AGE	1991	1992	1993	1994	1995
1	7.0	83.6	33.0	27.3	17.0
2	486.1	265.1	363.3	537.5	93.5
3	122.8	407.5	439.1	1191.5	614.3
4	2370.1	197.2	340.4	241.5	470.8
5	144.3	1960.1	120.1	142.1	58.9
6	517.6	181.2	741.4	73.4	29.4
7	127.9	425.7	62.6	313.4	8.5
8	171.9	46.6	169.2	55.2	61.4
9	65.0	99.5	82.2	109.7	16.2
AGE	1996	1997	1998	1999	2000
1	6.8	14.5	6.0	2.6	1.6
2	56.4	143.3	230.1	43.2	406.6
3	566.3	273.0	470.9	906.0	625.6
4	918.6	745.1	557.6	541.1	1570.9
5	450.3	561.3	767.2	605.7	588.0
6	66.0	217.9	570.7	565.5	527.7
7	22.1	17.5	168.9	383.5	377.0
8	6.9	18.4	23.4	163.2	258.1
9	78.2	48.8	48.6	47.6	98.5
AGE	2001	2002	2003	2004	2005
1	14.0	2.9	4.5	646.0	19.5
2	145.1	396.7	17.7	33.0	612.4
3	2393.3	345.3	1942.8	121.7	41.8
4	996.1	3177.4	461.1	5115.6	339.0
5	1280.6	926.2	2686.1	729.4	8505.4
6	655.6	1105.4	604.9	2935.4	777.7

7	437.6	401.6	719.1	686.7	1842.6
8	358.8	306.4	212.3	562.9	315.2
9	262.2	551.2	388.8	408.2	343.2
AGE	2006	2007			
1	164.4	13.0			
2	18.4	174.6			
3	3164.2	240.0			
4	70.9	11215.7			
5	375.2	194.2			
6	5418.3	311.4			
7	326.5	2511.7			
8	841.9	228.9			
9	227.6	564.4			

Weight At Age - Input Data

AGE	1931	1932	1933	1934	1935
1	0.7500	0.6400	0.5400	0.4200	0.4600
2	0.7800	0.8500	0.7300	0.7300	0.8700
3	1.1800	1.0900	1.3500	1.1300	1.2200
4	1.3700	1.8200	1.4200	1.4900	1.6000
5	1.6500	1.8900	1.7300	1.7500	1.7900
6	2.0100	2.1900	2.3900	2.1100	1.9800
7	2.3100	2.7400	2.4600	2.5400	2.5600
8	2.5400	2.9300	2.5900	2.8500	2.7900
9	3.0300	3.2000	2.6000	2.9800	3.4200
AGE	1936	1937	1938	1939	1940
1	0.5100	0.4800	0.5600	0.5700	0.5600
2	0.8100	0.8700	0.8700	0.8200	0.8900
3	1.1900	1.2400	1.3700	1.1800	1.2700
4	1.5600	1.5200	1.7600	1.6400	1.5900
5	1.7200	1.9400	2.1600	1.9800	1.8700
6	2.0900	2.1900	2.3000	2.4800	2.3400
7	2.3500	2.8200	2.6700	2.6600	2.9000
8	2.6300	3.0800	2.7500	2.9600	3.1000
9	3.3200	3.5600	3.7100	3.4200	3.8700
AGE	1941	1942	1943	1944	1945
1	0.5200	0.5200	0.5200	0.6200	0.5800
2	0.7900	0.7900	0.7300	0.8000	0.8400
3	1.2000	1.1500	0.9900	1.0900	1.2400
4	1.5700	1.4600	1.4300	1.4000	1.5700
5	1.8700	1.7100	1.6900	1.8700	1.9300
6	2.3100	2.0300	1.8900	2.3100	2.3700
7	2.6700	2.6400	2.3400	2.6100	2.6900
8	2.9300	3.1500	2.8400	3.0700	3.2300
9	3.5200	3.3800	3.3700	3.6800	3.3500
AGE	1946	1947	1948	1949	1950
1	0.5200	0.5800	0.5200	0.5400	0.4300
2	0.7800	0.7300	0.6700	0.7300	0.6800
3	1.2000	1.1500	1.0400	0.9900	1.0700
4	1.6300	1.6100	1.5400	1.4400	1.3300
5	1.8300	2.0200	1.9400	1.9400	1.8000
6	2.2200	2.3600	2.3500	2.4000	2.2400
7	2.7000	2.7900	2.6900	2.7200	2.6000
8	3.2800	3.0600	3.1600	3.2000	3.2600
9	4.1800	3.3200	3.5000	3.6900	3.4200

Weight At Age - Input Data

AGE	1951	1952	1953	1954	1955
1	0.5300	0.4880	0.5500	0.4400	0.5800
2	0.7000	0.6900	0.6400	0.7700	0.8300
3	0.9500	0.9400	0.9400	0.9000	1.0800
4	1.4000	1.2900	1.1900	1.2700	1.2900
5	1.7900	1.7100	1.6200	1.4900	1.6700
6	2.3400	2.2200	2.0200	1.8200	1.9500
7	2.8100	2.5400	2.3700	2.2400	2.3200
8	3.1100	3.1300	2.7100	2.4300	2.5300
9	3.3000	3.4900	3.3100	3.0800	2.9600
AGE	1956	1957	1958	1959	1960
1	0.4200	0.5400	0.6700	0.5600	0.6000
2	0.8400	0.8000	0.8200	0.8500	0.8100

3	1.0400	1.1100	1.1200	1.1500	1.2200
4	1.3800	1.4100	1.3500	1.4500	1.5500
5	1.7000	1.7700	1.7700	1.8000	1.9200
6	2.1300	2.0800	2.2500	2.1800	2.4700
7	2.4300	2.4100	2.6300	2.5700	2.9400
8	2.8800	2.7700	2.9300	3.0500	3.2600
9	3.6200	3.1100	3.3900	3.5200	3.7800
AGE	1961	1962	1963	1964	1965
1	0.5200	0.5400	0.5700	0.5000	0.5800
2	0.8400	0.8500	0.8700	0.8300	0.6900
3	1.1100	1.0700	1.1800	1.1200	1.0300
4	1.5400	1.4100	1.4700	1.4300	1.3500
5	1.8700	1.7700	1.6800	1.6400	1.6700
6	2.2600	2.1400	2.1500	2.0100	1.9900
7	2.5400	2.4700	2.3500	2.4000	2.2600
8	2.8800	2.6200	3.0400	2.6400	2.6600
9	3.2400	3.2900	3.1000	2.9700	3.1100
AGE	1966	1967	1968	1969	1970
1	0.5800	0.6600	0.5900	0.5200	0.7100
2	0.7300	0.7000	0.8100	0.7800	1.2700
3	0.8900	0.9500	1.0500	1.1000	1.2200
4	1.2600	1.1800	1.3200	1.6900	1.9300
5	1.7000	1.4200	1.5700	1.7500	2.1900
6	2.0700	2.0500	2.1000	1.9900	2.3900
7	2.2800	2.3100	2.3200	2.5200	2.5800
8	2.8700	2.6600	2.6200	2.9900	3.2300
9	3.1800	3.1000	2.8600	3.6300	3.7500

Weight At Age - Input Data

AGE	1971	1972	1973	1974	1975
1	0.6700	0.6200	0.6000	0.7200	0.6200
2	1.0300	1.0300	1.0300	1.0600	0.9800
3	1.3100	1.7400	1.5800	1.8200	1.6300
4	1.7400	2.0400	2.1300	2.3200	2.2100
5	2.3900	2.4200	2.4100	2.8300	2.2000
6	2.8100	2.9200	3.2900	3.7600	2.9400
7	2.9200	3.0600	3.4200	4.0500	4.0000
8	3.1000	3.4400	3.8600	3.9200	4.0500
9	3.7200	3.6600	3.9400	4.2600	4.3300
AGE	1976	1977	1978	1979	1980
1	0.5000	0.5300	0.5300	0.5300	0.5500
2	0.9900	1.0700	0.9400	1.0000	0.9400
3	1.3900	1.4400	1.5000	1.2800	1.2100
4	1.9900	2.1700	2.0400	2.0200	1.7300
5	2.6600	2.7300	2.7900	2.5100	2.1700
6	3.0800	3.2100	3.1900	3.1400	2.8200
7	3.6900	4.1500	3.3700	3.7800	3.6000
8	4.6700	4.0000	3.6100	3.7900	3.5600
9	4.9400	4.9900	5.1100	4.8700	3.8700
AGE	1981	1982	1983	1984	1985
1	0.3900	0.2200	0.3300	0.3300	0.3300
2	0.8700	0.9700	1.0200	0.9200	0.9900
3	1.2400	1.4500	1.3700	1.3200	1.3900
4	1.8300	1.8800	1.8300	1.8300	1.9800
5	2.3000	2.3700	2.2100	2.2000	2.4600
6	2.7200	2.7600	2.6500	2.6700	2.7200
7	3.7100	3.2400	3.2500	2.9600	3.0600
8	4.0400	3.9600	3.3600	3.4100	3.7200
9	4.4400	4.0900	4.2700	3.7200	3.8000
AGE	1986	1987	1988	1989	1990
1	0.4500	0.4300	0.4200	0.5300	0.6400
2	0.9400	0.8300	0.9800	0.8900	0.9700
3	1.3600	1.4300	1.3400	1.4800	1.4800
4	1.8300	2.0000	1.6800	1.7900	1.7800
5	2.5600	2.2500	2.0600	2.2100	2.1200
6	2.8300	2.6300	2.4500	2.5700	2.5500
7	2.9600	3.0200	2.9700	3.2400	2.8100
8	3.4600	3.7700	3.4900	3.5600	2.9900
9	3.7800	4.2900	3.9600	3.8200	4.1600

Weight At Age - Input Data

AGE	1991	1992	1993	1994	1995
1	0.5810	0.5380	0.6590	0.4470	0.4290
2	1.2010	1.1750	1.1690	1.0930	0.9670
3	1.3110	1.6390	1.7280	1.6430	1.4890
4	1.8170	1.7680	2.1710	2.2090	2.0250
5	2.1830	2.1860	2.1190	2.6280	2.5420
6	2.6450	2.5190	2.6280	2.7280	2.8150
7	2.8520	2.9670	2.6490	2.9020	3.2750
8	3.0480	3.3650	3.1230	3.7830	3.0910
9	4.3370	4.2670	4.0140	4.5460	3.9810
AGE	1996	1997	1998	1999	2000
1	0.4560	0.4160	0.5110	0.6780	0.6640
2	1.0980	0.9980	0.9680	1.1010	1.1330
3	1.4970	1.6900	1.4850	1.5270	1.4640
4	1.8380	1.8910	1.9170	1.8300	1.8930
5	2.3250	2.2130	2.3330	2.1110	2.2520
6	2.5430	2.5470	2.6880	2.3390	2.3720
7	3.4230	3.1400	3.0270	2.6970	2.7320
8	3.5160	3.3800	3.0380	2.9730	2.9910
9	3.7120	3.6550	4.0700	3.6820	3.2980
AGE	2001	2002	2003	2004	2005
1	0.3580	0.3050	0.2580	0.2120	0.1802
2	1.1730	0.9100	0.6470	0.3940	0.5659
3	1.4590	1.3360	1.3600	1.0010	1.0523
4	1.7540	1.7350	1.6140	1.4970	1.4530
5	2.1570	1.9490	1.8550	1.6660	1.6688
6	2.5260	2.4740	2.0470	1.9530	1.8311
7	2.6270	3.1270	2.5200	2.0710	2.0312
8	2.7280	3.0690	3.0900	2.4680	2.1322
9	3.4110	3.3380	3.1660	2.9140	2.6310
AGE	2006	2007			
1	0.1936	0.1475			
2	0.4769	0.8781			
3	0.9502	1.0866			
4	1.0638	1.2582			
5	1.6088	1.4819			
6	1.7809	1.8319			
7	1.8856	1.9325			
8	2.0639	2.0155			
9	2.3078	2.1751			

JAN-1 Weights at Age - Input Data

AGE	1931	1932	1933	1934	1935
1	0.7045	0.5993	0.4644	0.2918	0.3467
2	0.6598	0.7984	0.6835	0.6279	0.6045
3	0.9501	0.9221	1.0712	0.9082	0.9437
4	1.1664	1.4655	1.2441	1.4183	1.3446
5	1.4322	1.6091	1.7744	1.5764	1.6331
6	1.7215	1.9009	2.1253	1.9106	1.8615
7	2.0511	2.3468	2.3211	2.4639	2.3241
8	2.4223	2.6016	2.6639	2.6478	2.6621
9	3.0300	3.2000	2.6000	2.9800	3.4200
AGE	1936	1937	1938	1939	1940
1	0.3905	0.3565	0.4628	0.4562	0.4715
2	0.6104	0.6661	0.6462	0.6776	0.7122
3	1.0175	1.0022	1.0917	1.0132	1.0205
4	1.3796	1.3449	1.4773	1.4989	1.3697
5	1.6589	1.7397	1.8120	1.8668	1.7512
6	1.9342	1.9408	2.1123	2.3145	2.1525
7	2.1571	2.4277	2.4181	2.4735	2.6818
8	2.5948	2.6904	2.7848	2.8113	2.8716
9	3.3200	3.5600	3.7100	3.4200	3.8700
AGE	1941	1942	1943	1944	1945
1	0.4219	0.4389	0.4192	0.5327	0.5001
2	0.6651	0.6409	0.6161	0.6450	0.7217
3	1.0334	0.9532	0.8844	0.8920	0.9960
4	1.4121	1.3236	1.2824	1.1773	1.3082
5	1.7243	1.6385	1.5708	1.6353	1.6438
6	2.0784	1.9484	1.7977	1.9758	2.1052

7	2.4996	2.4695	2.1795	2.2210	2.4928
8	2.9150	2.9001	2.7382	2.6803	2.9035
9	3.5200	3.3800	3.3700	3.6800	3.3500
AGE	1946	1947	1948	1949	1950
1	0.4389	0.5396	0.4389	0.4812	0.3370
2	0.6726	0.6161	0.6234	0.6161	0.6060
3	1.0040	0.9471	0.8713	0.8144	0.8838
4	1.4217	1.3900	1.3308	1.2238	1.1475
5	1.6950	1.8146	1.7673	1.7285	1.6100
6	2.0699	2.0782	2.1788	2.1578	2.0846
7	2.5296	2.4887	2.5196	2.5282	2.4980
8	2.9704	2.8744	2.9692	2.9339	2.9778
9	4.1800	3.3200	3.5000	3.6900	3.4200

JAN-1 Weights at Age - Input Data

AGE	1951	1952	1953	1954	1955
1	0.4645	0.4261	0.4648	0.3204	0.4820
2	0.5486	0.6047	0.5589	0.6508	0.6043
3	0.8037	0.8112	0.8054	0.7589	0.9119
4	1.2239	1.1070	1.0576	1.0926	1.0775
5	1.5430	1.5473	1.4456	1.3316	1.4563
6	2.0523	1.9934	1.8585	1.7171	1.7046
7	2.5089	2.4380	2.2938	2.1272	2.0548
8	2.8436	2.9657	2.6236	2.3998	2.3806
9	3.3000	3.4900	3.3100	3.0800	2.9600
AGE	1956	1957	1958	1959	1960
1	0.3043	0.4382	0.5948	0.4656	0.5071
2	0.6980	0.5797	0.6654	0.7547	0.6735
3	0.9291	0.9656	0.9466	0.9711	1.0183
4	1.2208	1.2110	1.2241	1.2744	1.3351
5	1.4809	1.5629	1.5798	1.5588	1.6685
6	1.8860	1.8804	1.9956	1.9643	2.1086
7	2.1768	2.2657	2.3389	2.4047	2.5316
8	2.5849	2.5944	2.6573	2.8322	2.8945
9	3.6200	3.1100	3.3900	3.5200	3.7800
AGE	1961	1962	1963	1964	1965
1	0.4067	0.4254	0.4724	0.4256	0.5170
2	0.7099	0.6648	0.6854	0.6878	0.5874
3	0.9482	0.9481	1.0015	0.9871	0.9246
4	1.3707	1.2510	1.2542	1.2990	1.2296
5	1.7025	1.6510	1.5391	1.5527	1.5453
6	2.0831	2.0005	1.9508	1.8376	1.8065
7	2.5048	2.3627	2.2425	2.2716	2.1313
8	2.9098	2.5797	2.7402	2.4908	2.5267
9	3.2400	3.2900	3.1000	2.9700	3.1100
AGE	1966	1967	1968	1969	1970
1	0.5280	0.5958	0.5131	0.3327	0.5895
2	0.6507	0.6372	0.7312	0.6784	0.8127
3	0.7836	0.8328	0.8573	0.9439	0.9755
4	1.1392	1.0248	1.1198	1.3321	1.4571
5	1.5149	1.3376	1.3611	1.5199	1.9238
6	1.8593	1.8668	1.7268	1.7676	2.0451
7	2.1301	2.1867	2.1808	2.3004	2.2659
8	2.5468	2.4627	2.4601	2.6338	2.8530
9	3.1800	3.1000	2.8600	3.6300	3.7500

JAN-1 Weights at Age - Input Data

AGE	1971	1972	1973	1974	1975
1	0.5404	0.4810	0.4514	0.6171	0.4906
2	0.8552	0.8307	0.7991	0.7975	0.8400
3	1.2898	1.3387	1.2757	1.3692	1.3145
4	1.4570	1.6347	1.9251	1.9146	2.0055
5	2.1477	2.0520	2.2173	2.4552	2.2592
6	2.4807	2.6417	2.8217	3.0102	2.8845
7	2.6417	2.9323	3.1601	3.6503	3.8781
8	2.8281	3.1694	3.4368	3.6615	4.0500
9	3.7200	3.6600	3.9400	4.2600	4.3300
AGE	1976	1977	1978	1979	1980
1	0.3418	0.3980	0.3858	0.3980	0.4373
2	0.7835	0.7314	0.7058	0.7280	0.7058

3	1.1671	1.1940	1.2669	1.0969	1.1000
4	1.8010	1.7368	1.7139	1.7407	1.4881
5	2.4246	2.3308	2.4605	2.2628	2.0937
6	2.6031	2.9221	2.9511	2.9598	2.6605
7	3.2937	3.5752	3.2890	3.4725	3.3621
8	4.3220	3.8419	3.8706	3.5738	3.6684
9	4.9400	4.9900	5.1100	4.8700	3.8700

AGE	1981	1982	1983	1984	1985
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1	0.2473	0.1022	0.1976	0.1905	0.1955
2	0.6917	0.6151	0.4737	0.5510	0.5716
3	1.0796	1.1232	1.1528	1.1603	1.1308
4	1.4881	1.5268	1.6290	1.5834	1.6167
5	1.9947	2.0826	2.0383	2.0065	2.1217
6	2.4295	2.5195	2.5061	2.4291	2.4462
7	3.2345	2.9686	2.9950	2.8007	2.8584
8	3.8137	3.8330	3.2995	3.3290	3.3183
9	4.4400	4.0900	4.2700	3.7200	3.8000

AGE	1986	1987	1988	1989	1990
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1	0.3313	0.2848	0.2885	0.3918	0.4672
2	0.5570	0.6111	0.6492	0.6114	0.7170
3	1.1603	1.1594	1.0546	1.2043	1.1477
4	1.5949	1.6492	1.5500	1.5487	1.6231
5	2.2514	2.0292	2.0298	1.9269	1.9480
6	2.6385	2.5948	2.3479	2.3009	2.3739
7	2.8375	2.9235	2.7948	2.8174	2.6873
8	3.2539	3.3405	3.2465	3.2516	3.1125
9	3.7800	4.2900	3.9600	3.8200	4.1600

JAN-1 Weights at Age - Input Data

AGE	1991	1992	1993	1994	1995
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1	0.4086	0.3650	0.5117	0.3039	0.2682
2	0.8767	0.8262	0.7930	0.8487	0.6575
3	1.1277	1.4030	1.4249	1.3859	1.2757
4	1.6399	1.5224	1.8863	1.9538	1.8240
5	1.9712	1.9930	1.9356	2.3886	2.3697
6	2.3680	2.3450	2.3968	2.4043	2.7199
7	2.6968	2.8014	2.5832	2.7616	2.9890
8	2.9266	3.0979	3.0440	3.1656	2.9950
9	4.3370	4.2670	4.0140	4.5460	3.9810

AGE	1996	1997	1998	1999	2000
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1	0.3082	0.2727	0.3481	0.5245	0.4996
2	0.6863	0.6746	0.6346	0.7501	0.8765
3	1.2032	1.3622	1.2174	1.2158	1.2696
4	1.6543	1.6825	1.7999	1.6485	1.7002
5	2.1698	2.0168	2.1004	2.0117	2.0301
6	2.5425	2.4335	2.4390	2.3360	2.2377
7	3.1042	2.8258	2.7766	2.6925	2.5279
8	3.3934	3.4014	3.0886	2.9999	2.8402
9	3.7120	3.6550	4.0700	3.6820	3.2980

AGE	2001	2002	2003	2004	2005
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1	0.2245	0.2094	0.2088	0.1298	0.1107
2	0.8825	0.5708	0.4442	0.3188	0.3464
3	1.2857	1.2519	1.1125	0.8048	0.6439
4	1.6025	1.5910	1.4684	1.4269	1.2060
5	2.0207	1.8489	1.7940	1.6398	1.5806
6	2.3851	2.3101	1.9974	1.9034	1.7466
7	2.4962	2.8105	2.4969	2.0590	1.9917
8	2.7300	2.8394	3.1084	2.4939	2.1014
9	3.4110	3.3380	3.1660	2.9140	2.6310

AGE	2006	2007	2008
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1	0.0906	0.0231	0.1126
2	0.2931	0.4139	0.3633
3	0.7333	0.7198	0.8029
4	1.0580	1.0934	1.2505
5	1.5289	1.2553	1.5597
6	1.7239	1.7166	1.8176
7	1.8581	1.8551	2.0522
8	2.0474	1.9495	2.3401
9	2.3078	2.1750	2.6388

SSB Weight At Age - Input Data

AGE	1931	1932	1933	1934	1935
1	0.7045	0.5993	0.4644	0.2918	0.3467
2	0.6598	0.7984	0.6835	0.6279	0.6045
3	0.9501	0.9221	1.0712	0.9082	0.9437
4	1.1664	1.4655	1.2441	1.4183	1.3446
5	1.4322	1.6091	1.7744	1.5764	1.6331
6	1.7215	1.9009	2.1253	1.9106	1.8615
7	2.0511	2.3468	2.3211	2.4639	2.3241
8	2.4223	2.6016	2.6639	2.6478	2.6621
9	3.0300	3.2000	2.6000	2.9800	3.4200
AGE	1936	1937	1938	1939	1940
1	0.3905	0.3565	0.4628	0.4562	0.4715
2	0.6104	0.6661	0.6462	0.6776	0.7122
3	1.0175	1.0022	1.0917	1.0132	1.0205
4	1.3796	1.3449	1.4773	1.4989	1.3697
5	1.6589	1.7397	1.8120	1.8668	1.7512
6	1.9342	1.9408	2.1123	2.3145	2.1525
7	2.1571	2.4277	2.4181	2.4735	2.6818
8	2.5948	2.6904	2.7848	2.8113	2.8716
9	3.3200	3.5600	3.7100	3.4200	3.8700
AGE	1941	1942	1943	1944	1945
1	0.4219	0.4389	0.4192	0.5327	0.5001
2	0.6651	0.6409	0.6161	0.6450	0.7217
3	1.0334	0.9532	0.8844	0.8920	0.9960
4	1.4121	1.3236	1.2824	1.1773	1.3082
5	1.7243	1.6385	1.5708	1.6353	1.6438
6	2.0784	1.9484	1.7977	1.9758	2.1052
7	2.4996	2.4695	2.1795	2.2210	2.4928
8	2.9150	2.9001	2.7382	2.6803	2.9035
9	3.5200	3.3800	3.3700	3.6800	3.3500
AGE	1946	1947	1948	1949	1950
1	0.4389	0.5396	0.4389	0.4812	0.3370
2	0.6726	0.6161	0.6234	0.6161	0.6060
3	1.0040	0.9471	0.8713	0.8144	0.8838
4	1.4217	1.3900	1.3308	1.2238	1.1475
5	1.6950	1.8146	1.7673	1.7285	1.6100
6	2.0699	2.0782	2.1788	2.1578	2.0846
7	2.5296	2.4887	2.5196	2.5282	2.4980
8	2.9704	2.8744	2.9692	2.9339	2.9778
9	4.1800	3.3200	3.5000	3.6900	3.4200

SSB Weight At Age - Input Data

AGE	1951	1952	1953	1954	1955
1	0.4645	0.4261	0.4648	0.3204	0.4820
2	0.5486	0.6047	0.5589	0.6508	0.6043
3	0.8037	0.8112	0.8054	0.7589	0.9119
4	1.2239	1.1070	1.0576	1.0926	1.0775
5	1.5430	1.5473	1.4456	1.3316	1.4563
6	2.0523	1.9934	1.8585	1.7171	1.7046
7	2.5089	2.4380	2.2938	2.1272	2.0548
8	2.8436	2.9657	2.6236	2.3998	2.3806
9	3.3000	3.4900	3.3100	3.0800	2.9600
AGE	1956	1957	1958	1959	1960
1	0.3043	0.4382	0.5948	0.4656	0.5071
2	0.6980	0.5797	0.6654	0.7547	0.6735
3	0.9291	0.9656	0.9466	0.9711	1.0183
4	1.2208	1.2110	1.2241	1.2744	1.3351
5	1.4809	1.5629	1.5798	1.5588	1.6685
6	1.8860	1.8804	1.9956	1.9643	2.1086
7	2.1768	2.2657	2.3389	2.4047	2.5316
8	2.5849	2.5944	2.6573	2.8322	2.8945
9	3.6200	3.1100	3.3900	3.5200	3.7800
AGE	1961	1962	1963	1964	1965
1	0.4067	0.4254	0.4724	0.4256	0.5170
2	0.7099	0.6648	0.6854	0.6878	0.5874
3	0.9482	0.9481	1.0015	0.9871	0.9246
4	1.3707	1.2510	1.2542	1.2990	1.2296
5	1.7025	1.6510	1.5391	1.5527	1.5453
6	2.0831	2.0005	1.9508	1.8376	1.8065

7	2.5048	2.3627	2.2425	2.2716	2.1313
8	2.9098	2.5797	2.7402	2.4908	2.5267
9	3.2400	3.2900	3.1000	2.9700	3.1100
AGE	1966	1967	1968	1969	1970
1	0.5280	0.5958	0.5131	0.3327	0.5895
2	0.6507	0.6372	0.7312	0.6784	0.8127
3	0.7836	0.8328	0.8573	0.9439	0.9755
4	1.1392	1.0248	1.1198	1.3321	1.4571
5	1.5149	1.3376	1.3611	1.5199	1.9238
6	1.8593	1.8668	1.7268	1.7676	2.0451
7	2.1301	2.1867	2.1808	2.3004	2.2659
8	2.5468	2.4627	2.4601	2.6338	2.8530
9	3.1800	3.1000	2.8600	3.6300	3.7500
SSB Weight At Age - Input Data					
AGE	1971	1972	1973	1974	1975
1	0.5404	0.4810	0.4514	0.6171	0.4906
2	0.8552	0.8307	0.7991	0.7975	0.8400
3	1.2898	1.3387	1.2757	1.3692	1.3145
4	1.4570	1.6347	1.9251	1.9146	2.0055
5	2.1477	2.0520	2.2173	2.4552	2.2592
6	2.4807	2.6417	2.8217	3.0102	2.8845
7	2.6417	2.9323	3.1601	3.6503	3.8781
8	2.8281	3.1694	3.4368	3.6615	4.0500
9	3.7200	3.6600	3.9400	4.2600	4.3300
AGE	1976	1977	1978	1979	1980
1	0.3418	0.3980	0.3858	0.3980	0.4373
2	0.7835	0.7314	0.7058	0.7280	0.7058
3	1.1671	1.1940	1.2669	1.0969	1.1000
4	1.8010	1.7368	1.7139	1.7407	1.4881
5	2.4246	2.3308	2.4605	2.2628	2.0937
6	2.6031	2.9221	2.9511	2.9598	2.6605
7	3.2937	3.5752	3.2890	3.4725	3.3621
8	4.3220	3.8419	3.8706	3.5738	3.6684
9	4.9400	4.9900	5.1100	4.8700	3.8700
AGE	1981	1982	1983	1984	1985
1	0.2473	0.1022	0.1976	0.1905	0.1955
2	0.6917	0.6151	0.4737	0.5510	0.5716
3	1.0796	1.1232	1.1528	1.1603	1.1308
4	1.4881	1.5268	1.6290	1.5834	1.6167
5	1.9947	2.0826	2.0383	2.0065	2.1217
6	2.4295	2.5195	2.5061	2.4291	2.4462
7	3.2345	2.9686	2.9950	2.8007	2.8584
8	3.8137	3.8330	3.2995	3.3290	3.3183
9	4.4400	4.0900	4.2700	3.7200	3.8000
AGE	1986	1987	1988	1989	1990
1	0.3313	0.2848	0.2885	0.3918	0.4672
2	0.5570	0.6111	0.6492	0.6114	0.7170
3	1.1603	1.1594	1.0546	1.2043	1.1477
4	1.5949	1.6492	1.5500	1.5487	1.6231
5	2.2514	2.0292	2.0298	1.9269	1.9480
6	2.6385	2.5948	2.3479	2.3009	2.3739
7	2.8375	2.9235	2.7948	2.8174	2.6873
8	3.2539	3.3405	3.2465	3.2516	3.1125
9	3.7800	4.2900	3.9600	3.8200	4.1600

SSB Weight At Age - Input Data

AGE	1991	1992	1993	1994	1995
1	0.4086	0.3650	0.5117	0.3039	0.2682
2	0.8767	0.8262	0.7930	0.8487	0.6575
3	1.1277	1.4030	1.4249	1.3859	1.2757
4	1.6399	1.5224	1.8863	1.9538	1.8240
5	1.9712	1.9930	1.9356	2.3886	2.3697
6	2.3680	2.3450	2.3968	2.4043	2.7199
7	2.6968	2.8014	2.5832	2.7616	2.9890
8	2.9266	3.0979	3.0440	3.1656	2.9950
9	4.3370	4.2670	4.0140	4.5460	3.9810
AGE	1996	1997	1998	1999	2000
1	0.3082	0.2727	0.3481	0.5245	0.4996
2	0.6863	0.6746	0.6346	0.7501	0.8765
3	1.2032	1.3622	1.2174	1.2158	1.2696
4	1.6543	1.6825	1.7999	1.6485	1.7002
5	2.1698	2.0168	2.1004	2.0117	2.0301
6	2.5425	2.4335	2.4390	2.3360	2.2377
7	3.1042	2.8258	2.7766	2.6925	2.5279
8	3.3934	3.4014	3.0886	2.9999	2.8402
9	3.7120	3.6550	4.0700	3.6820	3.2980
AGE	2001	2002	2003	2004	2005
1	0.2245	0.2094	0.2088	0.1298	0.1107
2	0.8825	0.5708	0.4442	0.3188	0.3464
3	1.2857	1.2519	1.1125	0.8048	0.6439
4	1.6025	1.5910	1.4684	1.4269	1.2060
5	2.0207	1.8489	1.7940	1.6398	1.5806
6	2.3851	2.3101	1.9974	1.9034	1.7466
7	2.4962	2.8105	2.4969	2.0590	1.9917
8	2.7300	2.8394	3.1084	2.4939	2.1014
9	3.4110	3.3380	3.1660	2.9140	2.6310
AGE	2006	2007			
1	0.0906	0.0231			
2	0.2931	0.4139			
3	0.7333	0.7198			
4	1.0580	1.0934			
5	1.5289	1.2553			
6	1.7239	1.7166			
7	1.8581	1.8551			
8	2.0474	1.9495			
9	2.3078	2.1750			

Natural Mortality - Input Data

AGE	1931	1932	1933	1934	1935
1	0.2000	0.2000	0.2000	0.2000	0.2000
2	0.2000	0.2000	0.2000	0.2000	0.2000
3	0.2000	0.2000	0.2000	0.2000	0.2000
4	0.2000	0.2000	0.2000	0.2000	0.2000
5	0.2000	0.2000	0.2000	0.2000	0.2000
6	0.2000	0.2000	0.2000	0.2000	0.2000
7	0.2000	0.2000	0.2000	0.2000	0.2000
8	0.2000	0.2000	0.2000	0.2000	0.2000
9	0.2000	0.2000	0.2000	0.2000	0.2000
AGE	1936	1937	1938	1939	1940
1	0.2000	0.2000	0.2000	0.2000	0.2000
2	0.2000	0.2000	0.2000	0.2000	0.2000
3	0.2000	0.2000	0.2000	0.2000	0.2000
4	0.2000	0.2000	0.2000	0.2000	0.2000
5	0.2000	0.2000	0.2000	0.2000	0.2000
6	0.2000	0.2000	0.2000	0.2000	0.2000
7	0.2000	0.2000	0.2000	0.2000	0.2000
8	0.2000	0.2000	0.2000	0.2000	0.2000
9	0.2000	0.2000	0.2000	0.2000	0.2000
AGE	1941	1942	1943	1944	1945
1	0.2000	0.2000	0.2000	0.2000	0.2000
2	0.2000	0.2000	0.2000	0.2000	0.2000
3	0.2000	0.2000	0.2000	0.2000	0.2000
4	0.2000	0.2000	0.2000	0.2000	0.2000
5	0.2000	0.2000	0.2000	0.2000	0.2000
6	0.2000	0.2000	0.2000	0.2000	0.2000

7	0.2000	0.2000	0.2000	0.2000	0.2000
8	0.2000	0.2000	0.2000	0.2000	0.2000
9	0.2000	0.2000	0.2000	0.2000	0.2000
AGE	1946	1947	1948	1949	1950
1	0.2000	0.2000	0.2000	0.2000	0.2000
2	0.2000	0.2000	0.2000	0.2000	0.2000
3	0.2000	0.2000	0.2000	0.2000	0.2000
4	0.2000	0.2000	0.2000	0.2000	0.2000
5	0.2000	0.2000	0.2000	0.2000	0.2000
6	0.2000	0.2000	0.2000	0.2000	0.2000
7	0.2000	0.2000	0.2000	0.2000	0.2000
8	0.2000	0.2000	0.2000	0.2000	0.2000
9	0.2000	0.2000	0.2000	0.2000	0.2000

Natural Mortality - Input Data

AGE	1951	1952	1953	1954	1955
1	0.2000	0.2000	0.2000	0.2000	0.2000
2	0.2000	0.2000	0.2000	0.2000	0.2000
3	0.2000	0.2000	0.2000	0.2000	0.2000
4	0.2000	0.2000	0.2000	0.2000	0.2000
5	0.2000	0.2000	0.2000	0.2000	0.2000
6	0.2000	0.2000	0.2000	0.2000	0.2000
7	0.2000	0.2000	0.2000	0.2000	0.2000
8	0.2000	0.2000	0.2000	0.2000	0.2000
9	0.2000	0.2000	0.2000	0.2000	0.2000
AGE	1956	1957	1958	1959	1960
1	0.2000	0.2000	0.2000	0.2000	0.2000
2	0.2000	0.2000	0.2000	0.2000	0.2000
3	0.2000	0.2000	0.2000	0.2000	0.2000
4	0.2000	0.2000	0.2000	0.2000	0.2000
5	0.2000	0.2000	0.2000	0.2000	0.2000
6	0.2000	0.2000	0.2000	0.2000	0.2000
7	0.2000	0.2000	0.2000	0.2000	0.2000
8	0.2000	0.2000	0.2000	0.2000	0.2000
9	0.2000	0.2000	0.2000	0.2000	0.2000
AGE	1961	1962	1963	1964	1965
1	0.2000	0.2000	0.2000	0.2000	0.2000
2	0.2000	0.2000	0.2000	0.2000	0.2000
3	0.2000	0.2000	0.2000	0.2000	0.2000
4	0.2000	0.2000	0.2000	0.2000	0.2000
5	0.2000	0.2000	0.2000	0.2000	0.2000
6	0.2000	0.2000	0.2000	0.2000	0.2000
7	0.2000	0.2000	0.2000	0.2000	0.2000
8	0.2000	0.2000	0.2000	0.2000	0.2000
9	0.2000	0.2000	0.2000	0.2000	0.2000
AGE	1966	1967	1968	1969	1970
1	0.2000	0.2000	0.2000	0.2000	0.2000
2	0.2000	0.2000	0.2000	0.2000	0.2000
3	0.2000	0.2000	0.2000	0.2000	0.2000
4	0.2000	0.2000	0.2000	0.2000	0.2000
5	0.2000	0.2000	0.2000	0.2000	0.2000
6	0.2000	0.2000	0.2000	0.2000	0.2000
7	0.2000	0.2000	0.2000	0.2000	0.2000
8	0.2000	0.2000	0.2000	0.2000	0.2000
9	0.2000	0.2000	0.2000	0.2000	0.2000

Natural Mortality - Input Data

AGE	1971	1972	1973	1974	1975
1	0.2000	0.2000	0.2000	0.2000	0.2000
2	0.2000	0.2000	0.2000	0.2000	0.2000
3	0.2000	0.2000	0.2000	0.2000	0.2000
4	0.2000	0.2000	0.2000	0.2000	0.2000
5	0.2000	0.2000	0.2000	0.2000	0.2000
6	0.2000	0.2000	0.2000	0.2000	0.2000
7	0.2000	0.2000	0.2000	0.2000	0.2000
8	0.2000	0.2000	0.2000	0.2000	0.2000
9	0.2000	0.2000	0.2000	0.2000	0.2000
AGE	1976	1977	1978	1979	1980
1	0.2000	0.2000	0.2000	0.2000	0.2000
2	0.2000	0.2000	0.2000	0.2000	0.2000
3	0.2000	0.2000	0.2000	0.2000	0.2000
4	0.2000	0.2000	0.2000	0.2000	0.2000
5	0.2000	0.2000	0.2000	0.2000	0.2000
6	0.2000	0.2000	0.2000	0.2000	0.2000
7	0.2000	0.2000	0.2000	0.2000	0.2000
8	0.2000	0.2000	0.2000	0.2000	0.2000
9	0.2000	0.2000	0.2000	0.2000	0.2000
AGE	1981	1982	1983	1984	1985
1	0.2000	0.2000	0.2000	0.2000	0.2000
2	0.2000	0.2000	0.2000	0.2000	0.2000
3	0.2000	0.2000	0.2000	0.2000	0.2000
4	0.2000	0.2000	0.2000	0.2000	0.2000
5	0.2000	0.2000	0.2000	0.2000	0.2000
6	0.2000	0.2000	0.2000	0.2000	0.2000
7	0.2000	0.2000	0.2000	0.2000	0.2000
8	0.2000	0.2000	0.2000	0.2000	0.2000
9	0.2000	0.2000	0.2000	0.2000	0.2000
AGE	1986	1987	1988	1989	1990
1	0.2000	0.2000	0.2000	0.2000	0.2000
2	0.2000	0.2000	0.2000	0.2000	0.2000
3	0.2000	0.2000	0.2000	0.2000	0.2000
4	0.2000	0.2000	0.2000	0.2000	0.2000
5	0.2000	0.2000	0.2000	0.2000	0.2000
6	0.2000	0.2000	0.2000	0.2000	0.2000
7	0.2000	0.2000	0.2000	0.2000	0.2000
8	0.2000	0.2000	0.2000	0.2000	0.2000
9	0.2000	0.2000	0.2000	0.2000	0.2000

Natural Mortality - Input Data

AGE	1991	1992	1993	1994	1995
1	0.2000	0.2000	0.2000	0.2000	0.2000
2	0.2000	0.2000	0.2000	0.2000	0.2000
3	0.2000	0.2000	0.2000	0.2000	0.2000
4	0.2000	0.2000	0.2000	0.2000	0.2000
5	0.2000	0.2000	0.2000	0.2000	0.2000
6	0.2000	0.2000	0.2000	0.2000	0.2000
7	0.2000	0.2000	0.2000	0.2000	0.2000
8	0.2000	0.2000	0.2000	0.2000	0.2000
9	0.2000	0.2000	0.2000	0.2000	0.2000
AGE	1996	1997	1998	1999	2000
1	0.2000	0.2000	0.2000	0.2000	0.2000
2	0.2000	0.2000	0.2000	0.2000	0.2000
3	0.2000	0.2000	0.2000	0.2000	0.2000
4	0.2000	0.2000	0.2000	0.2000	0.2000
5	0.2000	0.2000	0.2000	0.2000	0.2000
6	0.2000	0.2000	0.2000	0.2000	0.2000
7	0.2000	0.2000	0.2000	0.2000	0.2000
8	0.2000	0.2000	0.2000	0.2000	0.2000
9	0.2000	0.2000	0.2000	0.2000	0.2000
AGE	2001	2002	2003	2004	2005
1	0.2000	0.2000	0.2000	0.2000	0.2000
2	0.2000	0.2000	0.2000	0.2000	0.2000
3	0.2000	0.2000	0.2000	0.2000	0.2000
4	0.2000	0.2000	0.2000	0.2000	0.2000
5	0.2000	0.2000	0.2000	0.2000	0.2000
6	0.2000	0.2000	0.2000	0.2000	0.2000

7	0.2000	0.2000	0.2000	0.2000	0.2000
8	0.2000	0.2000	0.2000	0.2000	0.2000
9	0.2000	0.2000	0.2000	0.2000	0.2000

AGE	2006	2007
1	0.2000	0.2000
2	0.2000	0.2000
3	0.2000	0.2000
4	0.2000	0.2000
5	0.2000	0.2000
6	0.2000	0.2000
7	0.2000	0.2000
8	0.2000	0.2000
9	0.2000	0.2000

Proportion of Natural Mortality Before Spawning = 0.2500
Proportion of Fishing Mortality Before Spawning = 0.2500

Maturity - Input Data

AGE	1931	1932	1933	1934	1935
1	0.0400	0.0400	0.0400	0.0400	0.0400
2	0.3800	0.3800	0.3800	0.3800	0.3800
3	0.8700	0.8700	0.8700	0.8700	0.8700
4	0.9900	0.9900	0.9900	0.9900	0.9900
5	1.0000	1.0000	1.0000	1.0000	1.0000
6	1.0000	1.0000	1.0000	1.0000	1.0000
7	1.0000	1.0000	1.0000	1.0000	1.0000
8	1.0000	1.0000	1.0000	1.0000	1.0000
9	1.0000	1.0000	1.0000	1.0000	1.0000
AGE	1936	1937	1938	1939	1940
1	0.0400	0.0400	0.0400	0.0400	0.0400
2	0.3800	0.3800	0.3800	0.3800	0.3800
3	0.8700	0.8700	0.8700	0.8700	0.8700
4	0.9900	0.9900	0.9900	0.9900	0.9900
5	1.0000	1.0000	1.0000	1.0000	1.0000
6	1.0000	1.0000	1.0000	1.0000	1.0000
7	1.0000	1.0000	1.0000	1.0000	1.0000
8	1.0000	1.0000	1.0000	1.0000	1.0000
9	1.0000	1.0000	1.0000	1.0000	1.0000
AGE	1941	1942	1943	1944	1945
1	0.0400	0.0400	0.0400	0.0400	0.0400
2	0.3800	0.3800	0.3800	0.3800	0.3800
3	0.8700	0.8700	0.8700	0.8700	0.8700
4	0.9900	0.9900	0.9900	0.9900	0.9900
5	1.0000	1.0000	1.0000	1.0000	1.0000
6	1.0000	1.0000	1.0000	1.0000	1.0000
7	1.0000	1.0000	1.0000	1.0000	1.0000
8	1.0000	1.0000	1.0000	1.0000	1.0000
9	1.0000	1.0000	1.0000	1.0000	1.0000
AGE	1946	1947	1948	1949	1950
1	0.0400	0.0400	0.0400	0.0400	0.0400
2	0.3800	0.3800	0.3800	0.3800	0.3800
3	0.8700	0.8700	0.8700	0.8700	0.8700
4	0.9900	0.9900	0.9900	0.9900	0.9900
5	1.0000	1.0000	1.0000	1.0000	1.0000
6	1.0000	1.0000	1.0000	1.0000	1.0000
7	1.0000	1.0000	1.0000	1.0000	1.0000
8	1.0000	1.0000	1.0000	1.0000	1.0000
9	1.0000	1.0000	1.0000	1.0000	1.0000

Maturity - Input Data

AGE	1951	1952	1953	1954	1955
1	0.0400	0.0400	0.0400	0.0400	0.0400
2	0.3800	0.3800	0.3800	0.3800	0.3800
3	0.8700	0.8700	0.8700	0.8700	0.8700
4	0.9900	0.9900	0.9900	0.9900	0.9900
5	1.0000	1.0000	1.0000	1.0000	1.0000
6	1.0000	1.0000	1.0000	1.0000	1.0000
7	1.0000	1.0000	1.0000	1.0000	1.0000
8	1.0000	1.0000	1.0000	1.0000	1.0000
9	1.0000	1.0000	1.0000	1.0000	1.0000
AGE	1956	1957	1958	1959	1960
1	0.0400	0.0400	0.0400	0.0400	0.0400
2	0.3800	0.3800	0.3800	0.3800	0.3800
3	0.8700	0.8700	0.8700	0.8700	0.8700
4	0.9900	0.9900	0.9900	0.9900	0.9900
5	1.0000	1.0000	1.0000	1.0000	1.0000
6	1.0000	1.0000	1.0000	1.0000	1.0000
7	1.0000	1.0000	1.0000	1.0000	1.0000
8	1.0000	1.0000	1.0000	1.0000	1.0000
9	1.0000	1.0000	1.0000	1.0000	1.0000
AGE	1961	1962	1963	1964	1965
1	0.0400	0.0400	0.0630	0.0630	0.0630
2	0.3800	0.3800	0.4690	0.4690	0.4690
3	0.8700	0.8700	0.9200	0.9200	0.9200
4	0.9900	0.9900	0.9930	0.9930	0.9930
5	1.0000	1.0000	0.9990	0.9990	0.9990
6	1.0000	1.0000	1.0000	1.0000	1.0000
7	1.0000	1.0000	1.0000	1.0000	1.0000
8	1.0000	1.0000	1.0000	1.0000	1.0000
9	1.0000	1.0000	1.0000	1.0000	1.0000
AGE	1966	1967	1968	1969	1970
1	0.0630	0.0630	0.0630	0.0630	0.0630
2	0.4690	0.4690	0.4690	0.4690	0.4690
3	0.9200	0.9200	0.9200	0.9200	0.9200
4	0.9930	0.9930	0.9930	0.9930	0.9930
5	0.9990	0.9990	0.9990	0.9990	0.9990
6	1.0000	1.0000	1.0000	1.0000	1.0000
7	1.0000	1.0000	1.0000	1.0000	1.0000
8	1.0000	1.0000	1.0000	1.0000	1.0000
9	1.0000	1.0000	1.0000	1.0000	1.0000

Maturity - Input Data

AGE	1971	1972	1973	1974	1975
1	0.0630	0.0630	0.0630	0.0630	0.0630
2	0.4690	0.4690	0.4690	0.4690	0.4690
3	0.9200	0.9200	0.9200	0.9200	0.9200
4	0.9930	0.9930	0.9930	0.9930	0.9930
5	0.9990	0.9990	0.9990	0.9990	0.9990
6	1.0000	1.0000	1.0000	1.0000	1.0000
7	1.0000	1.0000	1.0000	1.0000	1.0000
8	1.0000	1.0000	1.0000	1.0000	1.0000
9	1.0000	1.0000	1.0000	1.0000	1.0000
AGE	1976	1977	1978	1979	1980
1	0.0630	0.0630	0.0630	0.0630	0.0630
2	0.4690	0.4690	0.4690	0.4690	0.4690
3	0.9200	0.9200	0.9200	0.9200	0.9200
4	0.9930	0.9930	0.9930	0.9930	0.9930
5	0.9990	0.9990	0.9990	0.9990	0.9990
6	1.0000	1.0000	1.0000	1.0000	1.0000
7	1.0000	1.0000	1.0000	1.0000	1.0000
8	1.0000	1.0000	1.0000	1.0000	1.0000
9	1.0000	1.0000	1.0000	1.0000	1.0000
AGE	1981	1982	1983	1984	1985
1	0.0630	0.0630	0.0630	0.0630	0.0630
2	0.4690	0.4690	0.4690	0.4690	0.4690
3	0.9200	0.9200	0.9200	0.9200	0.9200
4	0.9930	0.9930	0.9930	0.9930	0.9930
5	0.9990	0.9990	0.9990	0.9990	0.9990
6	1.0000	1.0000	1.0000	1.0000	1.0000

7	1.0000	1.0000	1.0000	1.0000	1.0000
8	1.0000	1.0000	1.0000	1.0000	1.0000
9	1.0000	1.0000	1.0000	1.0000	1.0000
AGE	1986	1987	1988	1989	1990
1	0.0630	0.0630	0.0630	0.0630	0.0630
2	0.4690	0.4690	0.4690	0.4690	0.4690
3	0.9200	0.9200	0.9200	0.9200	0.9200
4	0.9930	0.9930	0.9930	0.9930	0.9930
5	0.9990	0.9990	0.9990	0.9990	0.9990
6	1.0000	1.0000	1.0000	1.0000	1.0000
7	1.0000	1.0000	1.0000	1.0000	1.0000
8	1.0000	1.0000	1.0000	1.0000	1.0000
9	1.0000	1.0000	1.0000	1.0000	1.0000

Maturity - Input Data

AGE	1991	1992	1993	1994	1995
1	0.0630	0.0630	0.0630	0.0630	0.0630
2	0.4690	0.4690	0.4690	0.4690	0.4690
3	0.9200	0.9200	0.9200	0.9200	0.9200
4	0.9930	0.9930	0.9930	0.9930	0.9930
5	0.9990	0.9990	0.9990	0.9990	0.9990
6	1.0000	1.0000	1.0000	1.0000	1.0000
7	1.0000	1.0000	1.0000	1.0000	1.0000
8	1.0000	1.0000	1.0000	1.0000	1.0000
9	1.0000	1.0000	1.0000	1.0000	1.0000
AGE	1996	1997	1998	1999	2000
1	0.0630	0.0630	0.0630	0.0630	0.0630
2	0.4690	0.4690	0.4690	0.4690	0.4690
3	0.9200	0.9200	0.9200	0.9200	0.9200
4	0.9930	0.9930	0.9930	0.9930	0.9930
5	0.9990	0.9990	0.9990	0.9990	0.9990
6	1.0000	1.0000	1.0000	1.0000	1.0000
7	1.0000	1.0000	1.0000	1.0000	1.0000
8	1.0000	1.0000	1.0000	1.0000	1.0000
9	1.0000	1.0000	1.0000	1.0000	1.0000
AGE	2001	2002	2003	2004	2005
1	0.0630	0.0630	0.0630	0.0630	0.0630
2	0.4690	0.4690	0.4690	0.4690	0.4690
3	0.9200	0.9200	0.9200	0.9200	0.9200
4	0.9930	0.9930	0.9930	0.9930	0.9930
5	0.9990	0.9990	0.9990	0.9990	0.9990
6	1.0000	1.0000	1.0000	1.0000	1.0000
7	1.0000	1.0000	1.0000	1.0000	1.0000
8	1.0000	1.0000	1.0000	1.0000	1.0000
9	1.0000	1.0000	1.0000	1.0000	1.0000
AGE	2006	2007			
1	0.0630	0.0630			
2	0.4690	0.4690			
3	0.9200	0.9200			
4	0.9930	0.9930			
5	0.9990	0.9990			
6	1.0000	1.0000			
7	1.0000	1.0000			
8	1.0000	1.0000			
9	1.0000	1.0000			

Input Partial Recruitment

AGE

1	0.0010
2	0.4100
3	0.8400
4	1.0000
5	1.0000
6	1.0000
7	1.0000
8	1.0000

Input F-Plus Ratio

YEAR

1931	1.0000
1932	1.0000
1933	1.0000
1934	1.0000
1935	1.0000
1936	1.0000
1937	1.0000
1938	1.0000
1939	1.0000
1940	1.0000
1941	1.0000
1942	1.0000
1943	1.0000
1944	1.0000
1945	1.0000
1946	1.0000
1947	1.0000
1948	1.0000
1949	1.0000
1950	1.0000
1951	1.0000
1952	1.0000
1953	1.0000
1954	1.0000
1955	1.0000
1956	1.0000
1957	1.0000
1958	1.0000
1959	1.0000
1960	1.0000
1961	1.0000
1962	1.0000
1963	1.0000
1964	1.0000
1965	1.0000
1966	1.0000
1967	1.0000
1968	1.0000
1969	1.0000
1970	1.0000
1971	1.0000
1972	1.0000
1973	1.0000
1974	1.0000
1975	1.0000
1976	1.0000
1977	1.0000
1978	1.0000
1979	1.0000
1980	1.0000
1981	1.0000
1982	1.0000
1983	1.0000
1984	1.0000
1985	1.0000
1986	1.0000
1987	1.0000
1988	1.0000
1989	1.0000
1990	1.0000
1991	1.0000
1992	1.0000
1993	1.0000
1994	1.0000
1995	1.0000
1996	1.0000
1997	1.0000
1998	1.0000
1999	1.0000
2000	1.0000
2001	1.0000
2002	1.0000
2003	1.0000
2004	1.0000
2005	1.0000
2006	1.0000
2007	1.0000

SURVEY - INPUT DATA

INDEX	1	2	3	4	5
SURVEY TAG	US_Sp	US_Sp	US_Sp	US_Sp	US_Sp
AGE	1	2	3	4	5
TIME	JAN-1	JAN-1	JAN-1	JAN-1	JAN-1
TYPE	NUMBERS	NUMBERS	NUMBERS	NUMBERS	NUMBERS
RETRO FLAG	1	1	1	1	1
1931	0.0000	0.0000	0.0000	0.0000	0.0000
1932	0.0000	0.0000	0.0000	0.0000	0.0000
1933	0.0000	0.0000	0.0000	0.0000	0.0000
1934	0.0000	0.0000	0.0000	0.0000	0.0000
1935	0.0000	0.0000	0.0000	0.0000	0.0000
1936	0.0000	0.0000	0.0000	0.0000	0.0000
1937	0.0000	0.0000	0.0000	0.0000	0.0000
1938	0.0000	0.0000	0.0000	0.0000	0.0000
1939	0.0000	0.0000	0.0000	0.0000	0.0000
1940	0.0000	0.0000	0.0000	0.0000	0.0000
1941	0.0000	0.0000	0.0000	0.0000	0.0000
1942	0.0000	0.0000	0.0000	0.0000	0.0000
1943	0.0000	0.0000	0.0000	0.0000	0.0000
1944	0.0000	0.0000	0.0000	0.0000	0.0000
1945	0.0000	0.0000	0.0000	0.0000	0.0000
1946	0.0000	0.0000	0.0000	0.0000	0.0000
1947	0.0000	0.0000	0.0000	0.0000	0.0000
1948	0.0000	0.0000	0.0000	0.0000	0.0000
1949	0.0000	0.0000	0.0000	0.0000	0.0000
1950	0.0000	0.0000	0.0000	0.0000	0.0000
1951	0.0000	0.0000	0.0000	0.0000	0.0000
1952	0.0000	0.0000	0.0000	0.0000	0.0000
1953	0.0000	0.0000	0.0000	0.0000	0.0000
1954	0.0000	0.0000	0.0000	0.0000	0.0000
1955	0.0000	0.0000	0.0000	0.0000	0.0000
1956	0.0000	0.0000	0.0000	0.0000	0.0000
1957	0.0000	0.0000	0.0000	0.0000	0.0000
1958	0.0000	0.0000	0.0000	0.0000	0.0000
1959	0.0000	0.0000	0.0000	0.0000	0.0000
1960	0.0000	0.0000	0.0000	0.0000	0.0000
1961	0.0000	0.0000	0.0000	0.0000	0.0000
1962	0.0000	0.0000	0.0000	0.0000	0.0000
1963	0.0000	0.0000	0.0000	0.0000	0.0000
1964	0.0000	0.0000	0.0000	0.0000	0.0000
1965	0.0000	0.0000	0.0000	0.0000	0.0000
1966	0.0000	0.0000	0.0000	0.0000	0.0000
1967	0.0000	0.0000	0.0000	0.0000	0.0000
1968	1298.2857	9185.3714	1493.0286	2272.0000	21811.2000
1969	0.0000	227.2000	1882.5143	811.4286	1363.2000
1970	2174.6286	811.4286	0.0000	1071.0857	1493.0286
1971	0.0000	3765.0286	811.4286	0.0000	389.4857
1972	13047.7714	292.1143	1979.8857	389.4857	97.3714
1973	0.0000	0.0000	0.0000	0.0000	0.0000
1974	0.0000	0.0000	0.0000	0.0000	0.0000
1975	0.0000	0.0000	0.0000	0.0000	0.0000
1976	0.0000	0.0000	0.0000	0.0000	0.0000
1977	0.0000	0.0000	0.0000	0.0000	0.0000
1978	0.0000	0.0000	0.0000	0.0000	0.0000
1979	0.0000	0.0000	0.0000	0.0000	0.0000
1980	0.0000	0.0000	0.0000	0.0000	0.0000
1981	0.0000	0.0000	0.0000	0.0000	0.0000
1982	2466.7429	4965.9429	3050.9714	13210.0571	1363.2000
1983	1395.6571	1785.1429	1882.5143	714.0571	7822.1714
1984	6783.5429	3829.9429	2077.2571	2044.8000	1882.5143
1985	0.0000	16098.7429	2466.7429	1298.2857	2823.7714
1986	8081.8286	584.2286	6686.1714	778.9714	357.0286
1987	0.0000	11749.4857	194.7429	2629.0286	259.6571
1988	5030.8571	129.8286	3213.2571	421.9429	1038.6286
1989	64.9143	11327.5429	1460.5714	2304.4571	454.4000
1990	2791.3143	0.0000	18565.4857	1071.0857	1882.5143
1991	1752.6857	3472.9143	778.9714	6004.5714	292.1143
1992	1298.2857	584.2286	357.0286	227.2000	1071.0857
1993	3797.4857	2109.7143	584.2286	454.4000	389.4857
1994	2269.0789	8707.6023	3254.1531	481.0149	330.4137
1995	1627.0766	4172.0411	7528.1097	2969.1794	536.1920
1996	3524.8457	14907.5657	28744.0457	16893.9429	8497.2800
1997	5825.7326	3319.3920	10884.5029	11870.8754	6521.9383
1998	2672.8457	9581.9977	4048.7040	3437.2114	2773.4629
1999	33135.4971	6581.3349	6950.3726	2327.5017	2085.0469
2000	5937.0606	7692.3429	13322.3589	6521.2891	3604.0411
2001	32501.6091	2789.3669	7910.1303	2707.2503	976.6354
2002	592.9920	62468.6400	21806.6560	10459.3143	3545.9429
2003	32.4571	811.4286	17689.1429	3927.3143	15741.7143
2004	363974.4000	6004.5714	3894.8571	29406.1714	7075.6571
2005	2596.5714	173126.4000	519.3143	1233.3714	10873.1429
2006	6532.3246	1850.0571	93249.3714	1643.9543	2058.1074
2007	2788.7177	22743.6937	5937.0606	146686.8114	1113.2800
2008	5978.6057	2841.6229	8373.9429	712.1097	65850.0251

SURVEY - INPUT DATA

INDEX	6	7	8	9	10
SURVEY TAG	US_Sp	US_Sp	US_Sp	US_S41	US_S41
AGE	6	7	8	1	2
TIME	JAN-1	JAN-1	JAN-1	JAN-1	JAN-1
TYPE	NUMBERS	NUMBERS	NUMBERS	NUMBERS	NUMBERS
RETRO FLAG	1	1	1	1	1
1931	0.0000	0.0000	0.0000	0.0000	0.0000
1932	0.0000	0.0000	0.0000	0.0000	0.0000
1933	0.0000	0.0000	0.0000	0.0000	0.0000
1934	0.0000	0.0000	0.0000	0.0000	0.0000
1935	0.0000	0.0000	0.0000	0.0000	0.0000
1936	0.0000	0.0000	0.0000	0.0000	0.0000
1937	0.0000	0.0000	0.0000	0.0000	0.0000
1938	0.0000	0.0000	0.0000	0.0000	0.0000
1939	0.0000	0.0000	0.0000	0.0000	0.0000
1940	0.0000	0.0000	0.0000	0.0000	0.0000
1941	0.0000	0.0000	0.0000	0.0000	0.0000
1942	0.0000	0.0000	0.0000	0.0000	0.0000
1943	0.0000	0.0000	0.0000	0.0000	0.0000
1944	0.0000	0.0000	0.0000	0.0000	0.0000
1945	0.0000	0.0000	0.0000	0.0000	0.0000
1946	0.0000	0.0000	0.0000	0.0000	0.0000
1947	0.0000	0.0000	0.0000	0.0000	0.0000
1948	0.0000	0.0000	0.0000	0.0000	0.0000
1949	0.0000	0.0000	0.0000	0.0000	0.0000
1950	0.0000	0.0000	0.0000	0.0000	0.0000
1951	0.0000	0.0000	0.0000	0.0000	0.0000
1952	0.0000	0.0000	0.0000	0.0000	0.0000
1953	0.0000	0.0000	0.0000	0.0000	0.0000
1954	0.0000	0.0000	0.0000	0.0000	0.0000
1955	0.0000	0.0000	0.0000	0.0000	0.0000
1956	0.0000	0.0000	0.0000	0.0000	0.0000
1957	0.0000	0.0000	0.0000	0.0000	0.0000
1958	0.0000	0.0000	0.0000	0.0000	0.0000
1959	0.0000	0.0000	0.0000	0.0000	0.0000
1960	0.0000	0.0000	0.0000	0.0000	0.0000
1961	0.0000	0.0000	0.0000	0.0000	0.0000
1962	0.0000	0.0000	0.0000	0.0000	0.0000
1963	0.0000	0.0000	0.0000	0.0000	0.0000
1964	0.0000	0.0000	0.0000	0.0000	0.0000
1965	0.0000	0.0000	0.0000	0.0000	0.0000
1966	0.0000	0.0000	0.0000	0.0000	0.0000
1967	0.0000	0.0000	0.0000	0.0000	0.0000
1968	5452.8000	811.4286	1460.5714	0.0000	0.0000
1969	13729.3714	3343.0857	908.8000	0.0000	0.0000
1970	1493.0286	6491.4286	3180.8000	0.0000	0.0000
1971	389.4857	292.1143	2661.4857	0.0000	0.0000
1972	129.8286	421.9429	97.3714	0.0000	0.0000
1973	0.0000	0.0000	0.0000	99578.5143	15709.2571
1974	0.0000	0.0000	0.0000	6913.3714	43135.5429
1975	0.0000	0.0000	0.0000	3050.9714	3148.3429
1976	0.0000	0.0000	0.0000	262221.2571	973.7143
1977	0.0000	0.0000	0.0000	1979.8857	108439.3143
1978	0.0000	0.0000	0.0000	227.2000	3148.3429
1979	0.0000	0.0000	0.0000	117235.2000	5128.2286
1980	0.0000	0.0000	0.0000	16877.7143	151574.8571
1981	0.0000	0.0000	0.0000	10710.8571	10678.4000
1982	908.8000	1979.8857	0.0000	0.0000	0.0000
1983	32.4571	129.8286	3765.0286	0.0000	0.0000
1984	2336.9143	227.2000	129.8286	0.0000	0.0000
1985	1103.5429	3797.4857	324.5714	0.0000	0.0000
1986	681.6000	389.4857	1071.0857	0.0000	0.0000
1987	324.5714	162.2857	714.0571	0.0000	0.0000
1988	389.4857	357.0286	389.4857	0.0000	0.0000
1989	1330.7429	194.7429	162.2857	0.0000	0.0000
1990	194.7429	421.9429	0.0000	0.0000	0.0000
1991	324.5714	64.9143	129.8286	0.0000	0.0000
1992	97.3714	97.3714	97.3714	0.0000	0.0000
1993	1200.9143	194.7429	64.9143	0.0000	0.0000
1994	213.5680	503.4103	49.0103	0.0000	0.0000
1995	369.6869	92.8274	577.7371	0.0000	0.0000
1996	1132.7543	236.9371	243.4286	0.0000	0.0000
1997	2886.7383	408.9600	228.4983	0.0000	0.0000
1998	695.8811	196.0411	17.8514	0.0000	0.0000
1999	1645.9017	662.7749	651.7394	0.0000	0.0000
2000	3590.7337	3292.4526	1543.3371	0.0000	0.0000
2001	681.6000	373.5817	265.1749	0.0000	0.0000
2002	1548.2057	1969.4994	552.4206	0.0000	0.0000
2003	3115.8857	3700.1143	2791.3143	0.0000	0.0000
2004	8666.0571	1395.6571	3115.8857	0.0000	0.0000
2005	1460.5714	3278.1714	616.6857	0.0000	0.0000
2006	12005.8971	1683.5520	1536.8457	0.0000	0.0000
2007	791.6297	4528.0960	431.0309	0.0000	0.0000
2008	1275.2411	552.7451	2919.8446	0.0000	0.0000

SURVEY - INPUT DATA

INDEX	11	12	13	14	15
SURVEY TAG	US_S41	US_S41	US_S41	US_S41	US_S41
AGE	3	4	5	6	7
TIME	JAN-1	JAN-1	JAN-1	JAN-1	JAN-1
TYPE	NUMBERS	NUMBERS	NUMBERS	NUMBERS	NUMBERS
RETRO FLAG	1	1	1	1	1
1931	0.0000	0.0000	0.0000	0.0000	0.0000
1932	0.0000	0.0000	0.0000	0.0000	0.0000
1933	0.0000	0.0000	0.0000	0.0000	0.0000
1934	0.0000	0.0000	0.0000	0.0000	0.0000
1935	0.0000	0.0000	0.0000	0.0000	0.0000
1936	0.0000	0.0000	0.0000	0.0000	0.0000
1937	0.0000	0.0000	0.0000	0.0000	0.0000
1938	0.0000	0.0000	0.0000	0.0000	0.0000
1939	0.0000	0.0000	0.0000	0.0000	0.0000
1940	0.0000	0.0000	0.0000	0.0000	0.0000
1941	0.0000	0.0000	0.0000	0.0000	0.0000
1942	0.0000	0.0000	0.0000	0.0000	0.0000
1943	0.0000	0.0000	0.0000	0.0000	0.0000
1944	0.0000	0.0000	0.0000	0.0000	0.0000
1945	0.0000	0.0000	0.0000	0.0000	0.0000
1946	0.0000	0.0000	0.0000	0.0000	0.0000
1947	0.0000	0.0000	0.0000	0.0000	0.0000
1948	0.0000	0.0000	0.0000	0.0000	0.0000
1949	0.0000	0.0000	0.0000	0.0000	0.0000
1950	0.0000	0.0000	0.0000	0.0000	0.0000
1951	0.0000	0.0000	0.0000	0.0000	0.0000
1952	0.0000	0.0000	0.0000	0.0000	0.0000
1953	0.0000	0.0000	0.0000	0.0000	0.0000
1954	0.0000	0.0000	0.0000	0.0000	0.0000
1955	0.0000	0.0000	0.0000	0.0000	0.0000
1956	0.0000	0.0000	0.0000	0.0000	0.0000
1957	0.0000	0.0000	0.0000	0.0000	0.0000
1958	0.0000	0.0000	0.0000	0.0000	0.0000
1959	0.0000	0.0000	0.0000	0.0000	0.0000
1960	0.0000	0.0000	0.0000	0.0000	0.0000
1961	0.0000	0.0000	0.0000	0.0000	0.0000
1962	0.0000	0.0000	0.0000	0.0000	0.0000
1963	0.0000	0.0000	0.0000	0.0000	0.0000
1964	0.0000	0.0000	0.0000	0.0000	0.0000
1965	0.0000	0.0000	0.0000	0.0000	0.0000
1966	0.0000	0.0000	0.0000	0.0000	0.0000
1967	0.0000	0.0000	0.0000	0.0000	0.0000
1968	0.0000	0.0000	0.0000	0.0000	0.0000
1969	0.0000	0.0000	0.0000	0.0000	0.0000
1970	0.0000	0.0000	0.0000	0.0000	0.0000
1971	0.0000	0.0000	0.0000	0.0000	0.0000
1972	0.0000	0.0000	0.0000	0.0000	0.0000
1973	0.0000	1752.6857	292.1143	0.0000	584.2286
1974	9282.7429	0.0000	778.9714	0.0000	32.4571
1975	10775.7714	2044.8000	0.0000	421.9429	292.1143
1976	1947.4286	2986.0571	1395.6571	0.0000	129.8286
1977	1363.2000	3959.7714	1947.4286	1460.5714	0.0000
1978	51704.2286	1168.4571	3050.9714	2661.4857	519.3143
1979	3667.6571	18533.0286	1071.0857	519.3143	1200.9143
1980	1655.3143	3375.5429	15806.6286	2174.6286	1200.9143
1981	63258.9714	7108.1143	2466.7429	5777.3714	778.9714
1982	0.0000	0.0000	0.0000	0.0000	0.0000
1983	0.0000	0.0000	0.0000	0.0000	0.0000
1984	0.0000	0.0000	0.0000	0.0000	0.0000
1985	0.0000	0.0000	0.0000	0.0000	0.0000
1986	0.0000	0.0000	0.0000	0.0000	0.0000
1987	0.0000	0.0000	0.0000	0.0000	0.0000
1988	0.0000	0.0000	0.0000	0.0000	0.0000
1989	0.0000	0.0000	0.0000	0.0000	0.0000
1990	0.0000	0.0000	0.0000	0.0000	0.0000
1991	0.0000	0.0000	0.0000	0.0000	0.0000
1992	0.0000	0.0000	0.0000	0.0000	0.0000
1993	0.0000	0.0000	0.0000	0.0000	0.0000
1994	0.0000	0.0000	0.0000	0.0000	0.0000
1995	0.0000	0.0000	0.0000	0.0000	0.0000
1996	0.0000	0.0000	0.0000	0.0000	0.0000
1997	0.0000	0.0000	0.0000	0.0000	0.0000
1998	0.0000	0.0000	0.0000	0.0000	0.0000
1999	0.0000	0.0000	0.0000	0.0000	0.0000
2000	0.0000	0.0000	0.0000	0.0000	0.0000
2001	0.0000	0.0000	0.0000	0.0000	0.0000
2002	0.0000	0.0000	0.0000	0.0000	0.0000
2003	0.0000	0.0000	0.0000	0.0000	0.0000
2004	0.0000	0.0000	0.0000	0.0000	0.0000
2005	0.0000	0.0000	0.0000	0.0000	0.0000
2006	0.0000	0.0000	0.0000	0.0000	0.0000
2007	0.0000	0.0000	0.0000	0.0000	0.0000
2008	0.0000	0.0000	0.0000	0.0000	0.0000

SURVEY - INPUT DATA

INDEX	16	17	18	19	20
SURVEY TAG	US_S41	US_Au0	US_Au1	US_Au2	US_Au3
AGE	8	1	2	3	4
TIME	JAN-1	JAN-1	JAN-1	JAN-1	JAN-1
TYPE	NUMBERS	NUMBERS	NUMBERS	NUMBERS	NUMBERS
RETRO FLAG	1	1	1	1	1
1931	0.0000	0.0000	0.0000	0.0000	0.0000
1932	0.0000	0.0000	0.0000	0.0000	0.0000
1933	0.0000	0.0000	0.0000	0.0000	0.0000
1934	0.0000	0.0000	0.0000	0.0000	0.0000
1935	0.0000	0.0000	0.0000	0.0000	0.0000
1936	0.0000	0.0000	0.0000	0.0000	0.0000
1937	0.0000	0.0000	0.0000	0.0000	0.0000
1938	0.0000	0.0000	0.0000	0.0000	0.0000
1939	0.0000	0.0000	0.0000	0.0000	0.0000
1940	0.0000	0.0000	0.0000	0.0000	0.0000
1941	0.0000	0.0000	0.0000	0.0000	0.0000
1942	0.0000	0.0000	0.0000	0.0000	0.0000
1943	0.0000	0.0000	0.0000	0.0000	0.0000
1944	0.0000	0.0000	0.0000	0.0000	0.0000
1945	0.0000	0.0000	0.0000	0.0000	0.0000
1946	0.0000	0.0000	0.0000	0.0000	0.0000
1947	0.0000	0.0000	0.0000	0.0000	0.0000
1948	0.0000	0.0000	0.0000	0.0000	0.0000
1949	0.0000	0.0000	0.0000	0.0000	0.0000
1950	0.0000	0.0000	0.0000	0.0000	0.0000
1951	0.0000	0.0000	0.0000	0.0000	0.0000
1952	0.0000	0.0000	0.0000	0.0000	0.0000
1953	0.0000	0.0000	0.0000	0.0000	0.0000
1954	0.0000	0.0000	0.0000	0.0000	0.0000
1955	0.0000	0.0000	0.0000	0.0000	0.0000
1956	0.0000	0.0000	0.0000	0.0000	0.0000
1957	0.0000	0.0000	0.0000	0.0000	0.0000
1958	0.0000	0.0000	0.0000	0.0000	0.0000
1959	0.0000	0.0000	0.0000	0.0000	0.0000
1960	0.0000	0.0000	0.0000	0.0000	0.0000
1961	0.0000	0.0000	0.0000	0.0000	0.0000
1962	0.0000	0.0000	0.0000	0.0000	0.0000
1963	0.0000	0.0000	0.0000	0.0000	0.0000
1964	0.0000	272418.3177	82407.3874	29935.5474	22101.0423
1965	0.0000	7689.4217	366335.6571	206888.9691	18909.2069
1966	0.0000	1063.9451	32982.2994	251187.7760	31483.1040
1967	0.0000	19924.7909	3095.1131	9382.0617	59677.6503
1968	0.0000	96.7223	21810.8754	1160.6674	3240.1966
1969	0.0000	290.1669	193.4446	3095.1131	435.2503
1970	0.0000	1257.3897	96.7223	0.0000	918.8617
1971	0.0000	145.0834	13396.0366	677.0560	48.3611
1972	0.0000	7882.8663	0.0000	1015.5840	241.8057
1973	32.4571	21907.5977	8173.0331	0.0000	1692.6400
1974	324.5714	10494.3680	29210.1303	5223.0034	0.0000
1975	32.4571	2418.0571	5754.9760	3191.8354	1015.5840
1976	0.0000	76217.1611	2031.1680	2321.3349	15765.7326
1977	129.8286	14024.7314	208291.4423	1692.6400	1741.0011
1978	194.7429	436.2240	6940.9600	60802.9394	1824.4160
1979	194.7429	42914.8343	2736.7863	3371.3234	30104.0000
1980	1493.0286	4283.6937	147902.0069	119.1177	2935.0994
1981	357.0286	37917.4080	8804.9737	41288.7314	1467.3874
1982	0.0000	1229.4766	19910.5097	6742.6469	12017.9063
1983	0.0000	4400.8640	0.0000	4304.1417	1112.3063
1984	0.0000	18812.4846	773.7783	677.0560	870.5006
1985	0.0000	96.7223	10784.5349	2853.3074	773.7783
1986	0.0000	36838.8571	2109.7143	4965.9429	714.0571
1987	0.0000	0.0000	16585.6000	292.1143	3927.3143
1988	0.0000	5842.2857	0.0000	2564.1143	324.5714
1989	0.0000	227.2000	9802.0571	584.2286	4219.4286
1990	0.0000	1517.0469	159.6891	8782.9029	638.7566
1991	0.0000	2501.7966	2182.4183	79.8446	3859.1543
1992	0.0000	6999.7074	665.3714	771.8309	159.6891
1993	0.0000	9250.2857	6751.0857	746.5143	778.9714
1994	0.0000	4923.7486	13121.1246	6520.6400	984.7497
1995	0.0000	2954.5737	2505.6914	2621.8880	2165.8651
1996	0.0000	7377.1840	23168.2331	15916.9829	7519.0217
1997	0.0000	4255.7806	1765.0194	3005.2069	3369.7006
1998	0.0000	1048.6903	8002.9577	4762.1120	2430.7154
1999	0.0000	14007.8537	9050.0251	8027.6251	2347.6251
2000	0.0000	5922.4549	2728.0229	10934.1623	26129.9474
2001	0.0000	13433.3623	9161.0286	17790.7337	10076.6446
2002	0.0000	2774.4366	28471.0811	5458.6423	24146.8160
2003	0.0000	377.4766	6203.2091	72275.5657	17672.9143
2004	0.0000	501602.0983	230.7703	1464.1417	27760.5943
2005	0.0000	5287.9177	531167.9589	710.8114	2740.6811
2006	0.0000	13817.9794	5744.9143	250706.7611	904.2560
2007	0.0000	3050.9714	14742.3589	2374.2400	156978.6469
2008	0.0000	0.0000	0.0000	0.0000	0.0000

SURVEY - INPUT DATA

INDEX	21	22	23	24	25
SURVEY TAG	US_Au4	US_Au5	Can_Sp	Can_Sp	Can_Sp
AGE	5	6	1	2	3
TIME	JAN-1	JAN-1	JAN-1	JAN-1	JAN-1
TYPE	NUMBERS	NUMBERS	NUMBERS	NUMBERS	NUMBERS
RETRO FLAG	1	1	1	1	1
1931	0.0000	0.0000	0.0000	0.0000	0.0000
1932	0.0000	0.0000	0.0000	0.0000	0.0000
1933	0.0000	0.0000	0.0000	0.0000	0.0000
1934	0.0000	0.0000	0.0000	0.0000	0.0000
1935	0.0000	0.0000	0.0000	0.0000	0.0000
1936	0.0000	0.0000	0.0000	0.0000	0.0000
1937	0.0000	0.0000	0.0000	0.0000	0.0000
1938	0.0000	0.0000	0.0000	0.0000	0.0000
1939	0.0000	0.0000	0.0000	0.0000	0.0000
1940	0.0000	0.0000	0.0000	0.0000	0.0000
1941	0.0000	0.0000	0.0000	0.0000	0.0000
1942	0.0000	0.0000	0.0000	0.0000	0.0000
1943	0.0000	0.0000	0.0000	0.0000	0.0000
1944	0.0000	0.0000	0.0000	0.0000	0.0000
1945	0.0000	0.0000	0.0000	0.0000	0.0000
1946	0.0000	0.0000	0.0000	0.0000	0.0000
1947	0.0000	0.0000	0.0000	0.0000	0.0000
1948	0.0000	0.0000	0.0000	0.0000	0.0000
1949	0.0000	0.0000	0.0000	0.0000	0.0000
1950	0.0000	0.0000	0.0000	0.0000	0.0000
1951	0.0000	0.0000	0.0000	0.0000	0.0000
1952	0.0000	0.0000	0.0000	0.0000	0.0000
1953	0.0000	0.0000	0.0000	0.0000	0.0000
1954	0.0000	0.0000	0.0000	0.0000	0.0000
1955	0.0000	0.0000	0.0000	0.0000	0.0000
1956	0.0000	0.0000	0.0000	0.0000	0.0000
1957	0.0000	0.0000	0.0000	0.0000	0.0000
1958	0.0000	0.0000	0.0000	0.0000	0.0000
1959	0.0000	0.0000	0.0000	0.0000	0.0000
1960	0.0000	0.0000	0.0000	0.0000	0.0000
1961	0.0000	0.0000	0.0000	0.0000	0.0000
1962	0.0000	0.0000	0.0000	0.0000	0.0000
1963	0.0000	0.0000	0.0000	0.0000	0.0000
1964	27082.2400	19296.0960	0.0000	0.0000	0.0000
1965	5803.3371	12380.4526	0.0000	0.0000	0.0000
1966	3482.0023	2611.5017	0.0000	0.0000	0.0000
1967	10881.2571	1692.6400	0.0000	0.0000	0.0000
1968	21955.9589	5271.3646	0.0000	0.0000	0.0000
1969	1063.9451	12525.5360	0.0000	0.0000	0.0000
1970	435.2503	531.9726	0.0000	0.0000	0.0000
1971	918.8617	870.5006	0.0000	0.0000	0.0000
1972	48.3611	725.4171	0.0000	0.0000	0.0000
1973	290.1669	0.0000	0.0000	0.0000	0.0000
1974	628.6949	145.0834	0.0000	0.0000	0.0000
1975	0.0000	48.3611	0.0000	0.0000	0.0000
1976	2998.3909	0.0000	0.0000	0.0000	0.0000
1977	2659.8629	967.2229	0.0000	0.0000	0.0000
1978	1864.0137	2062.3269	0.0000	0.0000	0.0000
1979	594.9394	832.8503	0.0000	0.0000	0.0000
1980	12374.6103	832.8503	0.0000	0.0000	0.0000
1981	594.9394	5513.1703	0.0000	0.0000	0.0000
1982	674.1349	1348.5943	0.0000	0.0000	0.0000
1983	4545.9474	435.2503	0.0000	0.0000	0.0000
1984	967.2229	3046.7520	0.0000	0.0000	0.0000
1985	918.8617	193.4446	0.0000	0.0000	0.0000
1986	162.2857	324.5714	5713.9874	309.6249	8514.6857
1987	194.7429	421.9429	42.2216	4278.4536	971.0964
1988	2499.2000	194.7429	2068.8575	70.3693	12005.0031
1989	389.4857	1298.2857	42.2216	7515.4416	1013.3180
1990	2155.8034	292.7634	1308.8690	154.8125	13890.9005
1991	159.6891	558.9120	1055.5395	2350.3347	197.0340
1992	718.6011	53.2297	4644.3740	4151.7889	1590.3463
1993	0.0000	1525.4857	5573.2488	3039.9539	774.0623
1994	0.0000	186.3040	4672.5217	16213.0875	5742.1351
1995	401.8194	147.0309	2730.3290	3687.3515	6051.7601
1996	1221.6869	38.6240	8599.1289	4067.3457	6811.7486
1997	1582.6103	462.8389	2448.8518	1632.5678	1393.3122
1998	1776.7040	1056.4800	3391.8004	11512.4180	4334.7491
1999	1337.5589	570.9211	27795.8748	4799.1865	10076.8842
2000	11429.4583	7535.5749	25797.3866	96546.6841	13116.8381
2001	3561.8469	2143.1451	31356.5615	3982.9026	15312.3604
2002	6877.3440	3774.1166	2786.6244	44614.1383	9359.1173
2003	27709.3120	6074.6789	1922.0671	3582.3605	97566.8982
2004	5758.8709	10892.6171	207872.0477	579.8431	2806.8908
2005	44206.3040	3814.0389	0.0000	0.0000	0.0000
2006	2260.3154	15370.4046	0.0000	0.0000	0.0000
2007	1282.0571	1404.0960	4215.1298	15001.2952	4418.9837
2008	0.0000	0.0000	3923.2138	1248.3493	4813.2667

SURVEY - INPUT DATA

INDEX	26	27	28	29	30
SURVEY TAG	Can_Sp	Can_Sp	Can_Sp	Can_Sp	Can_Sp
AGE	4	5	6	7	8
TIME	JAN-1	JAN-1	JAN-1	JAN-1	JAN-1
TYPE	NUMBERS	NUMBERS	NUMBERS	NUMBERS	NUMBERS
RETRO FLAG	1	1	1	1	1
1931	0.0000	0.0000	0.0000	0.0000	0.0000
1932	0.0000	0.0000	0.0000	0.0000	0.0000
1933	0.0000	0.0000	0.0000	0.0000	0.0000
1934	0.0000	0.0000	0.0000	0.0000	0.0000
1935	0.0000	0.0000	0.0000	0.0000	0.0000
1936	0.0000	0.0000	0.0000	0.0000	0.0000
1937	0.0000	0.0000	0.0000	0.0000	0.0000
1938	0.0000	0.0000	0.0000	0.0000	0.0000
1939	0.0000	0.0000	0.0000	0.0000	0.0000
1940	0.0000	0.0000	0.0000	0.0000	0.0000
1941	0.0000	0.0000	0.0000	0.0000	0.0000
1942	0.0000	0.0000	0.0000	0.0000	0.0000
1943	0.0000	0.0000	0.0000	0.0000	0.0000
1944	0.0000	0.0000	0.0000	0.0000	0.0000
1945	0.0000	0.0000	0.0000	0.0000	0.0000
1946	0.0000	0.0000	0.0000	0.0000	0.0000
1947	0.0000	0.0000	0.0000	0.0000	0.0000
1948	0.0000	0.0000	0.0000	0.0000	0.0000
1949	0.0000	0.0000	0.0000	0.0000	0.0000
1950	0.0000	0.0000	0.0000	0.0000	0.0000
1951	0.0000	0.0000	0.0000	0.0000	0.0000
1952	0.0000	0.0000	0.0000	0.0000	0.0000
1953	0.0000	0.0000	0.0000	0.0000	0.0000
1954	0.0000	0.0000	0.0000	0.0000	0.0000
1955	0.0000	0.0000	0.0000	0.0000	0.0000
1956	0.0000	0.0000	0.0000	0.0000	0.0000
1957	0.0000	0.0000	0.0000	0.0000	0.0000
1958	0.0000	0.0000	0.0000	0.0000	0.0000
1959	0.0000	0.0000	0.0000	0.0000	0.0000
1960	0.0000	0.0000	0.0000	0.0000	0.0000
1961	0.0000	0.0000	0.0000	0.0000	0.0000
1962	0.0000	0.0000	0.0000	0.0000	0.0000
1963	0.0000	0.0000	0.0000	0.0000	0.0000
1964	0.0000	0.0000	0.0000	0.0000	0.0000
1965	0.0000	0.0000	0.0000	0.0000	0.0000
1966	0.0000	0.0000	0.0000	0.0000	0.0000
1967	0.0000	0.0000	0.0000	0.0000	0.0000
1968	0.0000	0.0000	0.0000	0.0000	0.0000
1969	0.0000	0.0000	0.0000	0.0000	0.0000
1970	0.0000	0.0000	0.0000	0.0000	0.0000
1971	0.0000	0.0000	0.0000	0.0000	0.0000
1972	0.0000	0.0000	0.0000	0.0000	0.0000
1973	0.0000	0.0000	0.0000	0.0000	0.0000
1974	0.0000	0.0000	0.0000	0.0000	0.0000
1975	0.0000	0.0000	0.0000	0.0000	0.0000
1976	0.0000	0.0000	0.0000	0.0000	0.0000
1977	0.0000	0.0000	0.0000	0.0000	0.0000
1978	0.0000	0.0000	0.0000	0.0000	0.0000
1979	0.0000	0.0000	0.0000	0.0000	0.0000
1980	0.0000	0.0000	0.0000	0.0000	0.0000
1981	0.0000	0.0000	0.0000	0.0000	0.0000
1982	0.0000	0.0000	0.0000	0.0000	0.0000
1983	0.0000	0.0000	0.0000	0.0000	0.0000
1984	0.0000	0.0000	0.0000	0.0000	0.0000
1985	0.0000	0.0000	0.0000	0.0000	0.0000
1986	1505.9031	267.4034	408.1420	478.5113	520.7328
1987	3532.5390	942.9487	112.5909	422.2158	140.7386
1988	239.2556	4011.0503	253.3295	239.2556	154.8125
1989	2983.6585	267.4034	591.1021	42.2216	42.2216
1990	182.9602	4728.8172	323.6988	1534.0508	182.9602
1991	12652.4007	154.8125	2251.8177	126.6647	619.2499
1992	239.2556	5376.2148	42.2216	1491.8292	56.2954
1993	633.3237	56.2954	1801.4542	28.1477	450.3635
1994	591.1021	337.7727	28.1477	985.1702	14.0739
1995	3124.3971	788.1362	42.2216	0.0000	675.5453
1996	7093.2258	4109.5673	365.9204	337.7727	56.2954
1997	3293.2834	3335.5050	2392.5563	323.6988	126.6647
1998	3616.9822	5291.7716	5165.1069	2786.6244	337.7727
1999	3110.3232	1970.3405	1899.9712	1773.3064	464.4374
2000	12539.8098	2969.5846	2181.4484	2730.3290	1604.4201
2001	4348.8229	5812.5044	1815.5280	1618.4940	1984.4144
2002	21617.4500	6079.9078	7487.2939	2237.7438	1857.7496
2003	7228.6163	18640.2655	4132.9299	3779.3945	1697.4483
2004	55692.3777	5541.3012	10383.9759	1738.9662	1023.4511
2005	0.0000	0.0000	0.0000	0.0000	0.0000
2006	0.0000	0.0000	0.0000	0.0000	0.0000
2007	80460.3945	1120.6229	177.5060	4177.2086	299.0375
2008	5203.7707	109124.4661	1008.9984	194.6924	8594.6729

Additional Output Files

Population File C:\X-APPS\ADAPT\VPA280\GARM3_REVIEW\BASE_CASE\31T007_BOOTRUN\GAR
 Auxilliary File C:\X-APPS\ADAPT\VPA280\GARM3_REVIEW\BASE_CASE\31T007_BOOTRUN\GAR
 Covariance File C:\X-APPS\ADAPT\VPA280\GARM3_REVIEW\BASE_CASE\31T007_BOOTRUN\GAR
 Residuals File C:\X-APPS\ADAPT\VPA280\GARM3_REVIEW\BASE_CASE\31T007_BOOTRUN\GAR
 Log File C:\X-APPS\ADAPT\VPA280\GARM3_REVIEW\BASE_CASE\31T007_BOOTRUN\GAR

Estimation Results
 JAN-1 Population Numbers

AGE	1931	1932	1933	1934	1935
1	39938.	45315.	51615.	59569.	58214.
2	80387.	31115.	36994.	42038.	48463.
3	14081.	57882.	23594.	22668.	30403.
4	17665.	9690.	24276.	13906.	13693.
5	17144.	9275.	5758.	10890.	8032.
6	10197.	5932.	4304.	2841.	6090.
7	5491.	2979.	2275.	2110.	1384.
8	3086.	1496.	1260.	785.	1172.
9	961.	881.	1515.	527.	289.

=====
 Total 188951. 164565. 151591. 155335. 167739.

AGE	1936	1937	1938	1939	1940
1	57147.	105311.	78051.	59486.	111227.
2	46580.	45993.	85058.	62972.	48155.
3	29009.	27065.	27739.	51484.	39026.
4	16976.	13472.	12397.	15748.	24588.
5	7883.	9028.	5996.	6781.	8264.
6	3939.	4531.	3691.	3016.	3621.
7	2787.	1991.	2033.	1592.	1602.
8	686.	1066.	780.	821.	558.
9	329.	492.	413.	602.	342.

=====
 Total 165336. 208949. 216158. 202501. 237382.

AGE	1941	1942	1943	1944	1945
1	114267.	61875.	23306.	65151.	51807.
2	89222.	92850.	50379.	19064.	53283.
3	32893.	51973.	63135.	37467.	14922.
4	20903.	18129.	27887.	35765.	23090.
5	12732.	9923.	8992.	15326.	16006.
6	4513.	5276.	4549.	4581.	7453.
7	1642.	2101.	2236.	1332.	1717.
8	640.	508.	796.	1123.	645.
9	801.	394.	400.	259.	499.

=====
 Total 277614. 243027. 181680. 180068. 169422.

AGE	1946	1947	1948	1949	1950
1	93899.	59136.	32955.	124141.	57212.
2	42306.	76689.	48335.	26909.	101342.
3	35951.	27917.	47841.	29481.	16214.
4	10389.	15832.	13602.	21957.	12979.
5	13170.	6046.	6548.	6555.	9390.
6	7914.	5613.	3044.	2907.	3264.
7	4025.	3053.	2152.	1457.	1430.
8	592.	1664.	1161.	1063.	635.
9	50.	1021.	952.	918.	705.

=====
 Total 208296. 196971. 156589. 215387. 203172

JAN-1 Population Numbers

AGE	1951	1952	1953	1954	1955
1	103780.	42290.	132790.	52280.	89900.
2	46762.	84386.	34620.	107741.	42706.
3	56964.	30845.	46546.	26714.	59619.
4	9585.	23002.	17272.	22360.	17276.
5	6796.	5891.	11233.	9007.	13265.
6	4718.	3371.	3599.	5828.	5295.
7	1659.	1953.	1912.	2038.	2863.
8	705.	697.	1123.	1079.	1024.
9	510.	410.	506.	300.	553.

=====
 Total 231479. 192843. 249602. 227348. 232502.

AGE	1956	1957	1958	1959	1960
1	60261.	59630.	58676.	129847.	122245.
2	73523.	49291.	48790.	47927.	106224.

3	31411.	49438.	34415.	34924.	34088.
4	31547.	19693.	27866.	21801.	21407.
5	11161.	15026.	12058.	16825.	13203.
6	7915.	6083.	7091.	6477.	10239.
7	2856.	3460.	2870.	3684.	3725.
8	1388.	1135.	1378.	1540.	1965.
9	495.	878.	443.	1213.	1685.

=====
Total 220557. 204634. 193586. 264238. 314780.

AGE	1961	1962	1963	1964	1965
-----	------	------	------	------	------

1	54312.	39050.	188241.	460816.	32513.
2	99853.	44411.	31905.	151491.	368163.
3	72550.	72117.	32344.	22475.	109665.
4	22399.	45973.	44439.	19812.	14304.
5	13424.	14561.	28253.	26363.	11929.
6	8053.	8367.	8822.	15773.	13764.
7	6770.	4925.	4974.	5242.	7724.
8	2342.	4403.	2627.	2811.	2428.
9	3182.	3337.	3994.	3642.	3032.

=====
Total 282883. 237143. 345599. 708424. 563523.

AGE	1966	1967	1968	1969	1970
-----	------	------	------	------	------

1	4155.	14013.	542.	1111.	4616.
2	18003.	3299.	10436.	437.	908.
3	188650.	8612.	2549.	5856.	348.
4	49979.	64678.	4459.	1451.	3271.
5	6915.	23760.	34417.	1934.	786.
6	5833.	3185.	10213.	15196.	997.
7	5300.	2461.	1525.	5225.	7112.
8	2959.	2256.	1126.	652.	2866.
9	2023.	1717.	2094.	1653.	1782.

=====
Total 283817. 123980. 67362. 33515. 22685.

JAN-1 Population Numbers

AGE	1971	1972	1973	1974	1975
-----	------	------	------	------	------

1	267.	8526.	19498.	10577.	7930.
2	3737.	217.	6836.	13615.	8617.
3	601.	1828.	176.	3701.	7129.
4	270.	292.	1083.	141.	2417.
5	2165.	185.	165.	535.	114.
6	476.	1512.	122.	87.	372.
7	624.	171.	1127.	73.	69.
8	3753.	256.	68.	852.	57.
9	2371.	4801.	2036.	4002.	1276.

=====
Total 14264. 17789. 31112. 33582. 27981.

AGE	1976	1977	1978	1979	1980
-----	------	------	------	------	------

1	105349.	13984.	6125.	83889.	10935.
2	6313.	86118.	11448.	5014.	68676.
3	6091.	4726.	52656.	8681.	4081.
4	4105.	4473.	3699.	30082.	5540.
5	1630.	2540.	3041.	2751.	18125.
6	90.	1132.	1610.	1975.	1775.
7	266.	73.	602.	851.	1245.
8	53.	196.	56.	367.	412.
9	1495.	558.	270.	176.	218.

=====
Total 125391. 113801. 79507. 133787. 111007.

AGE	1981	1982	1983	1984	1985
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1	7364.	2581.	3284.	18083.	2519.
2	8946.	6028.	2112.	2689.	14804.
3	28385.	5745.	3880.	1535.	2116.
4	3027.	13326.	3227.	2438.	986.
5	3653.	1727.	7534.	2015.	1336.
6	9382.	2143.	1060.	4139.	1288.
7	918.	5355.	1240.	621.	2045.
8	529.	453.	3371.	846.	296.
9	315.	470.	320.	1720.	577.

=====
Total 62518. 37828. 26027. 34085. 25967.

AGE	1986	1987	1988	1989	1990
-----	------	------	------	------	------

1	16793.	2618.	20015.	1366.	3415.
2	2062.	13744.	2143.	16383.	1117.
3	9902.	1639.	9419.	1707.	12095.

4	1227.	5551.	1223.	5521.	1287.
5	628.	801.	3068.	878.	3603.
6	671.	382.	544.	1657.	524.
7	845.	391.	245.	308.	928.
8	1190.	555.	239.	150.	197.
9	268.	707.	395.	230.	174.
=====					
Total	33587.	26387.	37292.	28201.	23339.

JAN-1 Population Numbers

AGE	1991	1992	1993	1994	1995
1	2725.	10812.	15695.	15580.	12850.
2	2739.	2225.	8776.	12820.	12731.
3	904.	1805.	1583.	6857.	10011.
4	8374.	629.	1112.	901.	4542.
5	812.	4728.	338.	605.	521.
6	1942.	535.	2118.	169.	367.
7	290.	1125.	275.	1070.	73.
8	564.	123.	540.	169.	594.
9	213.	263.	262.	336.	157.
=====					
Total	18563.	22245.	30699.	38508.	41846.

AGE	1996	1997	1998	1999	2000
1	11939.	23830.	14944.	50508.	11982.
2	10505.	9769.	19497.	12230.	41348.
3	10339.	8550.	7868.	15755.	9974.
4	7642.	7954.	6754.	6017.	12082.
5	3294.	5429.	5840.	5027.	4439.
6	374.	2291.	3939.	4090.	3570.
7	274.	246.	1680.	2711.	2839.
8	52.	205.	186.	1223.	1874.
9	591.	543.	386.	357.	715.
=====					
Total	45010.	58816.	61094.	97917.	88822.

AGE	2001	2002	2003	2004	2005
1	97844.	5779.	2884.	494868.	8048.
2	9808.	80095.	4728.	2357.	404580.
3	33486.	7899.	65218.	3855.	1900.
4	7602.	25257.	6156.	51642.	3047.
5	8476.	5326.	17815.	4624.	37669.
6	3104.	5787.	3527.	12167.	3129.
7	2447.	1952.	3743.	2343.	7323.
8	1985.	1610.	1237.	2417.	1302.
9	1451.	2896.	2265.	1753.	1418.
=====					
Total	166203.	136600.	107574.	576027.	468416.

AGE	2006	2007	2008
1	26450.	7421.	16376.
2	6572.	21507.	6064.
3	330689.	5364.	17450.
4	1518.	267887.	4175.
5	2189.	1179.	209204.
6	23194.	1454.	790.
7	1863.	14119.	911.
8	4340.	1231.	9299.
9	1173.	3036.	300.
=====			
Total	397987.	323198.	264569.

Fishing Mortality Calculated

AGE	1931	1932	1933	1934	1935
1	0.0497	0.0029	0.0052	0.0063	0.0229
2	0.1284	0.0767	0.2898	0.1240	0.3132
3	0.1737	0.6689	0.3287	0.3041	0.3828
4	0.4442	0.3205	0.0016	0.3489	0.3522
5	0.8614	0.5677	0.5066	0.3813	0.5125
6	1.0305	0.7585	0.5130	0.5188	0.5818
7	1.1002	0.6608	0.8644	0.3881	0.5015
8	0.9973	0.6623	0.6280	0.4294	0.5319
9	0.9973	0.6623	0.6280	0.4294	0.5319
AGE	1936	1937	1938	1939	1940
1	0.0171	0.0136	0.0147	0.0113	0.0204
2	0.3430	0.3056	0.3021	0.2785	0.1812
3	0.5670	0.5807	0.3661	0.5390	0.4243
4	0.4315	0.6095	0.4034	0.4448	0.4581
5	0.3537	0.6943	0.4873	0.4272	0.4048
6	0.4823	0.6016	0.6410	0.4327	0.5910
7	0.7605	0.7365	0.7072	0.8488	0.7173
8	0.5322	0.6775	0.6118	0.5696	0.5710
9	0.5322	0.6775	0.6118	0.5696	0.5710
AGE	1941	1942	1943	1944	1945
1	0.0076	0.0055	0.0009	0.0011	0.0026
2	0.3404	0.1857	0.0961	0.0450	0.1935
3	0.3958	0.4226	0.3683	0.2841	0.1621
4	0.5451	0.5012	0.3986	0.6040	0.3614
5	0.6810	0.5800	0.4743	0.5209	0.5044
6	0.5645	0.6582	1.0282	0.7816	0.4160
7	0.9739	0.7702	0.4887	0.5245	0.8655
8	0.7398	0.6695	0.6638	0.6090	0.5953
9	0.7398	0.6695	0.6638	0.6090	0.5953
AGE	1946	1947	1948	1949	1950
1	0.0025	0.0017	0.0027	0.0029	0.0017
2	0.2157	0.2719	0.2944	0.3066	0.3761
3	0.6201	0.5191	0.5788	0.6204	0.3257
4	0.3413	0.6829	0.5300	0.6494	0.4470
5	0.6529	0.4862	0.6120	0.4973	0.4884
6	0.7525	0.7587	0.5372	0.5097	0.4769
7	0.6835	0.7671	0.5052	0.6307	0.5075
8	0.6963	0.6707	0.5515	0.5459	0.4909
9	0.6963	0.6707	0.5515	0.5459	0.4909

Fishing Mortality Calculated

AGE	1951	1952	1953	1954	1955
1	0.0069	0.0001	0.0090	0.0023	0.0011
2	0.2161	0.3950	0.0593	0.3918	0.1072
3	0.7068	0.3799	0.5332	0.2359	0.4365
4	0.2869	0.5167	0.4511	0.3221	0.2369
5	0.5011	0.2926	0.4561	0.3313	0.3164
6	0.6821	0.3669	0.3686	0.5108	0.4174
7	0.6672	0.3534	0.3722	0.4887	0.5243
8	0.6168	0.3376	0.3990	0.4436	0.4194
9	0.6168	0.3376	0.3990	0.4436	0.4194
AGE	1956	1957	1958	1959	1960
1	0.0010	0.0006	0.0024	0.0008	0.0023
2	0.1969	0.1592	0.1343	0.1407	0.1813
3	0.2669	0.3733	0.2565	0.2895	0.2199
4	0.5417	0.2906	0.3046	0.3015	0.2667
5	0.4070	0.5510	0.4214	0.2967	0.2944
6	0.6274	0.5511	0.4547	0.3534	0.2137
7	0.7229	0.7207	0.4227	0.4285	0.2641
8	0.5858	0.6076	0.4329	0.3595	0.2574
9	0.5858	0.6076	0.4329	0.3595	0.2574
AGE	1961	1962	1963	1964	1965
1	0.0013	0.0021	0.0172	0.0245	0.3911
2	0.1254	0.1171	0.1504	0.1231	0.4686
3	0.2562	0.2842	0.2901	0.2518	0.5858
4	0.2307	0.2868	0.3221	0.3074	0.5269

5	0.2727	0.3011	0.3829	0.4499	0.5153
6	0.2918	0.3202	0.3206	0.5139	0.7543
7	0.2301	0.4283	0.3707	0.5694	0.7595
8	0.2649	0.3498	0.3581	0.5111	0.6764
9	0.2649	0.3498	0.3581	0.5111	0.6764
AGE	1966	1967	1968	1969	1970
1	0.0307	0.0948	0.0164	0.0020	0.0111
2	0.5373	0.0578	0.3777	0.0282	0.2124
3	0.8705	0.4582	0.3638	0.3825	0.0521
4	0.5436	0.4309	0.6355	0.4131	0.2127
5	0.5753	0.6443	0.6175	0.4625	0.3009
6	0.6631	0.5364	0.4701	0.5592	0.2689
7	0.6544	0.5815	0.6491	0.4007	0.4392
8	0.6309	0.5874	0.5789	0.4741	0.3363
9	0.6309	0.5874	0.5789	0.4741	0.3363

Fishing Mortality Calculated

AGE	1971	1972	1973	1974	1975
1	0.0041	0.0209	0.1592	0.0050	0.0280
2	0.5150	0.0102	0.4136	0.4470	0.1469
3	0.5207	0.3234	0.0196	0.2261	0.3519
4	0.1778	0.3725	0.5059	0.0165	0.1942
5	0.1589	0.2159	0.4442	0.1618	0.0405
6	0.8264	0.0937	0.3214	0.0271	0.1373
7	0.6898	0.7136	0.0797	0.0325	0.0677
8	0.5584	0.3411	0.2818	0.0738	0.0818
9	0.5584	0.3411	0.2818	0.0738	0.0818
AGE	1976	1977	1978	1979	1980
1	0.0016	0.0001	0.0002	0.0001	0.0008
2	0.0895	0.2919	0.0767	0.0058	0.6835
3	0.1089	0.0452	0.3598	0.2492	0.0989
4	0.2799	0.1858	0.0960	0.3067	0.2164
5	0.1640	0.2560	0.2314	0.2379	0.4585
6	0.0001	0.4311	0.4377	0.2616	0.4595
7	0.1043	0.0636	0.2948	0.5254	0.6564
8	0.0895	0.2502	0.3213	0.3416	0.5248
9	0.0895	0.2502	0.3213	0.3416	0.5248
AGE	1981	1982	1983	1984	1985
1	0.0001	0.0004	0.0001	0.0001	0.0001
2	0.2429	0.2407	0.1195	0.0394	0.2021
3	0.5562	0.3769	0.2646	0.2424	0.3452
4	0.3613	0.3703	0.2708	0.4017	0.2503
5	0.3333	0.2883	0.3990	0.2473	0.4891
6	0.3607	0.3473	0.3347	0.5051	0.2222
7	0.5064	0.2630	0.1824	0.5398	0.3410
8	0.4001	0.2995	0.3054	0.4307	0.3508
9	0.4001	0.2995	0.3054	0.4307	0.3508
AGE	1986	1987	1988	1989	1990
1	0.0004	0.0001	0.0002	0.0015	0.0205
2	0.0297	0.1778	0.0278	0.1035	0.0115
3	0.3789	0.0926	0.3342	0.0824	0.1677
4	0.2262	0.3930	0.1317	0.2267	0.2608
5	0.2991	0.1874	0.4159	0.3170	0.4183
6	0.3383	0.2415	0.3672	0.3800	0.3902
7	0.2204	0.2940	0.2903	0.2482	0.2977
8	0.2859	0.2410	0.3578	0.3151	0.3687
9	0.2859	0.2410	0.3578	0.3151	0.3687

Fishing Mortality Calculated

AGE	1991	1992	1993	1994	1995
1	0.0028	0.0086	0.0023	0.0019	0.0015
2	0.2170	0.1406	0.0467	0.0473	0.0081
3	0.1620	0.2849	0.3628	0.2120	0.0700
4	0.3716	0.4206	0.4089	0.3480	0.1212
5	0.2174	0.6031	0.4918	0.2984	0.1329
6	0.3459	0.4637	0.4831	0.6407	0.0923
7	0.6562	0.5342	0.2872	0.3874	0.1370
8	0.4065	0.5336	0.4207	0.4422	0.1207
9	0.4065	0.5336	0.4207	0.4422	0.1207
AGE	1996	1997	1998	1999	2000
1	0.0006	0.0007	0.0004	0.0001	0.0001
2	0.0059	0.0163	0.0131	0.0039	0.0109
3	0.0623	0.0358	0.0682	0.0655	0.0716
4	0.1419	0.1089	0.0954	0.1043	0.1544
5	0.1630	0.1209	0.1562	0.1423	0.1576
6	0.2160	0.1106	0.1736	0.1650	0.1775
7	0.0930	0.0815	0.1174	0.1692	0.1580
8	0.1573	0.1043	0.1491	0.1588	0.1643
9	0.1573	0.1043	0.1491	0.1588	0.1643
AGE	2001	2002	2003	2004	2005
1	0.0002	0.0006	0.0017	0.0014	0.0027
2	0.0165	0.0055	0.0041	0.0156	0.0017
3	0.0820	0.0494	0.0334	0.0354	0.0246
4	0.1557	0.1490	0.0861	0.1155	0.1307
5	0.1817	0.2122	0.1813	0.1905	0.2850
6	0.2640	0.2357	0.2090	0.3077	0.3185
7	0.2189	0.2562	0.2372	0.3875	0.3231
8	0.2215	0.2347	0.2092	0.2952	0.3089
9	0.2215	0.2347	0.2092	0.2952	0.3089
AGE	2006	2007			
1	0.0069	0.0019			
2	0.0031	0.0090			
3	0.0106	0.0506			
4	0.0529	0.0473			
5	0.2088	0.1999			
6	0.2964	0.2681			
7	0.2140	0.2176			
8	0.2397	0.2285			
9	0.2397	0.2285			

Average Fishing Mortality For Ages 5- 7

Year	Average F	N Weighted	Biomass Wtd	Catch Wtd
1931	0.9973	0.9538	0.9674	0.9601
1932	0.6623	0.6452	0.6521	0.6533
1933	0.6280	0.5748	0.5857	0.5974
1934	0.4294	0.4068	0.4094	0.4121
1935	0.5319	0.5387	0.5396	0.5404
1936	0.5322	0.4660	0.4819	0.5035
1937	0.6775	0.6727	0.6735	0.6751
1938	0.6118	0.5738	0.5840	0.5847
1939	0.5696	0.4876	0.4993	0.5178
1940	0.5710	0.4919	0.5100	0.5125
1941	0.7398	0.6786	0.6841	0.6890
1942	0.6695	0.6270	0.6365	0.6315
1943	0.6638	0.6360	0.6436	0.7026
1944	0.6090	0.5774	0.5849	0.5914
1945	0.5953	0.5029	0.5078	0.5183
1946	0.6963	0.6892	0.6926	0.6912
1947	0.6707	0.6484	0.6619	0.6696
1948	0.5515	0.5730	0.5665	0.5757
1949	0.5459	0.5184	0.5240	0.5212
1950	0.4909	0.4877	0.4880	0.4878
1951	0.6168	0.5869	0.6016	0.5969
1952	0.3376	0.3255	0.3309	0.3287
1953	0.3990	0.4277	0.4212	0.4309
1954	0.4436	0.4123	0.4254	0.4273
1955	0.4194	0.3691	0.3788	0.3812
1956	0.5858	0.5277	0.5465	0.5509
1957	0.6076	0.5749	0.5821	0.5792
1958	0.4329	0.4323	0.4334	0.4327
1959	0.3595	0.3283	0.3362	0.3337
1960	0.2574	0.2599	0.2562	0.2646

1961	0.2649	0.2679	0.2656	0.2696
1962	0.3498	0.3293	0.3354	0.3347
1963	0.3581	0.3684	0.3661	0.3698
1964	0.5111	0.4844	0.4900	0.4872
1965	0.6764	0.6702	0.6820	0.6850
1966	0.6309	0.6269	0.6319	0.6289
1967	0.5874	0.6274	0.6216	0.6290
1968	0.5789	0.5860	0.5807	0.5911
1969	0.4741	0.5138	0.5068	0.5210
1970	0.3363	0.4079	0.4109	0.4162
1971	0.5584	0.3577	0.3813	0.5437
1972	0.3411	0.1625	0.1669	0.3209
1973	0.2818	0.1431	0.1304	0.2459
1974	0.0738	0.1315	0.1241	0.1546
1975	0.0818	0.1088	0.1101	0.1241
1976	0.0895	0.1486	0.1461	0.1582
1977	0.2502	0.3051	0.3117	0.3264
1978	0.3213	0.3019	0.3092	0.3258
1979	0.3416	0.2902	0.3037	0.3181
1980	0.5248	0.4702	0.4763	0.4736
1981	0.4001	0.3631	0.3677	0.3666
1982	0.2995	0.2873	0.2849	0.2908
1983	0.3054	0.3648	0.3541	0.3776
1984	0.4307	0.4316	0.4431	0.4605
1985	0.3508	0.3506	0.3448	0.3749
1986	0.2859	0.2804	0.2777	0.2884
1987	0.2410	0.2270	0.2341	0.2347
1988	0.3578	0.4010	0.3978	0.4034
1989	0.3151	0.3463	0.3453	0.3512
1990	0.3687	0.3932	0.3871	0.3978
1991	0.4065	0.3412	0.3512	0.3727
1992	0.5336	0.5793	0.5747	0.5818
1993	0.4207	0.4645	0.4624	0.4710
1994	0.4422	0.3815	0.3822	0.3987
1995	0.1207	0.1177	0.1167	0.1209
1996	0.1573	0.1632	0.1620	0.1666
1997	0.1043	0.1167	0.1160	0.1172
1998	0.1491	0.1565	0.1557	0.1584
1999	0.1588	0.1563	0.1576	0.1572
2000	0.1643	0.1642	0.1643	0.1647
2001	0.2215	0.2064	0.2090	0.2113
2002	0.2347	0.2292	0.2315	0.2301
2003	0.2092	0.1936	0.1962	0.1955
2004	0.2952	0.2891	0.2935	0.3006
2005	0.3089	0.2929	0.2943	0.2936
2006	0.2397	0.2837	0.2840	0.2866
2007	0.2285	0.2208	0.2209	0.2217

Back Calculated Partial Recruitment

AGE	1931	1932	1933	1934	1935
1	0.0451	0.0038	0.0060	0.0122	0.0394
2	0.1168	0.1011	0.3353	0.2391	0.5383
3	0.1579	0.8819	0.3802	0.5862	0.6579
4	0.4038	0.4225	0.6960	0.6726	0.6054
5	0.7830	0.7485	0.5861	0.7350	0.8809
6	0.9367	1.0000	0.5935	1.0000	1.0000
7	1.0000	0.8711	1.0000	0.7481	0.8621
8	0.9065	0.8732	0.7265	0.8277	0.9144
9	0.9065	0.8732	0.7265	0.8277	0.9144
AGE	1936	1937	1938	1939	1940
1	0.0225	0.0184	0.0207	0.0133	0.0285
2	0.4510	0.4150	0.4271	0.3281	0.2526
3	0.7456	0.7885	0.5177	0.6350	0.5916
4	0.5674	0.8276	0.5704	0.5241	0.6387
5	0.4651	0.9428	0.6890	0.5033	0.5644
6	0.6342	0.8168	0.9064	0.5098	0.8240
7	1.0000	1.0000	1.0000	1.0000	1.0000
8	0.6998	0.9198	0.8651	0.6710	0.7961
9	0.6998	0.9198	0.8651	0.6710	0.7961
AGE	1941	1942	1943	1944	1945
1	0.0078	0.0072	0.0009	0.0014	0.0030
2	0.3495	0.2411	0.0935	0.0576	0.2235
3	0.4064	0.5486	0.3582	0.3635	0.1873
4	0.5597	0.6507	0.3876	0.7727	0.4176
5	0.6993	0.7530	0.4612	0.6665	0.5828
6	0.5796	0.8546	1.0000	1.0000	0.4807
7	1.0000	1.0000	0.4753	0.6711	1.0000
8	0.7596	0.8692	0.6455	0.7792	0.6878
9	0.7596	0.8692	0.6455	0.7792	0.6878
AGE	1946	1947	1948	1949	1950
1	0.0033	0.0022	0.0044	0.0045	0.0033

2	0.2866	0.3544	0.4810	0.4720	0.7411
3	0.8242	0.6766	0.9457	0.9553	0.6418
4	0.4535	0.8902	0.8659	1.0000	0.8809
5	0.8677	0.6337	1.0000	0.7657	0.9624
6	1.0000	0.9890	0.8777	0.7848	0.9398
7	0.9084	1.0000	0.8254	0.9711	1.0000
8	0.9254	0.8743	0.9010	0.8405	0.9674
9	0.9254	0.8743	0.9010	0.8405	0.9674

Back Calculated Partial Recruitment

AGE	1951	1952	1953	1954	1955
1	0.0097	0.0002	0.0170	0.0045	0.0021
2	0.3057	0.7643	0.1111	0.7669	0.2044
3	1.0000	0.7352	1.0000	0.4617	0.8326
4	0.4059	1.0000	0.8460	0.6306	0.4519
5	0.7090	0.5663	0.8555	0.6486	0.6035
6	0.9650	0.7100	0.6914	1.0000	0.7962
7	0.9439	0.6840	0.6981	0.9568	1.0000
8	0.8726	0.6534	0.7483	0.8684	0.7999
9	0.8726	0.6534	0.7483	0.8684	0.7999
AGE	1956	1957	1958	1959	1960
1	0.0013	0.0009	0.0052	0.0019	0.0079
2	0.2723	0.2209	0.2954	0.3285	0.6157
3	0.3692	0.5179	0.5642	0.6756	0.7470
4	0.7493	0.4032	0.6698	0.7037	0.9058
5	0.5630	0.7645	0.9266	0.6924	1.0000
6	0.8679	0.7646	1.0000	0.8248	0.7259
7	1.0000	1.0000	0.9295	1.0000	0.8970
8	0.8103	0.8430	0.9520	0.8391	0.8743
9	0.8103	0.8430	0.9520	0.8391	0.8743
AGE	1961	1962	1963	1964	1965
1	0.0043	0.0049	0.0449	0.0430	0.5150
2	0.4298	0.2733	0.3927	0.2162	0.6170
3	0.8782	0.6635	0.7577	0.4423	0.7713
4	0.7906	0.6697	0.8413	0.5398	0.6937
5	0.9346	0.7030	1.0000	0.7901	0.6785
6	1.0000	0.7476	0.8374	0.9026	0.9932
7	0.7886	1.0000	0.9682	1.0000	1.0000
8	0.9077	0.8169	0.9352	0.8976	0.8906
9	0.9077	0.8169	0.9352	0.8976	0.8906
AGE	1966	1967	1968	1969	1970
1	0.0353	0.1471	0.0253	0.0036	0.0252
2	0.6173	0.0897	0.5819	0.0504	0.4837
3	1.0000	0.7111	0.5606	0.6841	0.1186
4	0.6245	0.6687	0.9791	0.7388	0.4843
5	0.6609	1.0000	0.9514	0.8270	0.6852
6	0.7617	0.8325	0.7243	1.0000	0.6122
7	0.7517	0.9025	1.0000	0.7166	1.0000
8	0.7248	0.9117	0.8919	0.8479	0.7658
9	0.7248	0.9117	0.8919	0.8479	0.7658

Back Calculated Partial Recruitment

AGE	1971	1972	1973	1974	1975
1	0.0050	0.0292	0.3146	0.0112	0.0796
2	0.6231	0.0143	0.8174	1.0000	0.4174
3	0.6301	0.4533	0.0387	0.5059	1.0000
4	0.2151	0.5220	1.0000	0.0369	0.5518
5	0.1923	0.3025	0.8781	0.3620	0.1151
6	1.0000	0.1314	0.6353	0.0607	0.3901
7	0.8347	1.0000	0.1576	0.0726	0.1925
8	0.6756	0.4780	0.5570	0.1651	0.2326
9	0.6756	0.4780	0.5570	0.1651	0.2326
AGE	1976	1977	1978	1979	1980
1	0.0056	0.0002	0.0004	0.0002	0.0012
2	0.3197	0.6772	0.1752	0.0110	1.0000
3	0.3889	0.1049	0.8221	0.4742	0.1447
4	1.0000	0.4310	0.2194	0.5836	0.3166
5	0.5859	0.5938	0.5286	0.4528	0.6708
6	0.0004	1.0000	1.0000	0.4979	0.6722
7	0.3726	0.1476	0.6735	1.0000	0.9602
8	0.3196	0.5805	0.7341	0.6502	0.7677
9	0.3196	0.5805	0.7341	0.6502	0.7677

AGE	1981	1982	1983	1984	1985
1	0.0003	0.0011	0.0003	0.0002	0.0002
2	0.4367	0.6388	0.2996	0.0729	0.4132
3	1.0000	1.0000	0.6632	0.4490	0.7058
4	0.6496	0.9826	0.6787	0.7441	0.5117
5	0.5993	0.7651	1.0000	0.4581	1.0000
6	0.6485	0.9216	0.8389	0.9356	0.4543
7	0.9105	0.6978	0.4571	1.0000	0.6972
8	0.7194	0.7948	0.7653	0.7979	0.7172
9	0.7194	0.7948	0.7653	0.7979	0.7172
AGE	1986	1987	1988	1989	1990
1	0.0011	0.0003	0.0005	0.0040	0.0491
2	0.0784	0.4524	0.0667	0.2723	0.0276
3	1.0000	0.2357	0.8037	0.2168	0.4009
4	0.5971	1.0000	0.3167	0.5965	0.6235
5	0.7895	0.4770	1.0000	0.8342	1.0000
6	0.8928	0.6146	0.8830	1.0000	0.9330
7	0.5818	0.7480	0.6981	0.6533	0.7118
8	0.7547	0.6132	0.8603	0.8291	0.8816
9	0.7547	0.6132	0.8603	0.8291	0.8816

Back Calculated Partial Recruitment

AGE	1991	1992	1993	1994	1995
1	0.0043	0.0142	0.0047	0.0030	0.0107
2	0.3307	0.2331	0.0950	0.0739	0.0594
3	0.2468	0.4724	0.7377	0.3309	0.5110
4	0.5663	0.6974	0.8313	0.5431	0.8844
5	0.3314	1.0000	1.0000	0.4658	0.9697
6	0.5272	0.7688	0.9823	1.0000	0.6736
7	1.0000	0.8858	0.5839	0.6047	1.0000
8	0.6195	0.8849	0.8554	0.6901	0.8811
9	0.6195	0.8849	0.8554	0.6901	0.8811
AGE	1996	1997	1998	1999	2000
1	0.0029	0.0056	0.0026	0.0006	0.0008
2	0.0275	0.1350	0.0755	0.0231	0.0615
3	0.2883	0.2966	0.3930	0.3870	0.4036
4	0.6572	0.9010	0.5491	0.6165	0.8700
5	0.7548	1.0000	0.8993	0.8411	0.8878
6	1.0000	0.9153	1.0000	0.9754	1.0000
7	0.4305	0.6741	0.6759	1.0000	0.8900
8	0.7284	0.8631	0.8584	0.9388	0.9259
9	0.7284	0.8631	0.8584	0.9388	0.9259
AGE	2001	2002	2003	2004	2005
1	0.0006	0.0022	0.0073	0.0037	0.0083
2	0.0623	0.0214	0.0174	0.0402	0.0052
3	0.3107	0.1927	0.1408	0.0914	0.0760
4	0.5899	0.5816	0.3632	0.2980	0.4044
5	0.6885	0.8281	0.7646	0.4917	0.8818
6	1.0000	0.9196	0.8811	0.7939	0.9857
7	0.8292	1.0000	1.0000	1.0000	1.0000
8	0.8392	0.9159	0.8819	0.7618	0.9559
9	0.8392	0.9159	0.8819	0.7618	0.9559
AGE	2006	2007			
1	0.0232	0.0072			
2	0.0104	0.0336			
3	0.0358	0.1886			
4	0.1784	0.1762			
5	0.7047	0.7454			
6	1.0000	1.0000			
7	0.7222	0.8116			
8	0.8089	0.8523			
9	0.8089	0.8523			

JAN-1 Biomass

AGE	1931	1932	1933	1934	1935
1	28136.	27157.	23970.	17382.	20183.
2	53040.	24842.	25285.	26396.	29296.
3	13379.	53373.	25274.	20587.	28691.
4	20604.	14201.	30202.	19723.	18412.
5	24554.	14925.	10218.	17168.	13117.
6	17555.	11275.	9148.	5427.	11336.
7	11262.	6992.	5279.	5198.	3217.
8	7474.	3892.	3356.	2077.	3119.
9	2913.	2819.	3939.	1571.	988.
=====					
Total	178917.	159477.	136671.	115530.	128360.

AGE	1936	1937	1938	1939	1940
1	22316.	37543.	36122.	27138.	52443.
2	28433.	30636.	54964.	42670.	34296.
3	29517.	27124.	30283.	52164.	39826.
4	23420.	18119.	18315.	23604.	33679.
5	13077.	15705.	10865.	12658.	14471.
6	7619.	8794.	7797.	6980.	7795.
7	6011.	4833.	4915.	3938.	4296.
8	1781.	2869.	2173.	2307.	1602.
9	1091.	1752.	1532.	2057.	1322.
=====					
Total	133264.	147376.	166966.	173516.	189729.

AGE	1941	1942	1943	1944	1945
1	48209.	27157.	9770.	34706.	25908.
2	59342.	59507.	31038.	12297.	38454.
3	33992.	49540.	55836.	33420.	14862.
4	29517.	23995.	35762.	42106.	30206.
5	21955.	16258.	14124.	25063.	26311.
6	9381.	10279.	8177.	9052.	15690.
7	4104.	5189.	4874.	2958.	4279.
8	1866.	1472.	2181.	3010.	1874.
9	2818.	1330.	1350.	952.	1673.
=====					
Total	211183.	194729.	163113.	163564.	159258.

AGE	1946	1947	1948	1949	1950
1	41212.	31910.	14464.	59737.	19281.
2	28455.	47248.	30132.	16579.	61413.
3	36095.	26441.	41684.	24009.	14330.
4	14770.	22006.	18101.	26871.	14894.
5	22323.	10972.	11572.	11330.	15118.
6	16380.	11665.	6633.	6273.	6804.
7	10182.	7598.	5422.	3683.	3571.
8	1757.	4782.	3446.	3119.	1890.
9	209.	3388.	3331.	3386.	2412.
=====					
Total	171384.	166009.	134785.	154986.	139713.

JAN-1 Biomass

AGE	1951	1952	1953	1954	1955
1	48206.	18020.	61721.	16751.	43332.
2	25654.	51028.	19349.	70118.	25807.
3	45782.	25022.	37488.	20273.	54367.
4	11731.	25463.	18267.	24430.	18615.
5	10486.	9114.	16238.	11994.	19318.
6	9682.	6720.	6689.	10008.	9025.
7	4161.	4761.	4386.	4336.	5883.
8	2004.	2067.	2946.	2590.	2437.
9	1683.	1430.	1676.	923.	1638.
=====					
Total	159389.	143623.	168761.	161422.	180423.

AGE	1956	1957	1958	1959	1960
1	18337.	26130.	34900.	60457.	61991.
2	51319.	28574.	32465.	36170.	71542.
3	29184.	47737.	32577.	33915.	34711.
4	38513.	23849.	34111.	27783.	28580.
5	16528.	23485.	19049.	26226.	22029.
6	14928.	11438.	14151.	12724.	21589.
7	6216.	7840.	6713.	8860.	9429.
8	3587.	2944.	3662.	4361.	5689.
9	1793.	2731.	1501.	4270.	6368.

Total	180406.	174727.	179128.	214766.	261928.
AGE	1961	1962	1963	1964	1965
1	22089.	16612.	88925.	196123.	16809.
2	70886.	29524.	21867.	104196.	216259.
3	68792.	68374.	32393.	22185.	101397.
4	30702.	57512.	55735.	25736.	17588.
5	22854.	24040.	43484.	40934.	18433.
6	16775.	16739.	17210.	28985.	24865.
7	16957.	11635.	11153.	11907.	16463.
8	6814.	11359.	7199.	7001.	6136.
9	10309.	10978.	12381.	10816.	9430.

Total	266177.	246773.	290348.	447882.	427380.
AGE	1966	1967	1968	1969	1970
1	2194.	8349.	278.	370.	2721.
2	11714.	2102.	7631.	296.	738.
3	147826.	7172.	2186.	5528.	339.
4	56936.	66282.	4994.	1932.	4766.
5	10475.	31781.	46845.	2939.	1512.
6	10846.	5945.	17636.	26860.	2039.
7	11290.	5381.	3325.	12021.	16116.
8	7536.	5555.	2771.	1718.	8176.
9	6434.	5322.	5988.	5999.	6684.

JAN-1 Biomass

AGE	1971	1972	1973	1974	1975
1	144.	4101.	8802.	6527.	3890.
2	3196.	181.	5463.	10858.	7238.
3	775.	2448.	225.	5068.	9371.
4	394.	478.	2085.	271.	4847.
5	4649.	380.	366.	1313.	257.
6	1181.	3994.	345.	261.	1074.
7	1648.	500.	3562.	265.	268.
8	10615.	812.	235.	3120.	233.
9	8820.	17573.	8020.	17047.	5525.

Total	31423.	30466.	29102.	44728.	32703.
AGE	1976	1977	1978	1979	1980
1	36008.	5566.	2363.	33388.	4782.
2	4946.	62986.	8080.	3650.	48471.
3	7109.	5643.	66710.	9522.	4490.
4	7393.	7768.	6339.	52364.	8243.
5	3951.	5921.	7482.	6225.	37948.
6	233.	3309.	4752.	5847.	4723.
7	875.	262.	1982.	2955.	4186.
8	228.	753.	218.	1313.	1511.
9	7384.	2786.	1378.	857.	844.

Total	68129.	94995.	99303.	116120.	115199.
AGE	1981	1982	1983	1984	1985
1	1821.	264.	649.	3445.	492.
2	6188.	3708.	1001.	1482.	8462.
3	30644.	6453.	4472.	1781.	2393.
4	4504.	20345.	5256.	3860.	1594.
5	7287.	3596.	15356.	4043.	2834.
6	22794.	5399.	2656.	10053.	3152.
7	2969.	15898.	3713.	1739.	5845.
8	2017.	1736.	11122.	2816.	983.
9	1397.	1922.	1368.	6400.	2192.

Total	79622.	59322.	45592.	35618.	27947.
AGE	1986	1987	1988	1989	1990
1	5564.	746.	5774.	535.	1596.
2	1149.	8399.	1391.	10017.	801.
3	11490.	1900.	9934.	2055.	13881.
4	1957.	9154.	1896.	8550.	2089.
5	1415.	1626.	6227.	1692.	7019.
6	1769.	990.	1277.	3813.	1243.
7	2397.	1144.	686.	869.	2493.
8	3873.	1853.	775.	489.	613.
9	1015.	3031.	1565.	880.	723.

Total	30628.	28843.	29525.	28899.	30458.
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JAN-1 Biomass

AGE	1991	1992	1993	1994	1995
1	1113.	3946.	8031.	4735.	3446.
2	2401.	1838.	6960.	10880.	8370.
3	1019.	2533.	2255.	9504.	12771.
4	13732.	958.	2097.	1761.	8284.
5	1600.	9423.	655.	1444.	1235.
6	4598.	1254.	5076.	407.	999.
7	782.	3151.	711.	2954.	218.
8	1651.	382.	1643.	536.	1780.
9	925.	1123.	1053.	1528.	624.
=====					
Total	27822.	24608.	28481.	33749.	37729.

AGE	1996	1997	1998	1999	2000
1	3680.	6498.	5202.	26491.	5986.
2	7210.	6590.	12373.	9174.	36242.
3	12439.	11647.	9579.	19155.	12663.
4	12642.	13382.	12156.	9919.	20541.
5	7148.	10949.	12266.	10112.	9011.
6	950.	5570.	9607.	9554.	7988.
7	851.	696.	4663.	7299.	7177.
8	177.	696.	574.	3668.	5322.
9	2194.	1983.	1572.	1313.	2359.
=====					
Total	47291.	58018.	67993.	96686.	107289.

AGE	2001	2002	2003	2004	2005
1	21966.	1210.	602.	64234.	891.
2	8656.	45718.	2100.	751.	140147.
3	43053.	9889.	72555.	3103.	1224.
4	12182.	40184.	9039.	73688.	3674.
5	17128.	9848.	31961.	7583.	59539.
6	7404.	13367.	7045.	23158.	5465.
7	6109.	5486.	9346.	4825.	14586.
8	5419.	4571.	3844.	6029.	2736.
9	4948.	9666.	7171.	5108.	3730.
=====					
Total	126863.	139939.	143664.	188479.	231992.

AGE	2006	2007	2008
1	2396.	171.	1844.
2	1926.	8902.	2203.
3	242494.	3861.	14011.
4	1606.	292908.	5221.
5	3346.	1480.	326296.
6	39984.	2496.	1436.
7	3462.	26192.	1869.
8	8886.	2401.	21760.
9	2708.	6604.	792.
=====			
Total	306808.	345015.	375431.

Mean Biomass

AGE	1931	1932	1933	1934	1935
1	26507.	26249.	25198.	22607.	24003.
2	53446.	23104.	21352.	26212.	32980.
3	13864.	42157.	24739.	20120.	28110.
4	17841.	13749.	23712.	15945.	16835.
5	17431.	12238.	7143.	14453.	10283.
6	11791.	8356.	7356.	4275.	8366.
7	7097.	5474.	3444.	4052.	2547.
8	4569.	2937.	2219.	1659.	2318.
9	1698.	1889.	2679.	1166.	701.
=====					
Total	154245.	136152.	117841.	110489.	126143.

AGE	1936	1937	1938	1939	1940
1	26198.	45516.	39335.	30564.	55900.
2	29114.	31407.	58179.	41039.	35636.
3	24106.	23295.	29018.	42946.	36865.
4	19634.	14037.	16383.	19034.	28644.
5	10411.	11576.	9367.	9973.	11595.
6	5967.	6826.	5741.	5542.	5856.
7	4209.	3645.	3568.	2623.	3040.
8	1280.	2187.	1470.	1694.	1205.
9	774.	1167.	1049.	1435.	922.

=====					
Total	121693.	139655.	164109.	154851.	179662.
=====					
AGE	1941	1942	1943	1944	1945
=====					
1	53658.	29084.	10980.	36591.	27200.
2	54453.	60861.	31831.	13527.	37002.
3	29739.	44492.	47679.	32374.	15523.
4	23138.	19024.	30007.	34406.	27739.
5	15827.	11782.	11053.	20422.	22174.
6	7289.	7189.	4950.	6742.	13188.
7	2580.	3551.	3782.	2473.	2841.
8	1216.	1068.	1515.	2364.	1438.
9	1827.	889.	904.	653.	1154.
=====					
Total	189725.	177939.	142701.	149551.	148258.
=====					
AGE	1946	1947	1948	1949	1950
=====					
1	44202.	31061.	15511.	60672.	22279.
2	27000.	44629.	25550.	15412.	52383.
3	29438.	22895.	34565.	19913.	13494.
4	13077.	16930.	14866.	21304.	12710.
5	16215.	8838.	8698.	9156.	12218.
6	11329.	8520.	5062.	4996.	5312.
7	7217.	5459.	4153.	2691.	2664.
8	1281.	3399.	2579.	2398.	1494.
9	138.	2262.	2342.	2386.	1742.
=====					
Total	149897.	143993.	113327.	138929.	124296.
=====					
Mean Biomass					
=====					
AGE	1951	1952	1953	1954	1955
=====					
1	49687.	18704.	65906.	20826.	47234.
2	26777.	43884.	19518.	62617.	30519.
3	35578.	22002.	31009.	19488.	47633.
4	10624.	21182.	15106.	22122.	18056.
5	8744.	7954.	13344.	10411.	17303.
6	7335.	5712.	5545.	7592.	7703.
7	3117.	3809.	3451.	3300.	4726.
8	1497.	1687.	2289.	1934.	1931.
9	1150.	1106.	1261.	680.	1221.
=====					
Total	144510.	126040.	157430.	148970.	176325.
=====					
AGE	1956	1957	1958	1959	1960
=====					
1	22929.	29176.	35590.	65879.	66403.
2	50976.	33127.	34006.	34523.	71539.
3	26102.	41766.	30945.	31759.	33959.
4	30739.	21946.	29542.	24859.	26514.
5	14223.	18703.	15895.	23868.	20000.
6	11468.	8897.	11707.	10845.	20711.
7	4531.	5450.	5619.	7030.	8761.
8	2768.	2156.	2992.	3597.	5142.
9	1242.	1873.	1112.	3270.	5110.
=====					
Total	164978.	163094.	167409.	205630.	258138.
=====					
AGE	1961	1962	1963	1964	1965
=====					
1	25582.	19093.	96445.	206379.	14237.
2	71597.	32350.	23416.	107447.	185250.
3	64662.	61167.	30171.	20253.	78232.
4	28027.	51319.	50889.	22220.	13724.
5	20004.	20271.	35969.	31793.	14230.
6	14376.	13961.	14786.	22660.	17649.
7	13975.	9031.	8906.	8775.	11224.
8	5393.	8874.	6121.	5310.	4302.
9	8245.	8445.	9488.	7740.	6281.
=====					
Total	251860.	224513.	276191.	432578.	345129.
=====					
AGE	1966	1967	1968	1969	1970
=====					
1	2152.	8010.	288.	523.	2954.
2	9297.	2036.	6421.	305.	945.
3	103071.	5994.	2046.	4883.	375.
4	44427.	56601.	3990.	1833.	5172.
5	8179.	22783.	36913.	2475.	1354.
6	8089.	4620.	15630.	21189.	1902.
7	8125.	3945.	2384.	9899.	13558.
8	5768.	4152.	2050.	1419.	7164.
9	4370.	3684.	4160.	4364.	5173.
=====					
Total	193478.	111825.	73881.	46888.	38598.
=====					

Mean Biomass

AGE	1971	1972	1973	1974	1975
1	162.	4743.	9829.	6886.	4396.
2	2750.	202.	5263.	10626.	7135.
3	561.	2477.	250.	5485.	8930.
4	391.	454.	1655.	295.	4415.
5	4347.	367.	293.	1270.	223.
6	836.	3825.	313.	291.	929.
7	1206.	342.	3362.	262.	242.
8	8156.	681.	210.	2922.	203.
9	6183.	13572.	6364.	14912.	4814.
=====					
Total	24592.	26663.	27539.	42949.	31288.

AGE	1976	1977	1978	1979	1980
1	47705.	6717.	2942.	40295.	5449.
2	5427.	72782.	9400.	4532.	42866.
3	7284.	6036.	60482.	8951.	4269.
4	6488.	8053.	6531.	47674.	7839.
5	3634.	5570.	6891.	5591.	28811.
6	250.	2690.	3798.	4968.	3666.
7	846.	267.	1602.	2288.	3011.
8	214.	631.	158.	1075.	1043.
9	6411.	2244.	1074.	661.	600.
=====					
Total	78259.	104995.	92878.	116035.	97554.

AGE	1981	1982	1983	1984	1985
1	2603.	515.	982.	5408.	753.
2	6288.	4729.	1844.	2200.	12067.
3	24695.	6330.	4251.	1637.	2268.
4	4239.	19093.	4710.	3352.	1572.
5	6512.	3238.	12526.	3574.	2374.
6	19534.	4555.	2175.	7929.	2859.
7	2443.	13889.	3348.	1298.	4833.
8	1606.	1412.	8891.	2139.	847.
9	1051.	1513.	1074.	4747.	1686.
=====					
Total	68970.	55273.	39801.	32285.	29259.

AGE	1986	1987	1988	1989	1990
1	6848.	1020.	7618.	656.	1961.
2	1732.	9500.	1878.	12576.	976.
3	10224.	2032.	9779.	2201.	14978.
4	1828.	8374.	1749.	8045.	1835.
5	1267.	1494.	4718.	1515.	5697.
6	1467.	811.	1017.	3231.	1008.
7	2041.	933.	576.	805.	2054.
8	3262.	1691.	639.	418.	449.
9	804.	2451.	1200.	687.	552.
=====					
Total	29473.	28307.	29174.	30134.	29512.

Mean Biomass

AGE	1991	1992	1993	1994	1995
1	1433.	5250.	9364.	6306.	4993.
2	2690.	2215.	9092.	12414.	11114.
3	994.	2344.	2091.	9234.	13063.
4	11589.	829.	1807.	1533.	7867.
5	1449.	7105.	517.	1251.	1127.
6	3958.	984.	4033.	313.	897.
7	556.	2364.	577.	2347.	203.
8	1289.	294.	1256.	472.	1572.
9	693.	796.	784.	1128.	534.
=====					
Total	24651.	22182.	29522.	34999.	41369.

AGE	1996	1997	1998	1999	2000
1	4933.	8982.	6920.	31036.	7210.
2	10425.	8767.	16998.	12181.	42237.
3	13614.	12872.	10249.	21130.	12787.
4	11897.	12939.	11210.	9494.	19257.
5	6423.	10277.	11462.	8986.	8404.
6	777.	5017.	8835.	8015.	7052.
7	814.	674.	4356.	6113.	6520.
8	154.	596.	477.	3055.	4697.
9	1845.	1710.	1327.	1103.	1977.

=====					
Total	50881.	61834.	71834.	101112.	110142.
=====					
AGE	2001	2002	2003	2004	2005
=====					
1	31745.	1597.	674.	95020.	1313.
2	10345.	65886.	2767.	835.	207358.
3	42571.	9341.	79106.	3439.	1791.
4	11220.	36990.	8641.	66300.	3769.
5	15198.	8507.	27476.	6378.	49811.
6	6274.	11605.	5926.	18634.	4471.
7	5252.	4901.	7641.	3670.	11582.
8	4418.	4007.	3136.	4705.	2176.
9	4037.	7840.	5885.	4029.	2923.
=====					
Total	131061.	150673.	141253.	203010.	285194.
=====					
AGE	2006	2007			
=====					
1	4627.	991.			
2	2836.	17042.			
3	283345.	5155.			
4	1427.	298626.			
5	2890.	1440.			
6	32559.	2127.			
7	2877.	22304.			
8	7248.	2019.			
9	2191.	5371.			
=====					
Total	340000.	355077.			
=====					
Spawning Stock Biomass					
=====					
AGE	1931	1932	1933	1934	1935
=====					
1	1057.	1033.	911.	660.	764.
2	18566.	8809.	8501.	9250.	9792.
3	10601.	37368.	19266.	15790.	21577.
4	17364.	12344.	24470.	17022.	15877.
5	18832.	12319.	8563.	14846.	10977.
6	12906.	8873.	7654.	4535.	9324.
7	8137.	5638.	4046.	4488.	2700.
8	5541.	3137.	2728.	1775.	2598.
9	2160.	2272.	3202.	1342.	823.
=====					
Total	95164.	91793.	79343.	69708.	74431.
=====					
AGE	1936	1937	1938	1939	1940
=====					
1	845.	1424.	1369.	1030.	1985.
2	9433.	10259.	18423.	14387.	11848.
3	21199.	19414.	22869.	37727.	29641.
4	19799.	14651.	15593.	19889.	28284.
5	11386.	12559.	9150.	10821.	12441.
6	6424.	7197.	6318.	5959.	6396.
7	4728.	3825.	3918.	3029.	3415.
8	1483.	2304.	1774.	1903.	1321.
9	909.	1407.	1250.	1697.	1090.
=====					
Total	76207.	73039.	80664.	96442.	96422.
=====					
AGE	1941	1942	1943	1944	1945
=====					
1	1831.	1032.	372.	1320.	985.
2	19700.	20534.	10953.	4395.	13244.
3	25480.	36888.	42144.	25762.	11811.
4	24256.	19935.	30484.	34095.	25988.
5	17614.	13378.	11933.	20930.	22063.
6	7749.	8294.	6015.	7082.	13451.
7	3060.	4072.	4103.	2468.	3279.
8	1475.	1184.	1757.	2459.	1536.
9	2228.	1070.	1087.	778.	1371.
=====					
Total	103394.	106388.	108848.	99288.	93727.
=====					
AGE	1946	1947	1948	1949	1950
=====					
1	1567.	1214.	550.	2271.	733.
2	9746.	15956.	10119.	5550.	20207.
3	25581.	19218.	29849.	17015.	10932.
4	12772.	17471.	14931.	21513.	12542.
5	18037.	9242.	9446.	9518.	12728.
6	12910.	9179.	5517.	5253.	5745.
7	8164.	5966.	4546.	2992.	2992.
8	1404.	3847.	2856.	2588.	1590.
9	167.	2726.	2761.	2810.	2029.
=====					
Total	90348.	84819.	80573.	69510.	69499.
=====					

Spawning Stock Biomass

AGE	1951	1952	1953	1954	1955
1	1831.	686.	2343.	637.	1648.
2	8785.	16711.	6891.	22981.	9082.
3	31751.	18831.	27152.	15817.	40341.
4	10283.	21073.	15368.	21226.	16522.
5	8800.	8058.	13782.	10502.	16979.
6	7766.	5832.	5803.	8379.	7734.
7	3350.	4145.	3802.	3650.	4909.
8	1634.	1807.	2536.	2205.	2087.
9	1372.	1250.	1443.	786.	1403.
=====					
Total	75572.	78393.	79120.	86182.	100705.

AGE	1956	1957	1958	1959	1960
1	698.	994.	1327.	2300.	2357.
2	17659.	9925.	11347.	12622.	24714.
3	22593.	35986.	25285.	26108.	27189.
4	31675.	20885.	29768.	24264.	25179.
5	14201.	19465.	16308.	23164.	19468.
6	12138.	9480.	12014.	11080.	19468.
7	4935.	6228.	5745.	7572.	8396.
8	2947.	2406.	3126.	3792.	5074.
9	1474.	2231.	1281.	3713.	5680.
=====					
Total	108320.	107600.	106202.	114614.	137525.

AGE	1961	1962	1963	1964	1965
1	840.	632.	5306.	11681.	913.
2	24832.	10364.	9396.	45076.	85813.
3	53398.	52704.	26364.	18230.	76646.
4	27292.	50412.	48572.	22512.	14563.
5	20307.	21209.	37550.	34761.	15399.
6	14834.	14698.	15110.	24247.	19587.
7	15228.	9944.	9670.	9823.	12952.
8	6066.	9900.	6262.	5860.	4929.
9	9178.	9568.	10769.	9054.	7575.
=====					
Total	171975.	179431.	168999.	181245.	238377.

AGE	1966	1967	1968	1969	1970
1	130.	489.	17.	22.	163.
2	4569.	924.	3097.	131.	312.
3	104067.	5598.	1746.	4396.	293.
4	46946.	56214.	4024.	1646.	4268.
5	8621.	25708.	38148.	2488.	1332.
6	8741.	4945.	14915.	22217.	1814.
7	9119.	4426.	2689.	10344.	13736.
8	6123.	4562.	2281.	1452.	7150.
9	5227.	4371.	4928.	5069.	5846.
=====					
Total	193543.	107237.	71846.	47766.	34913.

Spawning Stock Biomass

AGE	1971	1972	1973	1974	1975
1	9.	244.	507.	391.	232.
2	1254.	80.	2198.	4332.	3113.
3	596.	1976.	196.	4191.	7510.
4	356.	411.	1736.	255.	4362.
5	4246.	342.	311.	1198.	242.
6	914.	3711.	303.	246.	987.
7	1319.	398.	3321.	250.	250.
8	8782.	709.	208.	2913.	217.
9	7297.	15350.	7110.	15919.	5149.
=====					
Total	24771.	23222.	15889.	29695.	22061.

AGE	1976	1977	1978	1979	1980
1	2157.	334.	142.	2001.	287.
2	2158.	26122.	3536.	1626.	18228.
3	6054.	4883.	53357.	7830.	3833.
4	6512.	7004.	5846.	45812.	7377.
5	3604.	5278.	6711.	5574.	32156.
6	222.	2826.	4052.	5210.	4005.
7	811.	245.	1751.	2465.	3379.
8	212.	673.	191.	1147.	1261.
9	6868.	2490.	1209.	748.	704.
=====					

Total	28598.	49856.	76794.	72411.	71229.
AGE	1981	1982	1983	1984	1985
1	109.	16.	39.	206.	30.
2	2598.	1558.	433.	654.	3589.
3	23337.	5139.	3663.	1467.	1921.
4	3887.	17519.	4640.	3298.	1414.
5	6371.	3180.	13207.	3612.	2383.
6	19812.	4709.	2323.	8429.	2836.
7	2489.	14160.	3375.	1445.	5106.
8	1736.	1532.	9802.	2405.	857.
9	1203.	1696.	1206.	5466.	1910.

=====

Total 61541. 49509. 38688. 26982. 20045.

AGE	1986	1987	1988	1989	1990
1	333.	45.	346.	32.	95.
2	509.	3584.	616.	4355.	356.
3	9146.	1625.	7996.	1762.	11649.
4	1747.	7837.	1733.	7631.	1848.
5	1248.	1474.	5333.	1485.	6008.
6	1546.	887.	1108.	3298.	1072.
7	2158.	1011.	607.	777.	2201.
8	3430.	1660.	674.	430.	532.
9	899.	2715.	1362.	773.	627.

=====

Total 21016. 20838. 19775. 20543. 24390.

Spawning Stock Biomass

AGE	1991	1992	1993	1994	1995
1	67.	236.	481.	284.	206.
2	1015.	792.	3069.	4797.	3727.
3	856.	2064.	1802.	7888.	10982.
4	11820.	815.	1788.	1525.	7592.
5	1440.	7701.	550.	1274.	1135.
6	4011.	1062.	4279.	330.	929.
7	632.	2623.	630.	2550.	201.
8	1418.	318.	1407.	456.	1643.
9	795.	935.	901.	1302.	576.

=====

Total 22055. 16545. 14908. 20405. 26991.

AGE	1996	1997	1998	1999	2000
1	220.	389.	312.	1588.	359.
2	3212.	2928.	5502.	4089.	16124.
3	10718.	10102.	8241.	16491.	10885.
4	11525.	12301.	11212.	9128.	18668.
5	6521.	10095.	11210.	9273.	8232.
6	856.	5159.	8750.	8721.	7268.
7	791.	649.	4308.	6655.	6563.
8	162.	645.	526.	3354.	4859.
9	2007.	1838.	1441.	1201.	2153.

=====

Total 36012. 44106. 51501. 60500. 75112.

AGE	2001	2002	2003	2004	2005
1	1316.	73.	36.	3848.	53.
2	3846.	20368.	936.	334.	62497.
3	36912.	8548.	62967.	2691.	1064.
4	11067.	36568.	8356.	67623.	3359.
5	15553.	8875.	29025.	6870.	52689.
6	6593.	11988.	6360.	20398.	4801.
7	5501.	4894.	8378.	4165.	12798.
8	4877.	4100.	3471.	5327.	2409.
9	4453.	8671.	6474.	4514.	3284.

=====

Total 90119. 104085. 126004. 115770. 142954.

AGE	2006	2007
1	143.	10.
2	859.	3962.
3	211652.	3336.
4	1497.	273423.
5	3018.	1338.
6	35317.	2221.
7	3121.	23595.
8	7961.	2157.
9	2426.	5933.

=====

Total 265995. 315976.

Catch Biomass

AGE	1931	1932	1933	1934	1935
1	1316.	76.	132.	143.	551.
2	6865.	1771.	6187.	3251.	10329.
3	2408.	28199.	8131.	6118.	10759.
4	7925.	4406.	14265.	5564.	5930.
5	15015.	6948.	3619.	5511.	5270.
6	12150.	6338.	3774.	2218.	4867.
7	7808.	3617.	2977.	1572.	1277.
8	4557.	1946.	1393.	712.	1233.
9	1694.	1251.	1682.	501.	373.
=====					
Total	59739.	54552.	42161.	25590.	40588.

AGE	1936	1937	1938	1939	1940
1	449.	618.	577.	346.	1142.
2	9985.	9600.	17573.	11428.	6456.
3	13668.	13528.	10624.	23148.	15643.
4	8472.	8556.	6609.	8467.	13122.
5	3683.	8037.	4564.	4261.	4694.
6	2878.	4100.	3680.	2398.	3461.
7	3201.	2685.	2523.	2226.	2181.
8	681.	1481.	899.	965.	688.
9	412.	790.	642.	817.	526.
=====					
Total	43428.	49402.	47691.	54058.	47913.

AGE	1941	1942	1943	1944	1945
1	406.	161.	10.	40.	70.
2	18537.	11303.	3059.	609.	7158.
3	11770.	18800.	17561.	9196.	2516.
4	12612.	9535.	11961.	20780.	10026.
5	10779.	6833.	5242.	10638.	11184.
6	4114.	4732.	5090.	5269.	5487.
7	2512.	2735.	1849.	1297.	2459.
8	900.	715.	1005.	1440.	856.
9	1352.	595.	600.	397.	687.
=====					
Total	62980.	55409.	46376.	49667.	40443.

AGE	1946	1947	1948	1949	1950
1	109.	52.	42.	177.	38.
2	5823.	12133.	7522.	4725.	19700.
3	18256.	11884.	20006.	12354.	4394.
4	4463.	11561.	7879.	13836.	5682.
5	10587.	4297.	5323.	4553.	5967.
6	8525.	6464.	2719.	2546.	2533.
7	4933.	4188.	2098.	1697.	1352.
8	892.	2280.	1422.	1309.	734.
9	96.	1517.	1292.	1303.	855.
=====					
Total	53683.	54376.	48303.	42500.	41255.

Catch Biomass

AGE	1951	1952	1953	1954	1955
1	342.	0.	596.	48.	52.
2	5786.	17333.	1156.	24531.	3271.
3	25148.	8358.	16533.	4596.	20791.
4	3048.	10946.	6814.	7126.	4278.
5	4382.	2327.	6086.	3449.	5474.
6	5003.	2096.	2044.	3878.	3216.
7	2079.	1346.	1285.	1613.	2478.
8	924.	570.	913.	858.	810.
9	710.	373.	503.	302.	512.
=====					
Total	47422.	43349.	35930.	46401.	40881.

AGE	1956	1957	1958	1959	1960
1	22.	19.	84.	53.	155.
2	10036.	5275.	4568.	4859.	12968.
3	6966.	15591.	7939.	9193.	7469.
4	16651.	6377.	8998.	7495.	7071.
5	5788.	10305.	6698.	7081.	5889.
6	7195.	4903.	5324.	3832.	4426.
7	3276.	3928.	2375.	3012.	2314.
8	1621.	1310.	1295.	1293.	1324.
9	728.	1138.	481.	1176.	1315.

=====					
Total	52284.	48847.	37761.	37994.	42930.
=====					
AGE	1961	1962	1963	1964	1965
=====					
1	32.	40.	1659.	5050.	5569.
2	8979.	3787.	3521.	13226.	86814.
3	16569.	17382.	8753.	5100.	45831.
4	6465.	14720.	16393.	6830.	7231.
5	5455.	6103.	13773.	14304.	7333.
6	4195.	4470.	4741.	11646.	13313.
7	3216.	3868.	3302.	4997.	8525.
8	1428.	3105.	2192.	2714.	2910.
9	2184.	2954.	3398.	3956.	4248.

=====					
Total	48522.	56430.	57731.	67823.	181774.
=====					
AGE	1966	1967	1968	1969	1970
=====					
1	66.	759.	5.	1.	33.
2	4995.	118.	2425.	9.	201.
3	89721.	2746.	744.	1868.	20.
4	24150.	24387.	2536.	757.	1100.
5	4706.	14680.	22795.	1144.	407.
6	5363.	2478.	7348.	11848.	511.
7	5317.	2294.	1547.	3966.	5955.
8	3639.	2439.	1187.	673.	2410.
9	2757.	2164.	2408.	2069.	1740.

=====					
Total	140715.	52065.	40995.	22336.	12376.
=====					

Catch Biomass

=====					
AGE	1971	1972	1973	1974	1975
=====					
1	1.	99.	1564.	34.	123.
2	1416.	2.	2176.	4750.	1048.
3	292.	801.	5.	1240.	3143.
4	70.	169.	837.	5.	857.
5	691.	79.	130.	205.	9.
6	691.	359.	101.	8.	128.
7	832.	244.	268.	9.	16.
8	4554.	232.	59.	216.	17.
9	3452.	4629.	1793.	1100.	394.

=====					
Total	11999.	6614.	6934.	7567.	5735.
=====					
AGE	1976	1977	1978	1979	1980
=====					
1	75.	1.	1.	1.	4.
2	486.	21248.	721.	26.	29300.
3	793.	273.	21764.	2230.	422.
4	1816.	1496.	627.	14620.	1696.
5	596.	1426.	1594.	1330.	13209.
6	0.	1162.	1662.	1300.	1684.
7	88.	17.	472.	1202.	1976.
8	19.	158.	51.	367.	548.
9	574.	561.	345.	226.	315.

=====					
Total	4446.	26342.	27237.	21302.	49156.
=====					
AGE	1981	1982	1983	1984	1985
=====					
1	0.	0.	0.	0.	0.
2	1527.	1138.	220.	87.	2439.
3	13735.	2385.	1125.	397.	783.
4	1532.	7070.	1275.	1347.	393.
5	2171.	934.	4998.	884.	1161.
6	7046.	1582.	728.	4005.	635.
7	1237.	3652.	611.	701.	1648.
8	643.	423.	2715.	921.	297.
9	420.	453.	328.	2045.	591.

=====					
Total	28310.	17638.	12000.	10385.	7948.
=====					
AGE	1986	1987	1988	1989	1990
=====					
1	3.	0.	2.	1.	40.
2	51.	1689.	52.	1301.	11.
3	3874.	188.	3268.	181.	2512.
4	414.	3291.	230.	1823.	479.
5	379.	280.	1962.	480.	2383.
6	496.	196.	373.	1228.	393.
7	450.	274.	167.	200.	611.
8	933.	408.	229.	132.	166.
9	230.	591.	429.	217.	203.

=====					
Total	6829.	6917.	6713.	5564.	6799.
=====					

Catch Biomass

AGE	1991	1992	1993	1994	1995
1	4.	45.	22.	12.	7.
2	584.	311.	425.	587.	90.
3	161.	668.	759.	1958.	915.
4	4306.	349.	739.	533.	953.
5	315.	4285.	254.	373.	150.
6	1369.	456.	1948.	200.	83.
7	365.	1263.	166.	909.	28.
8	524.	157.	528.	209.	190.
9	282.	425.	330.	499.	64.
=====					
Total	7910.	7959.	5171.	5281.	2480.
=====					
AGE	1996	1997	1998	1999	2000
1	3.	6.	3.	2.	1.
2	62.	143.	223.	48.	461.
3	848.	461.	699.	1383.	916.
4	1688.	1409.	1069.	990.	2974.
5	1047.	1242.	1790.	1279.	1324.
6	168.	555.	1534.	1323.	1252.
7	76.	55.	511.	1034.	1030.
8	24.	62.	71.	485.	772.
9	290.	178.	198.	175.	325.
=====					
Total	4206.	4112.	6098.	6719.	9054.
=====					
AGE	2001	2002	2003	2004	2005
1	5.	1.	1.	137.	4.
2	170.	361.	11.	13.	347.
3	3492.	461.	2642.	122.	44.
4	1747.	5513.	744.	7658.	493.
5	2762.	1805.	4983.	1215.	14194.
6	1656.	2735.	1238.	5733.	1424.
7	1150.	1256.	1812.	1422.	3743.
8	979.	940.	656.	1389.	672.
9	894.	1840.	1231.	1189.	903.
=====					
Total	12855.	14912.	13319.	18879.	21822.
=====					
AGE	2006	2007			
1	32.	2.			
2	9.	153.			
3	3007.	261.			
4	75.	14112.			
5	604.	288.			
6	9649.	570.			
7	616.	4854.			
8	1738.	461.			
9	525.	1228.			
=====					
Total	16254.	21929.			

Catch Numbers

AGE	1931	1932	1933	1934	1935
1	1755.0	118.0	244.0	341.0	1197.0
2	8801.0	2084.0	8476.0	4454.0	11872.0
3	2041.0	25871.0	6023.0	5414.0	8819.0
4	5785.0	2421.0	10046.0	3734.0	3706.0
5	9100.0	3676.0	2092.0	3149.0	2944.0
6	6045.0	2894.0	1579.0	1051.0	2458.0
7	3380.0	1320.0	1210.0	619.0	499.0
8	1794.0	664.0	538.0	250.0	442.0
9	559.0	391.0	647.0	168.0	109.0
=====					
Total	39260.0	39439.0	30855.0	19180.0	32046.0
=====					
AGE	1936	1937	1938	1939	1940
1	880.0	1288.0	1030.0	607.0	2040.0
2	12327.0	11034.0	20199.0	13937.0	7254.0
3	11486.0	10910.0	7755.0	19617.0	12317.0
4	5431.0	5629.0	3755.0	5163.0	8253.0
5	2141.0	4143.0	2113.0	2152.0	2510.0
6	1377.0	1875.0	1600.0	967.0	1479.0
7	1362.0	952.0	945.0	837.0	752.0
8	259.0	481.0	327.0	326.0	222.0
9	124.0	222.0	173.0	239.0	136.0

=====					
Total	35387.0	36534.0	37897.0	43845.0	34963.0
=====					
AGE	1941	1942	1943	1944	1945
=====					
1	780.0	310.0	19.0	64.0	121.0
2	23464.0	14307.0	4191.0	761.0	8522.0
3	9808.0	16348.0	17738.0	8437.0	2029.0
4	8033.0	6531.0	8364.0	14843.0	6386.0
5	5764.0	3996.0	3102.0	5689.0	5795.0
6	1781.0	2331.0	2693.0	2281.0	2315.0
7	941.0	1036.0	790.0	497.0	914.0
8	307.0	227.0	354.0	469.0	265.0
9	384.0	176.0	178.0	108.0	205.0
=====					
Total	51262.0	45262.0	37429.0	33149.0	26552.0
=====					
AGE	1946	1947	1948	1949	1950
=====					
1	209.0	90.0	80.0	328.0	88.0
2	7466.0	16621.0	11227.0	6472.0	28971.0
3	15213.0	10334.0	19237.0	12479.0	4107.0
4	2738.0	7181.0	5116.0	9608.0	4272.0
5	5785.0	2127.0	2744.0	2347.0	3315.0
6	3840.0	2739.0	1157.0	1061.0	1131.0
7	1827.0	1501.0	780.0	624.0	520.0
8	272.0	745.0	450.0	409.0	225.0
9	23.0	457.0	369.0	353.0	250.0
=====					
Total	37373.0	41795.0	41160.0	33681.0	42879.0
=====					
Catch Numbers					
=====					
AGE	1951	1952	1953	1954	1955
=====					
1	645.0	0.0	1083.0	108.0	90.0
2	8266.0	25120.0	1807.0	31858.0	3941.0
3	26472.0	8892.0	17588.0	5107.0	19251.0
4	2177.0	8485.0	5726.0	5611.0	3316.0
5	2448.0	1361.0	3757.0	2315.0	3278.0
6	2138.0	944.0	1012.0	2131.0	1649.0
7	740.0	530.0	542.0	720.0	1068.0
8	297.0	182.0	337.0	353.0	320.0
9	215.0	107.0	152.0	98.0	173.0
=====					
Total	43398.0	45621.0	32004.0	48301.0	33086.0
=====					
AGE	1956	1957	1958	1959	1960
=====					
1	52.0	35.0	125.0	94.0	258.0
2	11948.0	6594.0	5571.0	5716.0	16010.0
3	6698.0	14046.0	7088.0	7994.0	6122.0
4	12066.0	4523.0	6665.0	5169.0	4562.0
5	3405.0	5822.0	3784.0	3934.0	3067.0
6	3378.0	2357.0	2366.0	1758.0	1792.0
7	1348.0	1630.0	903.0	1172.0	787.0
8	563.0	473.0	442.0	424.0	406.0
9	201.0	366.0	142.0	334.0	348.0
=====					
Total	39659.0	35846.0	27086.0	26595.0	33352.0
=====					
AGE	1961	1962	1963	1964	1965
=====					
1	62.0	74.0	2910.0	10101.0	9601.0
2	10689.0	4455.0	4047.0	15935.0	125818.0
3	14927.0	16245.0	7418.0	4554.0	44496.0
4	4198.0	10440.0	11152.0	4776.0	5356.0
5	2917.0	3448.0	8198.0	8722.0	4391.0
6	1856.0	2089.0	2205.0	5794.0	6690.0
7	1266.0	1566.0	1405.0	2082.0	3772.0
8	496.0	1185.0	721.0	1028.0	1094.0
9	674.0	898.0	1096.0	1332.0	1366.0
=====					
Total	37085.0	40400.0	39152.0	54324.0	202584.0
=====					
AGE	1966	1967	1968	1969	1970
=====					
1	114.0	1150.0	8.0	2.0	46.0
2	6843.0	168.0	2994.0	11.0	158.0
3	100810.0	2891.0	709.0	1698.0	16.0
4	19167.0	20667.0	1921.0	448.0	570.0
5	2768.0	10338.0	14519.0	654.0	186.0
6	2591.0	1209.0	3499.0	5954.0	214.0
7	2332.0	993.0	667.0	1574.0	2308.0
8	1268.0	917.0	453.0	225.0	746.0
9	867.0	698.0	842.0	570.0	464.0
=====					
Total	136760.0	39031.0	25612.0	11136.0	4708.0
=====					

Catch Numbers

AGE	1971	1972	1973	1974	1975
1	1.0	159.6	2607.1	47.7	198.6
2	1375.0	2.0	2113.1	4481.1	1069.5
3	223.0	460.4	3.1	681.5	1928.0
4	40.0	82.9	393.1	2.1	387.9
5	289.0	32.7	54.0	72.6	4.1
6	246.0	122.8	30.6	2.1	43.4
7	285.0	79.8	78.4	2.1	4.1
8	1469.0	67.5	15.3	55.0	4.1
9	928.0	1264.7	455.2	258.3	91.0
=====					
Total	4856.0	2272.4	5749.9	5602.5	3730.7

AGE	1976	1977	1978	1979	1980
1	149.3	1.0	1.0	1.0	8.0
2	490.5	19857.7	767.0	26.2	31170.3
3	570.4	189.6	14509.1	1742.5	348.9
4	912.6	689.5	307.4	7237.5	980.4
5	224.0	522.2	571.5	530.0	6087.3
6	0.0	362.0	521.1	413.9	597.3
7	23.9	4.1	140.1	318.0	549.0
8	4.1	39.5	14.1	96.9	153.8
9	116.1	112.5	67.5	46.4	81.4
=====					
Total	2490.9	21778.1	16898.8	10412.4	39976.4

AGE	1981	1982	1983	1984	1985
1	1.0	1.0	0.0	0.0	0.0
2	1755.4	1173.7	216.1	94.1	2463.7
3	11076.4	1645.1	821.1	300.6	563.2
4	836.9	3760.7	696.9	735.8	198.7
5	943.7	393.9	2261.4	401.8	472.1
6	2590.3	573.2	274.7	1499.9	233.5
7	333.4	1127.3	187.9	236.8	538.6
8	159.1	106.8	808.0	270.2	79.9
9	94.7	110.8	76.8	549.6	155.6
=====					
Total	17790.9	8892.5	5342.9	4088.8	4705.3

AGE	1986	1987	1988	1989	1990
1	6.1	0.0	4.1	1.9	62.9
2	54.7	2035.1	53.2	1462.2	11.6
3	2848.3	131.6	2439.1	122.5	1697.0
4	226.0	1645.5	137.1	1018.7	268.9
5	148.0	124.5	952.5	217.3	1124.1
6	175.4	74.5	152.4	477.8	154.3
7	152.0	90.8	56.3	61.7	217.6
8	269.6	108.1	65.5	37.0	55.4
9	60.8	137.7	108.4	56.7	48.9
=====					
Total	3940.9	4347.8	3968.6	3455.8	3640.7

Catch Numbers

AGE	1991	1992	1993	1994	1995
1	7.0	83.6	33.0	27.3	17.0
2	486.1	265.1	363.3	537.5	93.5
3	122.8	407.5	439.1	1191.5	614.3
4	2370.1	197.2	340.4	241.5	470.8
5	144.3	1960.1	120.1	142.1	58.9
6	517.6	181.2	741.4	73.4	29.4
7	127.9	425.7	62.6	313.4	8.5
8	171.9	46.6	169.2	55.2	61.4
9	65.0	99.5	82.2	109.7	16.2
=====					
Total	4012.7	3666.5	2351.3	2691.6	1370.0

AGE	1996	1997	1998	1999	2000
1	6.8	14.5	6.0	2.6	1.6
2	56.4	143.3	230.1	43.2	406.6
3	566.3	273.0	470.9	906.0	625.6
4	918.6	745.1	557.6	541.1	1570.9
5	450.3	561.3	767.2	605.7	588.0
6	66.0	217.9	570.7	565.5	527.7
7	22.1	17.5	168.9	383.5	377.0
8	6.9	18.4	23.4	163.2	258.1
9	78.2	48.8	48.6	47.6	98.5
=====					

Total	2171.6	2039.8	2843.4	3258.4	4454.0
AGE	2001	2002	2003	2004	2005
1	14.0	2.9	4.5	646.0	19.5
2	145.1	396.7	17.7	33.0	612.4
3	2393.3	345.3	1942.8	121.7	41.8
4	996.1	3177.4	461.1	5115.6	339.0
5	1280.6	926.2	2686.1	729.4	8505.4
6	655.6	1105.4	604.9	2935.4	777.7
7	437.6	401.6	719.1	686.7	1842.6
8	358.8	306.4	212.3	562.9	315.2
9	262.2	551.2	388.8	408.2	343.2
=====					
Total	6543.3	7213.1	7037.3	11238.9	12796.8
AGE	2006	2007			
1	164.4	13.0			
2	18.4	174.6			
3	3164.2	240.0			
4	70.9	11215.7			
5	375.2	194.2			
6	5418.3	311.4			
7	326.5	2511.7			
8	841.9	228.9			
9	227.6	564.4			
=====					
Total	10607.4	15453.9			

Surplus Production

Average Adjustment Factor (Delta) = 1.0000

Year	Biomass	Delta Biomass	Catch Biomass	Surplus Production
1931	178917.421	-19440.405	59738.640	40298.235
1932	159477.016	-22805.645	54551.550	31745.905
1933	136671.371	-21140.915	42160.800	21019.885
1934	115530.456	12829.164	25589.800	38419.044
1935	128359.620	4904.405	40588.040	45492.445
1936	133264.026	14112.048	43428.370	57540.418
1937	147376.074	19589.657	49402.410	68992.067
1938	166965.731	6550.065	47691.390	54241.455
1939	173515.796	16213.416	54057.590	70271.006
1940	189729.212	21454.047	47913.200	69367.247
1941	211183.259	-16454.638	62980.020	46525.382
1942	194728.620	-31615.891	55409.250	23793.359
1943	163112.729	451.016	46376.420	46827.436
1944	163563.745	-4305.337	49666.990	45361.653
1945	159258.408	12126.066	40442.900	52568.966
1946	171384.474	-5375.027	53683.250	48308.223
1947	166009.447	-31224.528	54376.350	23151.822
1948	134784.919	20200.791	48302.820	68503.611
1949	154985.710	-15272.626	42499.640	27227.014
1950	139713.084	19676.304	41255.310	60931.614
1951	159389.388	-15765.890	47421.660	31655.770
1952	143623.498	25137.099	43349.210	68486.309
1953	168760.597	-7338.173	35930.300	28592.127
1954	161422.424	19000.388	46400.650	65401.038
1955	180422.812	-16.605	40881.200	40864.595
1956	180406.207	-5679.558	52283.500	46603.942
1957	174726.649	4401.442	48846.860	53248.302
1958	179128.091	35638.117	37760.790	73398.907
1959	214766.208	47162.237	37993.950	85156.187
1960	261928.445	4248.220	42930.500	47178.720
1961	266176.665	-19403.343	48522.120	29118.777
1962	246773.322	43575.148	56429.820	100004.968
1963	290348.470	157533.650	57730.850	215264.500
1964	447882.120	-20502.304	67823.490	47321.186
1965	427379.816	-162128.452	181773.570	19645.118
1966	265251.364	-127361.825	140714.980	13353.155
1967	137889.539	-46235.908	52065.370	5829.462
1968	91653.631	-33990.131	40995.180	7005.049
1969	57663.500	-14573.223	22335.830	7762.607
1970	43090.277	-11667.751	12375.960	708.209
1971	31422.526	-956.235	11998.880	11042.645
1972	30466.291	-1364.427	6614.124	5249.697
1973	29101.865	15626.507	6934.442	22560.949
1974	44728.372	-12025.062	7567.329	-4457.733
1975	32703.309	35425.275	5734.792	41160.067
1976	68128.584	26866.860	4445.890	31312.750
1977	94995.444	4307.427	26341.524	30648.951
1978	99302.871	16817.564	27237.013	44054.577
1979	116120.435	-921.824	21302.085	20380.261
1980	115198.611	-35577.103	49155.516	13578.413
1981	79621.509	-20299.687	28310.123	8010.436
1982	59321.822	-13729.330	17638.347	3909.017
1983	45592.491	-9974.619	11999.796	2025.177
1984	35617.872	-7670.575	10385.393	2714.818
1985	27947.297	2680.623	7948.447	10629.070
1986	30627.919	-1784.792	6829.253	5044.461

1987	28843.128	682.252	6916.867	7599.120
1988	29525.380	-626.466	6713.180	6086.714
1989	28898.914	1558.998	5563.539	7122.537
1990	30457.912	-2635.572	6798.793	4163.221
1991	27822.340	-3214.572	7910.021	4695.449
1992	24607.768	3872.909	7958.660	11831.569
1993	28480.677	5268.595	5171.299	10439.893
1994	33749.272	3980.161	5281.477	9261.639
1995	37729.433	9561.784	2480.372	12042.156
1996	47291.217	10726.296	4206.139	14932.434
1997	58017.513	9975.674	4112.054	14087.727
1998	67993.187	28693.254	6098.079	34791.333
1999	96686.441	10602.521	6719.095	17321.615
2000	107288.962	19574.490	9054.007	28628.496
2001	126863.451	13075.901	12855.244	25931.145
2002	139939.352	3724.871	14911.965	18636.836
2003	143664.223	44814.902	13319.062	58133.964
2004	188479.125	43512.594	18878.733	62391.327
2005	231991.719	74816.732	21822.015	96638.748
2006	306808.452	38206.541	16254.266	54460.807
2007	345014.992	30416.501	21928.976	52345.477
2008	375431.493			

Summary of Survey Indices Used in the Estimate

INDEX	Survey Tag	Age	Time	Type	Catchability	Std. Error	CV
1	US_Sp	1	JAN-1	NUMBER	0.3096E+00	0.6177E-01	0.1995E+00
2	US_Sp	2	JAN-1	NUMBER	0.5591E+00	0.7922E-01	0.1417E+00
3	US_Sp	3	JAN-1	NUMBER	0.6333E+00	0.8694E-01	0.1373E+00
4	US_Sp	4	JAN-1	NUMBER	0.5724E+00	0.5717E-01	0.9988E-01
5	US_Sp	5	JAN-1	NUMBER	0.6346E+00	0.7953E-01	0.1253E+00
6	US_Sp	6	JAN-1	NUMBER	0.5402E+00	0.8792E-01	0.1627E+00
7	US_Sp	7	JAN-1	NUMBER	0.5356E+00	0.7833E-01	0.1463E+00
8	US_Sp	8	JAN-1	NUMBER	0.6231E+00	0.1055E+00	0.1693E+00
9	US_S41	1	JAN-1	NUMBER	0.7210E+00	0.3678E+00	0.5101E+00
10	US_S41	2	JAN-1	NUMBER	0.8988E+00	0.3143E+00	0.3497E+00
11	US_S41	3	JAN-1	NUMBER	0.7757E+00	0.2441E+00	0.3147E+00
12	US_S41	4	JAN-1	NUMBER	0.8390E+00	0.1830E+00	0.2182E+00
13	US_S41	5	JAN-1	NUMBER	0.8889E+00	0.1462E+00	0.1645E+00
14	US_S41	6	JAN-1	NUMBER	0.8845E+00	0.2451E+00	0.2771E+00
15	US_S41	7	JAN-1	NUMBER	0.9118E+00	0.2367E+00	0.2596E+00
16	US_S41	8	JAN-1	NUMBER	0.8614E+00	0.2714E+00	0.3151E+00
17	US_Au0	1	JAN-1	NUMBER	0.4331E+00	0.6219E-01	0.1436E+00
18	US_Au1	2	JAN-1	NUMBER	0.6882E+00	0.1032E+00	0.1500E+00
19	US_Au2	3	JAN-1	NUMBER	0.5724E+00	0.7104E-01	0.1241E+00
20	US_Au3	4	JAN-1	NUMBER	0.6538E+00	0.6409E-01	0.9802E-01
21	US_Au4	5	JAN-1	NUMBER	0.5717E+00	0.6236E-01	0.1091E+00
22	US_Au5	6	JAN-1	NUMBER	0.5608E+00	0.6643E-01	0.1185E+00
23	Can_Sp	1	JAN-1	NUMBER	0.2825E+00	0.6593E-01	0.2334E+00
24	Can_Sp	2	JAN-1	NUMBER	0.3991E+00	0.8343E-01	0.2090E+00
25	Can_Sp	3	JAN-1	NUMBER	0.6555E+00	0.8296E-01	0.1266E+00
26	Can_Sp	4	JAN-1	NUMBER	0.6205E+00	0.8304E-01	0.1338E+00
27	Can_Sp	5	JAN-1	NUMBER	0.7079E+00	0.9924E-01	0.1402E+00
28	Can_Sp	6	JAN-1	NUMBER	0.5231E+00	0.9882E-01	0.1889E+00
29	Can_Sp	7	JAN-1	NUMBER	0.6800E+00	0.1220E+00	0.1794E+00
30	Can_Sp	8	JAN-1	NUMBER	0.6203E+00	0.9973E-01	0.1608E+00

Survey Index: 1 Tag: US_Sp AGE = 1
Time = JAN-1 Type = NUMBER
Catchability = 0.309573E+00 % Variance Contribution = 6.3228
Residual = LN(Observed) - LN(Predicted)

Year	Observed	Predicted	Residual
1931	N/A	0.123638E+05	N/A
1932	N/A	0.140282E+05	N/A
1933	N/A	0.159786E+05	N/A
1934	N/A	0.184410E+05	N/A
1935	N/A	0.180213E+05	N/A
1936	N/A	0.176911E+05	N/A
1937	N/A	0.326013E+05	N/A
1938	N/A	0.241623E+05	N/A
1939	N/A	0.184154E+05	N/A
1940	N/A	0.344327E+05	N/A
1941	N/A	0.353740E+05	N/A
1942	N/A	0.191547E+05	N/A
1943	N/A	0.721502E+04	N/A
1944	N/A	0.201688E+05	N/A
1945	N/A	0.160379E+05	N/A
1946	N/A	0.290685E+05	N/A
1947	N/A	0.183068E+05	N/A
1948	N/A	0.102019E+05	N/A
1949	N/A	0.384308E+05	N/A
1950	N/A	0.177114E+05	N/A
1951	N/A	0.321276E+05	N/A
1952	N/A	0.130917E+05	N/A
1953	N/A	0.411083E+05	N/A
1954	N/A	0.161846E+05	N/A
1955	N/A	0.278307E+05	N/A
1956	N/A	0.186552E+05	N/A

1957	N/A	0.184599E+05	N/A
1958	N/A	0.181643E+05	N/A
1959	N/A	0.401969E+05	N/A
1960	N/A	0.378438E+05	N/A
1961	N/A	0.168135E+05	N/A
1962	N/A	0.120888E+05	N/A
1963	N/A	0.582744E+05	N/A
1964	N/A	0.142656E+06	N/A
1965	N/A	0.100652E+05	N/A
1966	N/A	0.128629E+04	N/A
1967	N/A	0.433805E+04	N/A
1968	0.129829E+04	0.167858E+03	0.204568E+01
1969	N/A	0.343901E+03	N/A
1970	0.217463E+04	0.142885E+04	0.419990E+00
1971	N/A	0.825241E+02	N/A
1972	0.130478E+05	0.263939E+04	0.159807E+01
1973	N/A	0.603612E+04	N/A
1974	N/A	0.327439E+04	N/A
1975	N/A	0.245494E+04	N/A
1976	N/A	0.326132E+05	N/A
1977	N/A	0.432899E+04	N/A
1978	N/A	0.189617E+04	N/A
1979	N/A	0.259697E+05	N/A
1980	N/A	0.338524E+04	N/A
1981	N/A	0.227971E+04	N/A
1982	0.246674E+04	0.799029E+03	0.112726E+01
1983	0.139566E+04	0.101676E+04	0.316745E+00
1984	0.678354E+04	0.559811E+04	0.192070E+00
1985	N/A	0.779824E+03	N/A
1986	0.808183E+04	0.519876E+04	0.441197E+00
1987	N/A	0.810504E+03	N/A
1988	0.503086E+04	0.619613E+04	-0.208335E+00
1989	0.649143E+02	0.422859E+03	-0.187397E+01
1990	0.279131E+04	0.105720E+04	0.970884E+00
1991	0.175269E+04	0.843594E+03	0.731233E+00
1992	0.129829E+04	0.334698E+04	-0.947013E+00
1993	0.379749E+04	0.485872E+04	-0.246436E+00
1994	0.226908E+04	0.482300E+04	-0.754021E+00
1995	0.162708E+04	0.397799E+04	-0.893992E+00
1996	0.352485E+04	0.369593E+04	-0.473952E-01
1997	0.582573E+04	0.737714E+04	-0.236102E+00
1998	0.267285E+04	0.462640E+04	-0.548635E+00
1999	0.331355E+05	0.156358E+05	0.751043E+00
2000	0.593706E+04	0.370926E+04	0.470381E+00
2001	0.325016E+05	0.302899E+05	0.704758E-01
2002	0.592992E+03	0.178889E+04	-0.110417E+01
2003	0.324571E+02	0.892844E+03	-0.331449E+01
2004	0.363974E+06	0.153198E+06	0.865355E+00
2005	0.259657E+04	0.249147E+04	0.413188E-01
2006	0.653232E+04	0.818810E+04	-0.225919E+00
2007	0.278872E+04	0.229727E+04	0.193862E+00
2008	0.597861E+04	0.506966E+04	0.164913E+00

Survey Index: 2 Tag: US_Sp AGE = 2
 Time = JAN-1 Type = NUMBER
 Catchability = 0.559059E+00 % Variance Contribution = 3.9236
 Residual = LN(Observed) - LN(Predicted)

Year	Observed	Predicted	Residual
1931	N/A	0.449413E+05	N/A
1932	N/A	0.173949E+05	N/A
1933	N/A	0.206818E+05	N/A
1934	N/A	0.235019E+05	N/A
1935	N/A	0.270937E+05	N/A
1936	N/A	0.260411E+05	N/A
1937	N/A	0.257128E+05	N/A
1938	N/A	0.475523E+05	N/A
1939	N/A	0.352052E+05	N/A
1940	N/A	0.269215E+05	N/A
1941	N/A	0.498805E+05	N/A
1942	N/A	0.519003E+05	N/A
1943	N/A	0.281647E+05	N/A
1944	N/A	0.106582E+05	N/A
1945	N/A	0.297883E+05	N/A
1946	N/A	0.236517E+05	N/A
1947	N/A	0.428737E+05	N/A
1948	N/A	0.270220E+05	N/A
1949	N/A	0.150436E+05	N/A
1950	N/A	0.566561E+05	N/A
1951	N/A	0.261427E+05	N/A
1952	N/A	0.471766E+05	N/A
1953	N/A	0.193548E+05	N/A
1954	N/A	0.602338E+05	N/A
1955	N/A	0.238752E+05	N/A
1956	N/A	0.411037E+05	N/A
1957	N/A	0.275564E+05	N/A
1958	N/A	0.272762E+05	N/A
1959	N/A	0.267937E+05	N/A
1960	N/A	0.593857E+05	N/A
1961	N/A	0.558236E+05	N/A
1962	N/A	0.248283E+05	N/A
1963	N/A	0.178365E+05	N/A
1964	N/A	0.846924E+05	N/A

1965	N/A	0.205825E+06	N/A
1966	N/A	0.100645E+05	N/A
1967	N/A	0.184430E+04	N/A
1968	0.918537E+04	0.583417E+04	0.453881E+00
1969	0.227200E+03	0.244147E+03	-0.719397E-01
1970	0.811429E+03	0.507465E+03	0.469369E+00
1971	0.376503E+04	0.208939E+04	0.588881E+00
1972	0.292114E+03	0.121511E+03	0.877141E+00
1973	N/A	0.382189E+04	N/A
1974	N/A	0.761156E+04	N/A
1975	N/A	0.481727E+04	N/A
1976	N/A	0.352949E+04	N/A
1977	N/A	0.481448E+05	N/A
1978	N/A	0.639998E+04	N/A
1979	N/A	0.280308E+04	N/A
1980	N/A	0.383937E+05	N/A
1981	N/A	0.500120E+04	N/A
1982	0.496594E+04	0.337017E+04	0.387641E+00
1983	0.178514E+04	0.118090E+04	0.413223E+00
1984	0.382994E+04	0.150318E+04	0.935268E+00
1985	0.160987E+05	0.827625E+04	0.665351E+00
1986	0.584229E+03	0.115289E+04	-0.679737E+00
1987	0.117495E+05	0.768355E+04	0.424728E+00
1988	0.129829E+03	0.119825E+04	-0.222240E+01
1989	0.113275E+05	0.915922E+04	0.212476E+00
1990	N/A	0.624258E+03	N/A
1991	0.347291E+04	0.153137E+04	0.818829E+00
1992	0.584229E+03	0.124376E+04	-0.755603E+00
1993	0.210971E+04	0.490646E+04	-0.843999E+00
1994	0.870760E+04	0.716719E+04	0.194683E+00
1995	0.417204E+04	0.711725E+04	-0.534116E+00
1996	0.149076E+05	0.587307E+04	0.931492E+00
1997	0.331939E+04	0.546118E+04	-0.497883E+00
1998	0.958200E+04	0.109001E+05	-0.128890E+00
1999	0.658133E+04	0.683732E+04	-0.381590E-01
2000	0.769234E+04	0.231160E+05	-0.110030E+01
2001	0.278937E+04	0.548352E+04	-0.675933E+00
2002	0.624686E+05	0.447780E+05	0.332947E+00
2003	0.811429E+03	0.264349E+04	-0.118106E+01
2004	0.600457E+04	0.131784E+04	0.151653E+01
2005	0.173126E+06	0.226184E+06	-0.267327E+00
2006	0.185006E+04	0.367391E+04	-0.686041E+00
2007	0.227437E+05	0.120235E+05	0.637425E+00
2008	0.284162E+04	0.339006E+04	-0.176471E+00

Survey Index: 3 Tag: US_Sp AGE = 3
 Time = JAN-1 Type = NUMBER
 Catchability = 0.633341E+00 % Variance Contribution = 3.6820
 Residual = LN(Observed) - LN(Predicted)

Year	Observed	Predicted	Residual
1931	N/A	0.891821E+04	N/A
1932	N/A	0.366593E+05	N/A
1933	N/A	0.149432E+05	N/A
1934	N/A	0.143567E+05	N/A
1935	N/A	0.192554E+05	N/A
1936	N/A	0.183729E+05	N/A
1937	N/A	0.171411E+05	N/A
1938	N/A	0.175683E+05	N/A
1939	N/A	0.326072E+05	N/A
1940	N/A	0.247166E+05	N/A
1941	N/A	0.208325E+05	N/A
1942	N/A	0.329165E+05	N/A
1943	N/A	0.399858E+05	N/A
1944	N/A	0.237293E+05	N/A
1945	N/A	0.945057E+04	N/A
1946	N/A	0.227692E+05	N/A
1947	N/A	0.176812E+05	N/A
1948	N/A	0.302998E+05	N/A
1949	N/A	0.186716E+05	N/A
1950	N/A	0.102692E+05	N/A
1951	N/A	0.360777E+05	N/A
1952	N/A	0.195356E+05	N/A
1953	N/A	0.294792E+05	N/A
1954	N/A	0.169191E+05	N/A
1955	N/A	0.377593E+05	N/A
1956	N/A	0.198940E+05	N/A
1957	N/A	0.313110E+05	N/A
1958	N/A	0.217964E+05	N/A
1959	N/A	0.221190E+05	N/A
1960	N/A	0.215891E+05	N/A
1961	N/A	0.459492E+05	N/A
1962	N/A	0.456747E+05	N/A
1963	N/A	0.204848E+05	N/A
1964	N/A	0.142341E+05	N/A
1965	N/A	0.694556E+05	N/A
1966	N/A	0.119480E+06	N/A
1967	N/A	0.545463E+04	N/A
1968	0.149303E+04	0.161460E+04	-0.782800E-01
1969	0.188251E+04	0.370906E+04	-0.678171E+00
1970	N/A	0.220160E+03	N/A
1971	0.811429E+03	0.380606E+03	0.757031E+00
1972	0.197989E+04	0.115796E+04	0.536380E+00

1973	N/A	0.111559E+03	N/A
1974	N/A	0.234418E+04	N/A
1975	N/A	0.451505E+04	N/A
1976	N/A	0.385771E+04	N/A
1977	N/A	0.299346E+04	N/A
1978	N/A	0.333491E+05	N/A
1979	N/A	0.549783E+04	N/A
1980	N/A	0.258491E+04	N/A
1981	N/A	0.179774E+05	N/A
1982	0.305097E+04	0.363845E+04	-0.176097E+00
1983	0.188251E+04	0.245707E+04	-0.266362E+00
1984	0.207726E+04	0.971914E+03	0.759537E+00
1985	0.246674E+04	0.134042E+04	0.609915E+00
1986	0.668617E+04	0.627157E+04	0.640154E-01
1987	0.194743E+03	0.103805E+04	-0.167342E+01
1988	0.321326E+04	0.596574E+04	-0.618748E+00
1989	0.146057E+04	0.108097E+04	0.300965E+00
1990	0.185655E+05	0.766021E+04	0.885264E+00
1991	0.778971E+03	0.572374E+03	0.308181E+00
1992	0.357029E+03	0.114327E+04	-0.116383E+01
1993	0.584229E+03	0.100229E+04	-0.539755E+00
1994	0.325415E+04	0.434313E+04	-0.288663E+00
1995	0.752811E+04	0.634041E+04	0.171700E+00
1996	0.287440E+05	0.654788E+04	0.147929E+01
1997	0.108845E+05	0.541510E+04	0.698148E+00
1998	0.404870E+04	0.498337E+04	-0.207710E+00
1999	0.695037E+04	0.997845E+04	-0.361632E+00
2000	0.133224E+05	0.631702E+04	0.746197E+00
2001	0.791013E+04	0.212079E+05	-0.986228E+00
2002	0.218067E+05	0.500306E+04	0.147216E+01
2003	0.176891E+05	0.413054E+05	-0.848042E+00
2004	0.389486E+04	0.244176E+04	0.466938E+00
2005	0.519314E+03	0.120344E+04	-0.840433E+00
2006	0.932494E+05	0.209439E+06	-0.809155E+00
2007	0.593706E+04	0.339709E+04	0.558295E+00
2008	0.837394E+04	0.110521E+05	-0.277497E+00

Survey Index: 4 Tag: US_Sp AGE = 4
 Time = JAN-1 Type = NUMBER
 Catchability = 0.572417E+00 % Variance Contribution = 1.9491
 Residual = LN(Observed) - LN(Predicted)

Year	Observed	Predicted	Residual
1931	N/A	0.101117E+05	N/A
1932	N/A	0.554692E+04	N/A
1933	N/A	0.138961E+05	N/A
1934	N/A	0.796015E+04	N/A
1935	N/A	0.783819E+04	N/A
1936	N/A	0.971720E+04	N/A
1937	N/A	0.771161E+04	N/A
1938	N/A	0.709644E+04	N/A
1939	N/A	0.901436E+04	N/A
1940	N/A	0.140748E+05	N/A
1941	N/A	0.119653E+05	N/A
1942	N/A	0.103771E+05	N/A
1943	N/A	0.159630E+05	N/A
1944	N/A	0.204723E+05	N/A
1945	N/A	0.132169E+05	N/A
1946	N/A	0.594683E+04	N/A
1947	N/A	0.906232E+04	N/A
1948	N/A	0.778579E+04	N/A
1949	N/A	0.125685E+05	N/A
1950	N/A	0.742949E+04	N/A
1951	N/A	0.548676E+04	N/A
1952	N/A	0.131667E+05	N/A
1953	N/A	0.988681E+04	N/A
1954	N/A	0.127992E+05	N/A
1955	N/A	0.988928E+04	N/A
1956	N/A	0.180582E+05	N/A
1957	N/A	0.112729E+05	N/A
1958	N/A	0.159512E+05	N/A
1959	N/A	0.124793E+05	N/A
1960	N/A	0.122537E+05	N/A
1961	N/A	0.128213E+05	N/A
1962	N/A	0.263155E+05	N/A
1963	N/A	0.254376E+05	N/A
1964	N/A	0.113409E+05	N/A
1965	N/A	0.818787E+04	N/A
1966	N/A	0.286087E+05	N/A
1967	N/A	0.370226E+05	N/A
1968	0.227200E+04	0.255269E+04	-0.116488E+00
1969	0.811429E+03	0.830355E+03	-0.230566E-01
1970	0.107109E+04	0.187215E+04	-0.558416E+00
1971	N/A	0.154646E+03	N/A
1972	0.389486E+03	0.167318E+03	0.844933E+00
1973	N/A	0.620069E+03	N/A
1974	N/A	0.809485E+02	N/A
1975	N/A	0.138356E+04	N/A
1976	N/A	0.234988E+04	N/A
1977	N/A	0.256019E+04	N/A
1978	N/A	0.211711E+04	N/A
1979	N/A	0.172197E+05	N/A
1980	N/A	0.317096E+04	N/A

1981	N/A	0.173265E+04	N/A
1982	0.132101E+05	0.762777E+04	0.549183E+00
1983	0.714057E+03	0.184700E+04	-0.950356E+00
1984	0.204480E+04	0.139545E+04	0.382081E+00
1985	0.129829E+04	0.564380E+03	0.833072E+00
1986	0.778971E+03	0.702319E+03	0.103587E+00
1987	0.262903E+04	0.317721E+04	-0.189389E+00
1988	0.421943E+03	0.700184E+03	-0.506473E+00
1989	0.230446E+04	0.316025E+04	-0.315806E+00
1990	0.107109E+04	0.736636E+03	0.374334E+00
1991	0.600457E+04	0.479331E+04	0.225300E+00
1992	0.227200E+03	0.360215E+03	-0.460870E+00
1993	0.454400E+03	0.636273E+03	-0.336650E+00
1994	0.481015E+03	0.515983E+03	-0.701756E-01
1995	0.296918E+04	0.259986E+04	0.132827E+00
1996	0.168939E+05	0.437446E+04	0.135117E+01
1997	0.118709E+05	0.455274E+04	0.958360E+00
1998	0.343721E+04	0.386595E+04	-0.117547E+00
1999	0.232750E+04	0.344434E+04	-0.391937E+00
2000	0.652129E+04	0.691582E+04	-0.587390E-01
2001	0.270725E+04	0.435132E+04	-0.474546E+00
2002	0.104593E+05	0.144574E+05	-0.323714E+00
2003	0.392731E+04	0.352373E+04	0.108436E+00
2004	0.294062E+05	0.295609E+05	-0.524647E-02
2005	0.123337E+04	0.174394E+04	-0.346398E+00
2006	0.164395E+04	0.868911E+03	0.637619E+00
2007	0.146687E+06	0.153343E+06	-0.443797E-01
2008	0.712110E+03	0.238976E+04	-0.121072E+01

Survey Index: 5 Tag: US_Sp AGE = 5
 Time = JAN-1 Type = NUMBER
 Catchability = 0.634646E+00 % Variance Contribution = 3.2729
 Residual = LN(Observed) - LN(Predicted)

Year	Observed	Predicted	Residual
1931	N/A	0.108807E+05	N/A
1932	N/A	0.588657E+04	N/A
1933	N/A	0.365456E+04	N/A
1934	N/A	0.691159E+04	N/A
1935	N/A	0.509740E+04	N/A
1936	N/A	0.500276E+04	N/A
1937	N/A	0.572928E+04	N/A
1938	N/A	0.380533E+04	N/A
1939	N/A	0.430333E+04	N/A
1940	N/A	0.524447E+04	N/A
1941	N/A	0.808057E+04	N/A
1942	N/A	0.629738E+04	N/A
1943	N/A	0.570642E+04	N/A
1944	N/A	0.972678E+04	N/A
1945	N/A	0.101584E+05	N/A
1946	N/A	0.835833E+04	N/A
1947	N/A	0.383734E+04	N/A
1948	N/A	0.415541E+04	N/A
1949	N/A	0.416006E+04	N/A
1950	N/A	0.595937E+04	N/A
1951	N/A	0.431297E+04	N/A
1952	N/A	0.373840E+04	N/A
1953	N/A	0.712889E+04	N/A
1954	N/A	0.571637E+04	N/A
1955	N/A	0.841872E+04	N/A
1956	N/A	0.708328E+04	N/A
1957	N/A	0.953641E+04	N/A
1958	N/A	0.765229E+04	N/A
1959	N/A	0.106777E+05	N/A
1960	N/A	0.837932E+04	N/A
1961	N/A	0.851934E+04	N/A
1962	N/A	0.924088E+04	N/A
1963	N/A	0.179307E+05	N/A
1964	N/A	0.167313E+05	N/A
1965	N/A	0.757046E+04	N/A
1966	N/A	0.438849E+04	N/A
1967	N/A	0.150791E+05	N/A
1968	0.218112E+05	0.218427E+05	-0.144380E-02
1969	0.136320E+04	0.122735E+04	0.104975E+00
1970	0.149303E+04	0.498660E+03	0.109664E+01
1971	0.389486E+03	0.137380E+04	-0.126051E+01
1972	0.973714E+02	0.117514E+03	-0.188025E+00
1973	N/A	0.104647E+03	N/A
1974	N/A	0.339375E+03	N/A
1975	N/A	0.722763E+02	N/A
1976	N/A	0.103425E+04	N/A
1977	N/A	0.161231E+04	N/A
1978	N/A	0.192991E+04	N/A
1979	N/A	0.174583E+04	N/A
1980	N/A	0.115028E+05	N/A
1981	N/A	0.231835E+04	N/A
1982	0.136320E+04	0.109587E+04	0.218287E+00
1983	0.782217E+04	0.478122E+04	0.492267E+00
1984	0.188251E+04	0.127886E+04	0.386643E+00
1985	0.282377E+04	0.847673E+03	0.120333E+01
1986	0.357029E+03	0.398867E+03	-0.110813E+00
1987	0.259657E+03	0.508442E+03	-0.671989E+00
1988	0.103863E+04	0.194684E+04	-0.628306E+00

1989	0.454400E+03	0.557156E+03	-0.203867E+00
1990	0.188251E+04	0.228685E+04	-0.194569E+00
1991	0.292114E+03	0.515179E+03	-0.567369E+00
1992	0.107109E+04	0.300064E+04	-0.103015E+01
1993	0.389486E+03	0.214712E+03	0.595532E+00
1994	0.330414E+03	0.383737E+03	-0.149611E+00
1995	0.536192E+03	0.330723E+03	0.483211E+00
1996	0.849728E+04	0.209063E+04	0.140228E+01
1997	0.652194E+04	0.344547E+04	0.638110E+00
1998	0.277346E+04	0.370630E+04	-0.289936E+00
1999	0.208505E+04	0.319010E+04	-0.425262E+00
2000	0.360404E+04	0.281688E+04	0.246425E+00
2001	0.976635E+03	0.537946E+04	-0.170623E+01
2002	0.354594E+04	0.338027E+04	0.478481E-01
2003	0.157417E+05	0.113064E+05	0.330942E+00
2004	0.707566E+04	0.293465E+04	0.880072E+00
2005	0.108731E+05	0.239064E+05	-0.787848E+00
2006	0.205811E+04	0.138912E+04	0.393119E+00
2007	0.111328E+04	0.748131E+03	0.397487E+00
2008	0.658500E+05	0.132771E+06	-0.701242E+00

Survey Index: 6 Tag: US_Sp AGE = 6
 Time = JAN-1 Type = NUMBER
 Catchability = 0.540223E+00 % Variance Contribution = 5.5201
 Residual = LN(Observed) - LN(Predicted)

Year	Observed	Predicted	Residual
1931	N/A	0.550891E+04	N/A
1932	N/A	0.320439E+04	N/A
1933	N/A	0.232532E+04	N/A
1934	N/A	0.153456E+04	N/A
1935	N/A	0.328979E+04	N/A
1936	N/A	0.212793E+04	N/A
1937	N/A	0.244783E+04	N/A
1938	N/A	0.199404E+04	N/A
1939	N/A	0.162915E+04	N/A
1940	N/A	0.195630E+04	N/A
1941	N/A	0.243828E+04	N/A
1942	N/A	0.285006E+04	N/A
1943	N/A	0.245731E+04	N/A
1944	N/A	0.247498E+04	N/A
1945	N/A	0.402636E+04	N/A
1946	N/A	0.427513E+04	N/A
1947	N/A	0.303222E+04	N/A
1948	N/A	0.164466E+04	N/A
1949	N/A	0.157037E+04	N/A
1950	N/A	0.176327E+04	N/A
1951	N/A	0.254851E+04	N/A
1952	N/A	0.182103E+04	N/A
1953	N/A	0.194442E+04	N/A
1954	N/A	0.314864E+04	N/A
1955	N/A	0.286032E+04	N/A
1956	N/A	0.427588E+04	N/A
1957	N/A	0.328601E+04	N/A
1958	N/A	0.383073E+04	N/A
1959	N/A	0.349929E+04	N/A
1960	N/A	0.553117E+04	N/A
1961	N/A	0.435032E+04	N/A
1962	N/A	0.452023E+04	N/A
1963	N/A	0.476591E+04	N/A
1964	N/A	0.852098E+04	N/A
1965	N/A	0.743565E+04	N/A
1966	N/A	0.315138E+04	N/A
1967	N/A	0.172042E+04	N/A
1968	0.545280E+04	0.551727E+04	-0.117548E-01
1969	0.137294E+05	0.820917E+04	0.514286E+00
1970	0.149303E+04	0.538649E+03	0.101950E+01
1971	0.389486E+03	0.257210E+03	0.414934E+00
1972	0.129829E+03	0.816766E+03	-0.183914E+01
1973	N/A	0.659973E+02	N/A
1974	N/A	0.467717E+02	N/A
1975	N/A	0.201183E+03	N/A
1976	N/A	0.483713E+02	N/A
1977	N/A	0.611773E+03	N/A
1978	N/A	0.869900E+03	N/A
1979	N/A	0.106717E+04	N/A
1980	N/A	0.959084E+03	N/A
1981	N/A	0.506838E+04	N/A
1982	0.908800E+03	0.115772E+04	-0.242083E+00
1983	0.324571E+02	0.572428E+03	-0.286997E+01
1984	0.233691E+04	0.223584E+04	0.442161E-01
1985	0.110354E+04	0.695985E+03	0.460953E+00
1986	0.681600E+03	0.362232E+03	0.632158E+00
1987	0.324571E+03	0.206112E+03	0.454084E+00
1988	0.389486E+03	0.293776E+03	0.282009E+00
1989	0.133074E+04	0.895163E+03	0.396487E+00
1990	0.194743E+03	0.282807E+03	-0.373084E+00
1991	0.324571E+03	0.104898E+04	-0.117307E+01
1992	0.973714E+02	0.288874E+03	-0.108746E+01
1993	0.120091E+04	0.114415E+04	0.484194E-01
1994	0.213568E+03	0.915029E+02	0.847584E+00
1995	0.369687E+03	0.198431E+03	0.622213E+00
1996	0.113275E+04	0.201808E+03	0.172509E+01

1997	0.288674E+04	0.123785E+04	0.846753E+00
1998	0.695881E+03	0.212785E+04	-0.111769E+01
1999	0.164590E+04	0.220957E+04	-0.294508E+00
2000	0.359073E+04	0.192836E+04	0.621686E+00
2001	0.681600E+03	0.167695E+04	-0.900288E+00
2002	0.154821E+04	0.312600E+04	-0.702659E+00
2003	0.311589E+04	0.190538E+04	0.491831E+00
2004	0.866606E+04	0.657280E+04	0.276473E+00
2005	0.146057E+04	0.169039E+04	-0.146134E+00
2006	0.120059E+05	0.125298E+05	-0.427089E-01
2007	0.791630E+03	0.785639E+03	0.759574E-02
2008	0.127524E+04	0.426932E+03	0.109427E+01

Survey Index: 7 Tag: US_Sp AGE = 7
Time = JAN-1 Type = NUMBER
Catchability = 0.535573E+00 % Variance Contribution = 4.4580
Residual = LN(Observed) - LN(Predicted)

Year	Observed	Predicted	Residual
1931	N/A	0.294060E+04	N/A
1932	N/A	0.159560E+04	N/A
1933	N/A	0.121818E+04	N/A
1934	N/A	0.112996E+04	N/A
1935	N/A	0.741446E+03	N/A
1936	N/A	0.149246E+04	N/A
1937	N/A	0.106631E+04	N/A
1938	N/A	0.108870E+04	N/A
1939	N/A	0.852593E+03	N/A
1940	N/A	0.857859E+03	N/A
1941	N/A	0.879309E+03	N/A
1942	N/A	0.112547E+04	N/A
1943	N/A	0.119778E+04	N/A
1944	N/A	0.713324E+03	N/A
1945	N/A	0.919430E+03	N/A
1946	N/A	0.215584E+04	N/A
1947	N/A	0.163511E+04	N/A
1948	N/A	0.115250E+04	N/A
1949	N/A	0.780136E+03	N/A
1950	N/A	0.765645E+03	N/A
1951	N/A	0.888347E+03	N/A
1952	N/A	0.104577E+04	N/A
1953	N/A	0.102417E+04	N/A
1954	N/A	0.109163E+04	N/A
1955	N/A	0.153340E+04	N/A
1956	N/A	0.152939E+04	N/A
1957	N/A	0.185322E+04	N/A
1958	N/A	0.153722E+04	N/A
1959	N/A	0.197326E+04	N/A
1960	N/A	0.199477E+04	N/A
1961	N/A	0.362567E+04	N/A
1962	N/A	0.263749E+04	N/A
1963	N/A	0.266370E+04	N/A
1964	N/A	0.280730E+04	N/A
1965	N/A	0.413694E+04	N/A
1966	N/A	0.283867E+04	N/A
1967	N/A	0.131802E+04	N/A
1968	0.811429E+03	0.816687E+03	-0.645937E-02
1969	0.334309E+04	0.279859E+04	0.177777E+00
1970	0.649143E+04	0.380920E+04	0.533063E+00
1971	0.292114E+03	0.334141E+03	-0.134418E+00
1972	0.421943E+03	0.913610E+02	0.153005E+01
1973	N/A	0.603638E+03	N/A
1974	N/A	0.388435E+02	N/A
1975	N/A	0.369483E+02	N/A
1976	N/A	0.142348E+03	N/A
1977	N/A	0.392583E+02	N/A
1978	N/A	0.322677E+03	N/A
1979	N/A	0.455797E+03	N/A
1980	N/A	0.666829E+03	N/A
1981	N/A	0.491690E+03	N/A
1982	0.197989E+04	0.286821E+04	-0.370649E+00
1983	0.129829E+03	0.663982E+03	-0.163204E+01
1984	0.227200E+03	0.332467E+03	-0.380710E+00
1985	0.379749E+04	0.109518E+04	0.124342E+01
1986	0.389486E+03	0.452369E+03	-0.149671E+00
1987	0.162286E+03	0.209635E+03	-0.256007E+00
1988	0.357029E+03	0.131399E+03	0.999574E+00
1989	0.194743E+03	0.165170E+03	0.164705E+00
1990	0.421943E+03	0.496882E+03	-0.163483E+00
1991	0.649143E+02	0.155381E+03	-0.872812E+00
1992	0.973714E+02	0.602460E+03	-0.182249E+01
1993	0.194743E+03	0.147480E+03	0.277986E+00
1994	0.503410E+03	0.572858E+03	-0.129232E+00
1995	0.928274E+02	0.391338E+02	0.863755E+00
1996	0.236937E+03	0.146862E+03	0.478303E+00
1997	0.408960E+03	0.131988E+03	0.113091E+01
1998	0.196041E+03	0.899515E+03	-0.152353E+01
1999	0.662775E+03	0.145184E+04	-0.784149E+00
2000	0.329245E+04	0.152063E+04	0.772507E+00
2001	0.373582E+03	0.131067E+04	-0.125516E+01
2002	0.196950E+04	0.104536E+04	0.633417E+00
2003	0.370011E+04	0.200463E+04	0.612906E+00
2004	0.139566E+04	0.125493E+04	0.106283E+00

2005	0.327817E+04	0.392213E+04	-0.179349E+00
2006	0.168355E+04	0.997799E+03	0.523109E+00
2007	0.452810E+04	0.756171E+04	-0.512795E+00
2008	0.552745E+03	0.487705E+03	0.125185E+00

Survey Index: 8 Tag: US_Sp AGE = 8
Time = JAN-1 Type = NUMBER
Catchability = 0.623145E+00 % Variance Contribution = 5.2382
Residual = LN(Observed) - LN(Predicted)

Year	Observed	Predicted	Residual
1931	N/A	0.192278E+04	N/A
1932	N/A	0.932299E+03	N/A
1933	N/A	0.784985E+03	N/A
1934	N/A	0.488901E+03	N/A
1935	N/A	0.730200E+03	N/A
1936	N/A	0.427734E+03	N/A
1937	N/A	0.664568E+03	N/A
1938	N/A	0.486336E+03	N/A
1939	N/A	0.511310E+03	N/A
1940	N/A	0.347539E+03	N/A
1941	N/A	0.398860E+03	N/A
1942	N/A	0.316290E+03	N/A
1943	N/A	0.496284E+03	N/A
1944	N/A	0.699892E+03	N/A
1945	N/A	0.402165E+03	N/A
1946	N/A	0.368597E+03	N/A
1947	N/A	0.103674E+04	N/A
1948	N/A	0.723267E+03	N/A
1949	N/A	0.662463E+03	N/A
1950	N/A	0.395540E+03	N/A
1951	N/A	0.439091E+03	N/A
1952	N/A	0.434245E+03	N/A
1953	N/A	0.699611E+03	N/A
1954	N/A	0.672407E+03	N/A
1955	N/A	0.637862E+03	N/A
1956	N/A	0.864726E+03	N/A
1957	N/A	0.707076E+03	N/A
1958	N/A	0.858661E+03	N/A
1959	N/A	0.959606E+03	N/A
1960	N/A	0.122467E+04	N/A
1961	N/A	0.145915E+04	N/A
1962	N/A	0.274390E+04	N/A
1963	N/A	0.163720E+04	N/A
1964	N/A	0.175141E+04	N/A
1965	N/A	0.151324E+04	N/A
1966	N/A	0.184391E+04	N/A
1967	N/A	0.140551E+04	N/A
1968	0.146057E+04	0.701926E+03	0.732756E+00
1969	0.908800E+03	0.406516E+03	0.804503E+00
1970	0.318080E+04	0.178580E+04	0.577268E+00
1971	0.266149E+04	0.233888E+04	0.129211E+00
1972	0.973714E+02	0.159687E+03	-0.494685E+00
1973	N/A	0.426352E+02	N/A
1974	N/A	0.530954E+03	N/A
1975	N/A	0.358209E+02	N/A
1976	N/A	0.328917E+02	N/A
1977	N/A	0.122171E+03	N/A
1978	N/A	0.350921E+02	N/A
1979	N/A	0.228905E+03	N/A
1980	N/A	0.256738E+03	N/A
1981	N/A	0.329513E+03	N/A
1982	N/A	0.282278E+03	N/A
1983	0.376503E+04	0.210046E+04	0.583597E+00
1984	0.129829E+03	0.527061E+03	-0.140110E+01
1985	0.324571E+03	0.184597E+03	0.564332E+00
1986	0.107109E+04	0.741800E+03	0.367349E+00
1987	0.714057E+03	0.345679E+03	0.725453E+00
1988	0.389486E+03	0.148835E+03	0.961986E+00
1989	0.162286E+03	0.936322E+02	0.549984E+00
1990	N/A	0.122753E+03	N/A
1991	0.129829E+03	0.351447E+03	-0.995844E+00
1992	0.973714E+02	0.767951E+02	0.237392E+00
1993	0.649143E+02	0.336382E+03	-0.164518E+01
1994	0.490103E+02	0.105420E+03	-0.765919E+00
1995	0.577737E+03	0.370420E+03	0.444480E+00
1996	0.243429E+03	0.325052E+02	0.201342E+01
1997	0.228498E+03	0.127480E+03	0.583570E+00
1998	0.178514E+02	0.115894E+03	-0.187059E+01
1999	0.651739E+03	0.761991E+03	-0.156289E+00
2000	0.154334E+04	0.116775E+04	0.278865E+00
2001	0.265175E+03	0.123690E+04	-0.153997E+01
2002	0.552421E+03	0.100312E+04	-0.596556E+00
2003	0.279131E+04	0.770710E+03	0.128696E+01
2004	0.311589E+04	0.150642E+04	0.726779E+00
2005	0.616686E+03	0.811380E+03	-0.274378E+00
2006	0.153685E+04	0.270457E+04	-0.565210E+00
2007	0.431031E+03	0.767370E+03	-0.576789E+00
2008	0.291984E+04	0.579455E+04	-0.685388E+00

Survey Index: 9 Tag: US_S41 AGE = 1
Time = JAN-1 Type = NUMBER
Catchability = 0.721024E+00 % Variance Contribution = 3.9361

Residual = LN(Observed) - LN(Predicted)

Year	Observed	Predicted	Residual
1931	N/A	0.287963E+05	N/A
1932	N/A	0.326730E+05	N/A
1933	N/A	0.372156E+05	N/A
1934	N/A	0.429507E+05	N/A
1935	N/A	0.419733E+05	N/A
1936	N/A	0.412041E+05	N/A
1937	N/A	0.759315E+05	N/A
1938	N/A	0.562763E+05	N/A
1939	N/A	0.428911E+05	N/A
1940	N/A	0.801969E+05	N/A
1941	N/A	0.823893E+05	N/A
1942	N/A	0.446132E+05	N/A
1943	N/A	0.168045E+05	N/A
1944	N/A	0.469751E+05	N/A
1945	N/A	0.373538E+05	N/A
1946	N/A	0.677034E+05	N/A
1947	N/A	0.426382E+05	N/A
1948	N/A	0.237612E+05	N/A
1949	N/A	0.895088E+05	N/A
1950	N/A	0.412514E+05	N/A
1951	N/A	0.748282E+05	N/A
1952	N/A	0.304918E+05	N/A
1953	N/A	0.957450E+05	N/A
1954	N/A	0.376955E+05	N/A
1955	N/A	0.648204E+05	N/A
1956	N/A	0.434497E+05	N/A
1957	N/A	0.429948E+05	N/A
1958	N/A	0.423064E+05	N/A
1959	N/A	0.936224E+05	N/A
1960	N/A	0.881417E+05	N/A
1961	N/A	0.391602E+05	N/A
1962	N/A	0.281559E+05	N/A
1963	N/A	0.135727E+06	N/A
1964	N/A	0.332259E+06	N/A
1965	N/A	0.234427E+05	N/A
1966	N/A	0.299589E+04	N/A
1967	N/A	0.101037E+05	N/A
1968	N/A	0.390956E+03	N/A
1969	N/A	0.800978E+03	N/A
1970	N/A	0.332792E+04	N/A
1971	N/A	0.192206E+03	N/A
1972	N/A	0.614738E+04	N/A
1973	0.995785E+05	0.140587E+05	0.195771E+01
1974	0.691337E+04	0.762637E+04	-0.981546E-01
1975	0.305097E+04	0.571777E+04	-0.628119E+00
1976	0.262221E+06	0.759591E+05	0.123899E+01
1977	0.197989E+04	0.100826E+05	-0.162777E+01
1978	0.227200E+03	0.441636E+04	-0.296724E+01
1979	0.117235E+06	0.604860E+05	0.661771E+00
1980	0.168777E+05	0.788454E+04	0.761091E+00
1981	0.107109E+05	0.530967E+04	0.701728E+00
1982	N/A	0.186101E+04	N/A
1983	N/A	0.236813E+04	N/A
1984	N/A	0.130385E+05	N/A
1985	N/A	0.181628E+04	N/A
1986	N/A	0.121084E+05	N/A
1987	N/A	0.188774E+04	N/A
1988	N/A	0.144314E+05	N/A
1989	N/A	0.984878E+03	N/A
1990	N/A	0.246233E+04	N/A
1991	N/A	0.196481E+04	N/A
1992	N/A	0.779542E+04	N/A
1993	N/A	0.113164E+05	N/A
1994	N/A	0.112332E+05	N/A
1995	N/A	0.926511E+04	N/A
1996	N/A	0.860816E+04	N/A
1997	N/A	0.171821E+05	N/A
1998	N/A	0.107753E+05	N/A
1999	N/A	0.364172E+05	N/A
2000	N/A	0.863922E+04	N/A
2001	N/A	0.705480E+05	N/A
2002	N/A	0.416649E+04	N/A
2003	N/A	0.207952E+04	N/A
2004	N/A	0.356812E+06	N/A
2005	N/A	0.580287E+04	N/A
2006	N/A	0.190709E+05	N/A
2007	N/A	0.535055E+04	N/A
2008	N/A	0.118077E+05	N/A

Survey Index: 10 Tag: US_S41 AGE = 2
Time = JAN-1 Type = NUMBER
Catchability = 0.898814E+00 % Variance Contribution = 1.8500
Residual = LN(Observed) - LN(Predicted)

Year	Observed	Predicted	Residual
1931	N/A	0.722533E+05	N/A
1932	N/A	0.279662E+05	N/A
1933	N/A	0.332507E+05	N/A

1934	N/A	0.377846E+05	N/A
1935	N/A	0.435592E+05	N/A
1936	N/A	0.418670E+05	N/A
1937	N/A	0.413392E+05	N/A
1938	N/A	0.764511E+05	N/A
1939	N/A	0.566003E+05	N/A
1940	N/A	0.432825E+05	N/A
1941	N/A	0.801943E+05	N/A
1942	N/A	0.834544E+05	N/A
1943	N/A	0.452811E+05	N/A
1944	N/A	0.171354E+05	N/A
1945	N/A	0.478915E+05	N/A
1946	N/A	0.380255E+05	N/A
1947	N/A	0.689293E+05	N/A
1948	N/A	0.434441E+05	N/A
1949	N/A	0.241860E+05	N/A
1950	N/A	0.910876E+05	N/A
1951	N/A	0.420303E+05	N/A
1952	N/A	0.758470E+05	N/A
1953	N/A	0.311173E+05	N/A
1954	N/A	0.968394E+05	N/A
1955	N/A	0.383848E+05	N/A
1956	N/A	0.660835E+05	N/A
1957	N/A	0.443031E+05	N/A
1958	N/A	0.438527E+05	N/A
1959	N/A	0.430770E+05	N/A
1960	N/A	0.954760E+05	N/A
1961	N/A	0.897491E+05	N/A
1962	N/A	0.399171E+05	N/A
1963	N/A	0.286762E+05	N/A
1964	N/A	0.136162E+06	N/A
1965	N/A	0.330910E+06	N/A
1966	N/A	0.161810E+05	N/A
1967	N/A	0.296514E+04	N/A
1968	N/A	0.937975E+04	N/A
1969	N/A	0.392522E+03	N/A
1970	N/A	0.815865E+03	N/A
1971	N/A	0.335918E+04	N/A
1972	N/A	0.195356E+03	N/A
1973	0.157093E+05	0.614456E+04	0.938683E+00
1974	0.431355E+05	0.122373E+05	0.125986E+01
1975	0.314834E+04	0.774485E+04	-0.900152E+00
1976	0.973714E+03	0.567446E+04	-0.176261E+01
1977	0.108439E+06	0.774036E+05	0.337157E+00
1978	0.314834E+04	0.102894E+05	-0.118424E+01
1979	0.512823E+04	0.450659E+04	0.129220E+00
1980	0.151575E+06	0.617266E+05	0.898365E+00
1981	0.106784E+05	0.804057E+04	0.283723E+00
1982	N/A	0.541831E+04	N/A
1983	N/A	0.189856E+04	N/A
1984	N/A	0.241670E+04	N/A
1985	N/A	0.133060E+05	N/A
1986	N/A	0.185354E+04	N/A
1987	N/A	0.123530E+05	N/A
1988	N/A	0.192646E+04	N/A
1989	N/A	0.147255E+05	N/A
1990	N/A	0.100364E+04	N/A
1991	N/A	0.246203E+04	N/A
1992	N/A	0.199963E+04	N/A
1993	N/A	0.788824E+04	N/A
1994	N/A	0.115229E+05	N/A
1995	N/A	0.114426E+05	N/A
1996	N/A	0.944229E+04	N/A
1997	N/A	0.878008E+04	N/A
1998	N/A	0.175245E+05	N/A
1999	N/A	0.109926E+05	N/A
2000	N/A	0.371642E+05	N/A
2001	N/A	0.881600E+04	N/A
2002	N/A	0.719908E+05	N/A
2003	N/A	0.425002E+04	N/A
2004	N/A	0.211873E+04	N/A
2005	N/A	0.363642E+06	N/A
2006	N/A	0.590665E+04	N/A
2007	N/A	0.193305E+05	N/A
2008	N/A	0.545029E+04	N/A

Survey Index: 11 Tag: US_S41 AGE = 3
 Time = JAN-1 Type = NUMBER
 Catchability = 0.775702E+00 % Variance Contribution = 1.1650
 Residual = LN(Observed) - LN(Predicted)

Year	Observed	Predicted	Residual
1931	N/A	0.109228E+05	N/A
1932	N/A	0.448995E+05	N/A
1933	N/A	0.183021E+05	N/A
1934	N/A	0.175838E+05	N/A
1935	N/A	0.235836E+05	N/A
1936	N/A	0.225027E+05	N/A
1937	N/A	0.209941E+05	N/A
1938	N/A	0.215172E+05	N/A
1939	N/A	0.399365E+05	N/A
1940	N/A	0.302723E+05	N/A
1941	N/A	0.255152E+05	N/A

1942	N/A	0.403154E+05	N/A
1943	N/A	0.489737E+05	N/A
1944	N/A	0.290631E+05	N/A
1945	N/A	0.115748E+05	N/A
1946	N/A	0.278872E+05	N/A
1947	N/A	0.216556E+05	N/A
1948	N/A	0.371105E+05	N/A
1949	N/A	0.228685E+05	N/A
1950	N/A	0.125775E+05	N/A
1951	N/A	0.441872E+05	N/A
1952	N/A	0.239268E+05	N/A
1953	N/A	0.361055E+05	N/A
1954	N/A	0.207222E+05	N/A
1955	N/A	0.462468E+05	N/A
1956	N/A	0.243657E+05	N/A
1957	N/A	0.383490E+05	N/A
1958	N/A	0.266958E+05	N/A
1959	N/A	0.270908E+05	N/A
1960	N/A	0.264418E+05	N/A
1961	N/A	0.562775E+05	N/A
1962	N/A	0.559413E+05	N/A
1963	N/A	0.250893E+05	N/A
1964	N/A	0.174336E+05	N/A
1965	N/A	0.850676E+05	N/A
1966	N/A	0.146336E+06	N/A
1967	N/A	0.668070E+04	N/A
1968	N/A	0.197753E+04	N/A
1969	N/A	0.454278E+04	N/A
1970	N/A	0.269647E+03	N/A
1971	N/A	0.466158E+03	N/A
1972	N/A	0.141824E+04	N/A
1973	N/A	0.136635E+03	N/A
1974	0.928274E+04	0.287111E+04	0.117346E+01
1975	0.107758E+05	0.552993E+04	0.667125E+00
1976	0.194743E+04	0.472483E+04	-0.886323E+00
1977	0.136320E+04	0.366632E+04	-0.989354E+00
1978	0.517042E+05	0.408452E+05	0.235750E+00
1979	0.366766E+04	0.673362E+04	-0.607561E+00
1980	0.165531E+04	0.316595E+04	-0.648461E+00
1981	0.632590E+05	0.220183E+05	0.105536E+01
1982	N/A	0.445629E+04	N/A
1983	N/A	0.300937E+04	N/A
1984	N/A	0.119038E+04	N/A
1985	N/A	0.164172E+04	N/A
1986	N/A	0.768127E+04	N/A
1987	N/A	0.127138E+04	N/A
1988	N/A	0.730671E+04	N/A
1989	N/A	0.132395E+04	N/A
1990	N/A	0.938206E+04	N/A
1991	N/A	0.701031E+03	N/A
1992	N/A	0.140025E+04	N/A
1993	N/A	0.122759E+04	N/A
1994	N/A	0.531937E+04	N/A
1995	N/A	0.776560E+04	N/A
1996	N/A	0.801970E+04	N/A
1997	N/A	0.663230E+04	N/A
1998	N/A	0.610352E+04	N/A
1999	N/A	0.122214E+05	N/A
2000	N/A	0.773694E+04	N/A
2001	N/A	0.259749E+05	N/A
2002	N/A	0.612764E+04	N/A
2003	N/A	0.505899E+05	N/A
2004	N/A	0.299061E+04	N/A
2005	N/A	0.147395E+04	N/A
2006	N/A	0.256516E+06	N/A
2007	N/A	0.416068E+04	N/A
2008	N/A	0.135364E+05	N/A

Survey Index: 12 Tag: US_S41 AGE = 4
 Time = JAN-1 Type = NUMBER
 Catchability = 0.838990E+00 % Variance Contribution = 0.5600
 Residual = LN(Observed) - LN(Predicted)

Year	Observed	Predicted	Residual
1931	N/A	0.148207E+05	N/A
1932	N/A	0.813010E+04	N/A
1933	N/A	0.203675E+05	N/A
1934	N/A	0.116672E+05	N/A
1935	N/A	0.114884E+05	N/A
1936	N/A	0.142425E+05	N/A
1937	N/A	0.113029E+05	N/A
1938	N/A	0.104012E+05	N/A
1939	N/A	0.132123E+05	N/A
1940	N/A	0.206294E+05	N/A
1941	N/A	0.175375E+05	N/A
1942	N/A	0.152097E+05	N/A
1943	N/A	0.233970E+05	N/A
1944	N/A	0.300061E+05	N/A
1945	N/A	0.193720E+05	N/A
1946	N/A	0.871625E+04	N/A
1947	N/A	0.132826E+05	N/A
1948	N/A	0.114116E+05	N/A
1949	N/A	0.184217E+05	N/A

1950	N/A	0.108894E+05	N/A
1951	N/A	0.804192E+04	N/A
1952	N/A	0.192984E+05	N/A
1953	N/A	0.144911E+05	N/A
1954	N/A	0.187598E+05	N/A
1955	N/A	0.144947E+05	N/A
1956	N/A	0.264679E+05	N/A
1957	N/A	0.165226E+05	N/A
1958	N/A	0.233796E+05	N/A
1959	N/A	0.182908E+05	N/A
1960	N/A	0.179602E+05	N/A
1961	N/A	0.187921E+05	N/A
1962	N/A	0.385705E+05	N/A
1963	N/A	0.372838E+05	N/A
1964	N/A	0.166224E+05	N/A
1965	N/A	0.120009E+05	N/A
1966	N/A	0.419316E+05	N/A
1967	N/A	0.542638E+05	N/A
1968	N/A	0.374147E+04	N/A
1969	N/A	0.121705E+04	N/A
1970	N/A	0.274401E+04	N/A
1971	N/A	0.226665E+03	N/A
1972	N/A	0.245237E+03	N/A
1973	0.175269E+04	0.908832E+03	0.656744E+00
1974	N/A	0.118646E+03	N/A
1975	0.204480E+04	0.202788E+04	0.830663E-02
1976	0.298606E+04	0.344422E+04	-0.142742E+00
1977	0.395977E+04	0.375246E+04	0.537745E-01
1978	0.116846E+04	0.310304E+04	-0.976700E+00
1979	0.185330E+05	0.252388E+05	-0.308829E+00
1980	0.337554E+04	0.464766E+04	-0.319807E+00
1981	0.710811E+04	0.253954E+04	0.102925E+01
1982	N/A	0.111800E+05	N/A
1983	N/A	0.270714E+04	N/A
1984	N/A	0.204531E+04	N/A
1985	N/A	0.827210E+03	N/A
1986	N/A	0.102939E+04	N/A
1987	N/A	0.465683E+04	N/A
1988	N/A	0.102626E+04	N/A
1989	N/A	0.463196E+04	N/A
1990	N/A	0.107968E+04	N/A
1991	N/A	0.702553E+04	N/A
1992	N/A	0.527965E+03	N/A
1993	N/A	0.932583E+03	N/A
1994	N/A	0.756274E+03	N/A
1995	N/A	0.381061E+04	N/A
1996	N/A	0.641163E+04	N/A
1997	N/A	0.667293E+04	N/A
1998	N/A	0.566631E+04	N/A
1999	N/A	0.504836E+04	N/A
2000	N/A	0.101365E+05	N/A
2001	N/A	0.637771E+04	N/A
2002	N/A	0.211902E+05	N/A
2003	N/A	0.516472E+04	N/A
2004	N/A	0.433272E+05	N/A
2005	N/A	0.255609E+04	N/A
2006	N/A	0.127356E+04	N/A
2007	N/A	0.224755E+06	N/A
2008	N/A	0.350266E+04	N/A

Survey Index: 13 Tag: US_S41 AGE = 5
 Time = JAN-1 Type = NUMBER
 Catchability = 0.88891E+00 % Variance Contribution = 0.3183
 Residual = LN(Observed) - LN(Predicted)

Year	Observed	Predicted	Residual
1931	N/A	0.152396E+05	N/A
1932	N/A	0.824479E+04	N/A
1933	N/A	0.511861E+04	N/A
1934	N/A	0.968044E+04	N/A
1935	N/A	0.713946E+04	N/A
1936	N/A	0.700692E+04	N/A
1937	N/A	0.802448E+04	N/A
1938	N/A	0.532978E+04	N/A
1939	N/A	0.602728E+04	N/A
1940	N/A	0.734545E+04	N/A
1941	N/A	0.113177E+05	N/A
1942	N/A	0.882017E+04	N/A
1943	N/A	0.799247E+04	N/A
1944	N/A	0.136234E+05	N/A
1945	N/A	0.142280E+05	N/A
1946	N/A	0.117068E+05	N/A
1947	N/A	0.537462E+04	N/A
1948	N/A	0.582012E+04	N/A
1949	N/A	0.582662E+04	N/A
1950	N/A	0.834676E+04	N/A
1951	N/A	0.604079E+04	N/A
1952	N/A	0.523604E+04	N/A
1953	N/A	0.998480E+04	N/A
1954	N/A	0.800640E+04	N/A
1955	N/A	0.117913E+05	N/A
1956	N/A	0.992092E+04	N/A
1957	N/A	0.133568E+05	N/A

1958	N/A	0.107179E+05	N/A
1959	N/A	0.149554E+05	N/A
1960	N/A	0.117362E+05	N/A
1961	N/A	0.119323E+05	N/A
1962	N/A	0.129429E+05	N/A
1963	N/A	0.251140E+05	N/A
1964	N/A	0.234341E+05	N/A
1965	N/A	0.106033E+05	N/A
1966	N/A	0.614657E+04	N/A
1967	N/A	0.211199E+05	N/A
1968	N/A	0.305931E+05	N/A
1969	N/A	0.171904E+04	N/A
1970	N/A	0.698428E+03	N/A
1971	N/A	0.192415E+04	N/A
1972	N/A	0.164591E+03	N/A
1973	0.292114E+03	0.146570E+03	0.689645E+00
1974	0.778971E+03	0.475332E+03	0.493961E+00
1975	N/A	0.101231E+03	N/A
1976	0.139566E+04	0.144858E+04	-0.372168E-01
1977	0.194743E+04	0.225822E+04	-0.148068E+00
1978	0.305097E+04	0.270305E+04	0.121078E+00
1979	0.107109E+04	0.244523E+04	-0.825466E+00
1980	0.158066E+05	0.161109E+05	-0.190672E-01
1981	0.246674E+04	0.324711E+04	-0.274866E+00
1982	N/A	0.153489E+04	N/A
1983	N/A	0.669662E+04	N/A
1984	N/A	0.179118E+04	N/A
1985	N/A	0.118726E+04	N/A
1986	N/A	0.558658E+03	N/A
1987	N/A	0.712129E+03	N/A
1988	N/A	0.272676E+04	N/A
1989	N/A	0.780358E+03	N/A
1990	N/A	0.320299E+04	N/A
1991	N/A	0.721565E+03	N/A
1992	N/A	0.420273E+04	N/A
1993	N/A	0.300727E+03	N/A
1994	N/A	0.537465E+03	N/A
1995	N/A	0.463214E+03	N/A
1996	N/A	0.292815E+04	N/A
1997	N/A	0.482576E+04	N/A
1998	N/A	0.519108E+04	N/A
1999	N/A	0.446809E+04	N/A
2000	N/A	0.394536E+04	N/A
2001	N/A	0.753453E+04	N/A
2002	N/A	0.473444E+04	N/A
2003	N/A	0.158359E+05	N/A
2004	N/A	0.411030E+04	N/A
2005	N/A	0.334835E+05	N/A
2006	N/A	0.194561E+04	N/A
2007	N/A	0.104784E+04	N/A
2008	N/A	0.185960E+06	N/A

Survey Index: 14 Tag: US_S41 AGE = 6
 Time = JAN-1 Type = NUMBER
 Catchability = 0.884529E+00 % Variance Contribution = 0.4840
 Residual = LN(Observed) - LN(Predicted)

Year	Observed	Predicted	Residual
1931	N/A	0.901997E+04	N/A
1932	N/A	0.524667E+04	N/A
1933	N/A	0.380735E+04	N/A
1934	N/A	0.251259E+04	N/A
1935	N/A	0.538651E+04	N/A
1936	N/A	0.348415E+04	N/A
1937	N/A	0.400793E+04	N/A
1938	N/A	0.326493E+04	N/A
1939	N/A	0.266747E+04	N/A
1940	N/A	0.320314E+04	N/A
1941	N/A	0.399230E+04	N/A
1942	N/A	0.466652E+04	N/A
1943	N/A	0.402345E+04	N/A
1944	N/A	0.405238E+04	N/A
1945	N/A	0.659253E+04	N/A
1946	N/A	0.699985E+04	N/A
1947	N/A	0.496478E+04	N/A
1948	N/A	0.269287E+04	N/A
1949	N/A	0.257124E+04	N/A
1950	N/A	0.288708E+04	N/A
1951	N/A	0.417277E+04	N/A
1952	N/A	0.298165E+04	N/A
1953	N/A	0.318367E+04	N/A
1954	N/A	0.515540E+04	N/A
1955	N/A	0.468332E+04	N/A
1956	N/A	0.700108E+04	N/A
1957	N/A	0.538032E+04	N/A
1958	N/A	0.627221E+04	N/A
1959	N/A	0.572952E+04	N/A
1960	N/A	0.905641E+04	N/A
1961	N/A	0.712295E+04	N/A
1962	N/A	0.740116E+04	N/A
1963	N/A	0.780343E+04	N/A
1964	N/A	0.139518E+05	N/A
1965	N/A	0.121747E+05	N/A

1966	N/A	0.515988E+04	N/A
1967	N/A	0.281691E+04	N/A
1968	N/A	0.903366E+04	N/A
1969	N/A	0.134412E+05	N/A
1970	N/A	0.881952E+03	N/A
1971	N/A	0.421141E+03	N/A
1972	N/A	0.133732E+04	N/A
1973	N/A	0.108060E+03	N/A
1974	N/A	0.765812E+02	N/A
1975	0.421943E+03	0.329406E+03	0.247580E+00
1976	N/A	0.792003E+02	N/A
1977	0.146057E+04	0.100168E+04	0.377148E+00
1978	0.266149E+04	0.142432E+04	0.625188E+00
1979	0.519314E+03	0.174732E+04	-0.121333E+01
1980	0.217463E+04	0.157035E+04	0.325560E+00
1981	0.577737E+04	0.829866E+04	-0.362145E+00
1982	N/A	0.189558E+04	N/A
1983	N/A	0.937260E+03	N/A
1984	N/A	0.366083E+04	N/A
1985	N/A	0.113956E+04	N/A
1986	N/A	0.593097E+03	N/A
1987	N/A	0.337476E+03	N/A
1988	N/A	0.481012E+03	N/A
1989	N/A	0.146569E+04	N/A
1990	N/A	0.463051E+03	N/A
1991	N/A	0.171754E+04	N/A
1992	N/A	0.472985E+03	N/A
1993	N/A	0.187337E+04	N/A
1994	N/A	0.149822E+03	N/A
1995	N/A	0.324900E+03	N/A
1996	N/A	0.330428E+03	N/A
1997	N/A	0.202678E+04	N/A
1998	N/A	0.348402E+04	N/A
1999	N/A	0.361782E+04	N/A
2000	N/A	0.315739E+04	N/A
2001	N/A	0.274574E+04	N/A
2002	N/A	0.511833E+04	N/A
2003	N/A	0.311976E+04	N/A
2004	N/A	0.107619E+05	N/A
2005	N/A	0.276775E+04	N/A
2006	N/A	0.205155E+05	N/A
2007	N/A	0.128636E+04	N/A
2008	N/A	0.699033E+03	N/A

Survey Index: 15 Tag: US_S41 AGE = 7
 Time = JAN-1 Type = NUMBER
 Catchability = 0.911762E+00 % Variance Contribution = 0.7931
 Residual = LN(Observed) - LN(Predicted)

Year	Observed	Predicted	Residual
1931	N/A	0.500610E+04	N/A
1932	N/A	0.271636E+04	N/A
1933	N/A	0.207384E+04	N/A
1934	N/A	0.192365E+04	N/A
1935	N/A	0.126224E+04	N/A
1936	N/A	0.254078E+04	N/A
1937	N/A	0.181529E+04	N/A
1938	N/A	0.185341E+04	N/A
1939	N/A	0.145146E+04	N/A
1940	N/A	0.146042E+04	N/A
1941	N/A	0.149694E+04	N/A
1942	N/A	0.191600E+04	N/A
1943	N/A	0.203910E+04	N/A
1944	N/A	0.121437E+04	N/A
1945	N/A	0.156524E+04	N/A
1946	N/A	0.367011E+04	N/A
1947	N/A	0.278361E+04	N/A
1948	N/A	0.196202E+04	N/A
1949	N/A	0.132811E+04	N/A
1950	N/A	0.130344E+04	N/A
1951	N/A	0.151233E+04	N/A
1952	N/A	0.178033E+04	N/A
1953	N/A	0.174355E+04	N/A
1954	N/A	0.185840E+04	N/A
1955	N/A	0.261047E+04	N/A
1956	N/A	0.260364E+04	N/A
1957	N/A	0.315493E+04	N/A
1958	N/A	0.261698E+04	N/A
1959	N/A	0.335928E+04	N/A
1960	N/A	0.339590E+04	N/A
1961	N/A	0.617235E+04	N/A
1962	N/A	0.449008E+04	N/A
1963	N/A	0.453469E+04	N/A
1964	N/A	0.477916E+04	N/A
1965	N/A	0.704275E+04	N/A
1966	N/A	0.483256E+04	N/A
1967	N/A	0.224381E+04	N/A
1968	N/A	0.139033E+04	N/A
1969	N/A	0.476434E+04	N/A
1970	N/A	0.648480E+04	N/A
1971	N/A	0.568843E+03	N/A
1972	N/A	0.155533E+03	N/A
1973	0.584229E+03	0.102764E+04	-0.564725E+00

1974	0.324571E+02	0.661274E+02	-0.711662E+00
1975	0.292114E+03	0.629010E+02	0.153558E+01
1976	0.129829E+03	0.242335E+03	-0.624104E+00
1977	N/A	0.668335E+02	N/A
1978	0.519314E+03	0.549327E+03	-0.561854E-01
1979	0.120091E+04	0.775952E+03	0.436748E+00
1980	0.120091E+04	0.113521E+04	0.562626E-01
1981	0.778971E+03	0.837056E+03	-0.719168E-01
1982	N/A	0.488285E+04	N/A
1983	N/A	0.113037E+04	N/A
1984	N/A	0.565993E+03	N/A
1985	N/A	0.186444E+04	N/A
1986	N/A	0.770115E+03	N/A
1987	N/A	0.356883E+03	N/A
1988	N/A	0.223695E+03	N/A
1989	N/A	0.281186E+03	N/A
1990	N/A	0.845895E+03	N/A
1991	N/A	0.264521E+03	N/A
1992	N/A	0.102563E+04	N/A
1993	N/A	0.251071E+03	N/A
1994	N/A	0.975236E+03	N/A
1995	N/A	0.666216E+02	N/A
1996	N/A	0.250018E+03	N/A
1997	N/A	0.224696E+03	N/A
1998	N/A	0.153134E+04	N/A
1999	N/A	0.247161E+04	N/A
2000	N/A	0.258873E+04	N/A
2001	N/A	0.223129E+04	N/A
2002	N/A	0.177963E+04	N/A
2003	N/A	0.341269E+04	N/A
2004	N/A	0.213640E+04	N/A
2005	N/A	0.667706E+04	N/A
2006	N/A	0.169866E+04	N/A
2007	N/A	0.128731E+05	N/A
2008	N/A	0.830272E+03	N/A

Survey Index: 16 Tag: US_S41 AGE = 8
 Time = JAN-1 Type = NUMBER
 Catchability = 0.861378E+00 % Variance Contribution = 1.1681
 Residual = LN(Observed) - LN(Predicted)

Year	Observed	Predicted	Residual
1931	N/A	0.265787E+04	N/A
1932	N/A	0.128872E+04	N/A
1933	N/A	0.108509E+04	N/A
1934	N/A	0.675812E+03	N/A
1935	N/A	0.100936E+04	N/A
1936	N/A	0.591260E+03	N/A
1937	N/A	0.918638E+03	N/A
1938	N/A	0.672266E+03	N/A
1939	N/A	0.706788E+03	N/A
1940	N/A	0.480406E+03	N/A
1941	N/A	0.551347E+03	N/A
1942	N/A	0.437210E+03	N/A
1943	N/A	0.686017E+03	N/A
1944	N/A	0.967466E+03	N/A
1945	N/A	0.555916E+03	N/A
1946	N/A	0.509515E+03	N/A
1947	N/A	0.143309E+04	N/A
1948	N/A	0.999778E+03	N/A
1949	N/A	0.915727E+03	N/A
1950	N/A	0.546758E+03	N/A
1951	N/A	0.606959E+03	N/A
1952	N/A	0.600261E+03	N/A
1953	N/A	0.967078E+03	N/A
1954	N/A	0.929473E+03	N/A
1955	N/A	0.881722E+03	N/A
1956	N/A	0.119532E+04	N/A
1957	N/A	0.977396E+03	N/A
1958	N/A	0.118693E+04	N/A
1959	N/A	0.132647E+04	N/A
1960	N/A	0.169287E+04	N/A
1961	N/A	0.201700E+04	N/A
1962	N/A	0.379291E+04	N/A
1963	N/A	0.226312E+04	N/A
1964	N/A	0.242099E+04	N/A
1965	N/A	0.209177E+04	N/A
1966	N/A	0.254886E+04	N/A
1967	N/A	0.194284E+04	N/A
1968	N/A	0.970277E+03	N/A
1969	N/A	0.561930E+03	N/A
1970	N/A	0.246852E+04	N/A
1971	N/A	0.323306E+04	N/A
1972	N/A	0.220737E+03	N/A
1973	0.324571E+02	0.589350E+02	-0.596515E+00
1974	0.324571E+03	0.733941E+03	-0.815924E+00
1975	0.324571E+02	0.495156E+02	-0.422367E+00
1976	N/A	0.454665E+02	N/A
1977	0.129829E+03	0.168878E+03	-0.262963E+00
1978	0.194743E+03	0.485080E+02	0.138995E+01
1979	0.194743E+03	0.316417E+03	-0.485381E+00
1980	0.149303E+04	0.354891E+03	0.143675E+01
1981	0.357029E+03	0.455488E+03	-0.243554E+00

1982	N/A	0.390195E+03	N/A
1983	N/A	0.290349E+04	N/A
1984	N/A	0.728561E+03	N/A
1985	N/A	0.255169E+03	N/A
1986	N/A	0.102540E+04	N/A
1987	N/A	0.477834E+03	N/A
1988	N/A	0.205736E+03	N/A
1989	N/A	0.129428E+03	N/A
1990	N/A	0.169682E+03	N/A
1991	N/A	0.485808E+03	N/A
1992	N/A	0.106154E+03	N/A
1993	N/A	0.464984E+03	N/A
1994	N/A	0.145722E+03	N/A
1995	N/A	0.512035E+03	N/A
1996	N/A	0.449321E+02	N/A
1997	N/A	0.176216E+03	N/A
1998	N/A	0.160201E+03	N/A
1999	N/A	0.105331E+04	N/A
2000	N/A	0.161420E+04	N/A
2001	N/A	0.170977E+04	N/A
2002	N/A	0.138661E+04	N/A
2003	N/A	0.106536E+04	N/A
2004	N/A	0.208233E+04	N/A
2005	N/A	0.112158E+04	N/A
2006	N/A	0.373854E+04	N/A
2007	N/A	0.106074E+04	N/A
2008	N/A	0.800985E+04	N/A

Survey Index: 17 Tag: US_Au0 AGE = 1
Time = JAN-1 Type = NUMBER
Catchability = 0.433137E+00 % Variance Contribution = 7.8226
Residual = LN(Observed) - LN(Predicted)

Year	Observed	Predicted	Residual
1931	N/A	0.172987E+05	N/A
1932	N/A	0.196275E+05	N/A
1933	N/A	0.223563E+05	N/A
1934	N/A	0.258016E+05	N/A
1935	N/A	0.252144E+05	N/A
1936	N/A	0.247523E+05	N/A
1937	N/A	0.456139E+05	N/A
1938	N/A	0.338066E+05	N/A
1939	N/A	0.257657E+05	N/A
1940	N/A	0.481763E+05	N/A
1941	N/A	0.494933E+05	N/A
1942	N/A	0.268002E+05	N/A
1943	N/A	0.100949E+05	N/A
1944	N/A	0.282191E+05	N/A
1945	N/A	0.224394E+05	N/A
1946	N/A	0.406711E+05	N/A
1947	N/A	0.256138E+05	N/A
1948	N/A	0.142739E+05	N/A
1949	N/A	0.537702E+05	N/A
1950	N/A	0.247808E+05	N/A
1951	N/A	0.449511E+05	N/A
1952	N/A	0.183172E+05	N/A
1953	N/A	0.575164E+05	N/A
1954	N/A	0.226446E+05	N/A
1955	N/A	0.389392E+05	N/A
1956	N/A	0.261013E+05	N/A
1957	N/A	0.258281E+05	N/A
1958	N/A	0.254145E+05	N/A
1959	N/A	0.562413E+05	N/A
1960	N/A	0.529489E+05	N/A
1961	N/A	0.235245E+05	N/A
1962	N/A	0.169140E+05	N/A
1963	N/A	0.815343E+05	N/A
1964	0.272418E+06	0.199596E+06	0.311042E+00
1965	0.768942E+04	0.140826E+05	-0.605094E+00
1966	0.106395E+04	0.179971E+04	-0.525641E+00
1967	0.199248E+05	0.606955E+04	0.118868E+01
1968	0.967223E+02	0.234857E+03	-0.887134E+00
1969	0.290167E+03	0.481167E+03	-0.505759E+00
1970	0.125739E+04	0.199916E+04	-0.463691E+00
1971	0.145083E+03	0.115463E+03	0.228358E+00
1972	0.788287E+04	0.369288E+04	0.758284E+00
1973	0.219076E+05	0.844541E+04	0.953211E+00
1974	0.104944E+05	0.458135E+04	0.828845E+00
1975	0.241806E+04	0.343481E+04	-0.350997E+00
1976	0.762172E+05	0.456305E+05	0.513010E+00
1977	0.140247E+05	0.605688E+04	0.839628E+00
1978	0.436224E+03	0.265302E+04	-0.180530E+01
1979	0.429148E+05	0.363354E+05	0.166425E+00
1980	0.428369E+04	0.473644E+04	-0.100469E+00
1981	0.379174E+05	0.318965E+04	0.247550E+01
1982	0.122948E+04	0.111796E+04	0.950861E-01
1983	0.440086E+04	0.142259E+04	0.112932E+01
1984	0.188125E+05	0.783256E+04	0.876231E+00
1985	0.967223E+02	0.109109E+04	-0.242308E+01
1986	0.368389E+05	0.727382E+04	0.162227E+01
1987	N/A	0.113401E+04	N/A
1988	0.584229E+04	0.866928E+04	-0.394664E+00
1989	0.227200E+03	0.591640E+03	-0.957068E+00

1990	0.151705E+04	0.147918E+04	0.252768E-01
1991	0.250180E+04	0.118031E+04	0.751232E+00
1992	0.699971E+04	0.468290E+04	0.401950E+00
1993	0.925029E+04	0.679805E+04	0.308019E+00
1994	0.492375E+04	0.674807E+04	-0.315186E+00
1995	0.295457E+04	0.556578E+04	-0.633283E+00
1996	0.737718E+04	0.517114E+04	0.355300E+00
1997	0.425578E+04	0.103217E+05	-0.885969E+00
1998	0.104869E+04	0.647299E+04	-0.182010E+01
1999	0.140079E+05	0.218767E+05	-0.445805E+00
2000	0.592245E+04	0.518979E+04	0.132057E+00
2001	0.134334E+05	0.423799E+05	-0.114893E+01
2002	0.277444E+04	0.250291E+04	0.102993E+00
2003	0.377477E+03	0.124922E+04	-0.119676E+01
2004	0.501602E+06	0.214346E+06	0.850218E+00
2005	0.528792E+04	0.348593E+04	0.416691E+00
2006	0.138180E+05	0.114563E+05	0.187428E+00
2007	0.305097E+04	0.321421E+04	-0.521205E-01
2008	N/A	0.709319E+04	N/A

Survey Index: 18 Tag: US_Au1 AGE = 2
 Time = JAN-1 Type = NUMBER
 Catchability = 0.688246E+00 % Variance Contribution = 7.7540
 Residual = LN(Observed) - LN(Predicted)

Year	Observed	Predicted	Residual
1931	N/A	0.553263E+05	N/A
1932	N/A	0.214145E+05	N/A
1933	N/A	0.254609E+05	N/A
1934	N/A	0.289327E+05	N/A
1935	N/A	0.333545E+05	N/A
1936	N/A	0.320587E+05	N/A
1937	N/A	0.316545E+05	N/A
1938	N/A	0.585407E+05	N/A
1939	N/A	0.433404E+05	N/A
1940	N/A	0.331426E+05	N/A
1941	N/A	0.614070E+05	N/A
1942	N/A	0.639033E+05	N/A
1943	N/A	0.346730E+05	N/A
1944	N/A	0.131211E+05	N/A
1945	N/A	0.366718E+05	N/A
1946	N/A	0.291172E+05	N/A
1947	N/A	0.527810E+05	N/A
1948	N/A	0.332663E+05	N/A
1949	N/A	0.185199E+05	N/A
1950	N/A	0.697483E+05	N/A
1951	N/A	0.321838E+05	N/A
1952	N/A	0.580781E+05	N/A
1953	N/A	0.238273E+05	N/A
1954	N/A	0.741526E+05	N/A
1955	N/A	0.293923E+05	N/A
1956	N/A	0.506019E+05	N/A
1957	N/A	0.339241E+05	N/A
1958	N/A	0.335792E+05	N/A
1959	N/A	0.329852E+05	N/A
1960	N/A	0.731085E+05	N/A
1961	N/A	0.687233E+05	N/A
1962	N/A	0.305656E+05	N/A
1963	N/A	0.219582E+05	N/A
1964	0.824074E+05	0.104263E+06	-0.235243E+00
1965	0.366336E+06	0.253387E+06	0.368633E+00
1966	0.329823E+05	0.123902E+05	0.979063E+00
1967	0.309511E+04	0.227049E+04	0.309830E+00
1968	0.218109E+05	0.718233E+04	0.111079E+01
1969	0.193445E+03	0.300565E+03	-0.440672E+00
1970	0.967223E+02	0.624730E+03	-0.186548E+01
1971	0.133960E+05	0.257221E+04	0.165019E+01
1972	N/A	0.149590E+03	N/A
1973	0.817303E+04	0.470506E+04	0.552203E+00
1974	0.292101E+05	0.937045E+04	0.113695E+01
1975	0.575498E+04	0.593044E+04	-0.300339E-01
1976	0.203117E+04	0.434509E+04	-0.760436E+00
1977	0.208291E+06	0.592701E+05	0.125683E+01
1978	0.694096E+04	0.787889E+04	-0.126747E+00
1979	0.273679E+04	0.345082E+04	-0.231826E+00
1980	0.147902E+06	0.472657E+05	0.114076E+01
1981	0.880497E+04	0.615688E+04	0.357746E+00
1982	0.199105E+05	0.414894E+04	0.156839E+01
1983	N/A	0.145378E+04	N/A
1984	0.773778E+03	0.185053E+04	-0.871944E+00
1985	0.107845E+05	0.101887E+05	0.568305E-01
1986	0.210971E+04	0.141930E+04	0.396386E+00
1987	0.165856E+05	0.945907E+04	0.561561E+00
1988	N/A	0.147514E+04	N/A
1989	0.980206E+04	0.112757E+05	-0.140061E+00
1990	0.159689E+03	0.768512E+03	-0.157123E+01
1991	0.218242E+04	0.188524E+04	0.146376E+00
1992	0.665371E+03	0.153117E+04	-0.833442E+00
1993	0.675109E+04	0.604024E+04	0.111259E+00
1994	0.131211E+05	0.882339E+04	0.396818E+00
1995	0.250569E+04	0.876191E+04	-0.125185E+01
1996	0.231682E+05	0.723022E+04	0.116451E+01
1997	0.176502E+04	0.672315E+04	-0.133740E+01

1998	0.800296E+04	0.134190E+05	-0.516857E+00
1999	0.905003E+04	0.841730E+04	0.724788E-01
2000	0.272802E+04	0.284576E+05	-0.234484E+01
2001	0.916103E+04	0.675065E+04	0.305319E+00
2002	0.284711E+05	0.551253E+05	-0.660720E+00
2003	0.620321E+04	0.325435E+04	0.645073E+00
2004	0.230770E+03	0.162237E+04	-0.195022E+01
2005	0.531168E+06	0.278451E+06	0.645837E+00
2006	0.574491E+04	0.452288E+04	0.239165E+00
2007	0.147424E+05	0.148019E+05	-0.402994E-02
2008	N/A	0.417343E+04	N/A

Survey Index: 19 Tag: US_Au2 AGE = 3
Time = JAN-1 Type = NUMBER
Catchability = 0.572374E+00 % Variance Contribution = 5.5734
Residual = LN(Observed) - LN(Predicted)

Year	Observed	Predicted	Residual
1931	N/A	0.805972E+04	N/A
1932	N/A	0.331304E+05	N/A
1933	N/A	0.135048E+05	N/A
1934	N/A	0.129747E+05	N/A
1935	N/A	0.174018E+05	N/A
1936	N/A	0.166043E+05	N/A
1937	N/A	0.154911E+05	N/A
1938	N/A	0.158771E+05	N/A
1939	N/A	0.294683E+05	N/A
1940	N/A	0.223373E+05	N/A
1941	N/A	0.188271E+05	N/A
1942	N/A	0.297478E+05	N/A
1943	N/A	0.361366E+05	N/A
1944	N/A	0.214450E+05	N/A
1945	N/A	0.854083E+04	N/A
1946	N/A	0.205774E+05	N/A
1947	N/A	0.159792E+05	N/A
1948	N/A	0.273830E+05	N/A
1949	N/A	0.168742E+05	N/A
1950	N/A	0.928070E+04	N/A
1951	N/A	0.326048E+05	N/A
1952	N/A	0.176551E+05	N/A
1953	N/A	0.266415E+05	N/A
1954	N/A	0.152904E+05	N/A
1955	N/A	0.341245E+05	N/A
1956	N/A	0.179789E+05	N/A
1957	N/A	0.282969E+05	N/A
1958	N/A	0.196982E+05	N/A
1959	N/A	0.199897E+05	N/A
1960	N/A	0.195108E+05	N/A
1961	N/A	0.415260E+05	N/A
1962	N/A	0.412779E+05	N/A
1963	N/A	0.185129E+05	N/A
1964	0.299355E+05	0.128639E+05	0.844625E+00
1965	0.206889E+06	0.627696E+05	0.119271E+01
1966	0.251188E+06	0.107978E+06	0.844272E+00
1967	0.938206E+04	0.492955E+04	0.643553E+00
1968	0.116067E+04	0.145917E+04	-0.228874E+00
1969	0.309511E+04	0.335202E+04	-0.797376E-01
1970	N/A	0.198967E+03	N/A
1971	0.677056E+03	0.343968E+03	0.677206E+00
1972	0.101558E+04	0.104649E+04	-0.299780E-01
1973	N/A	0.100820E+03	N/A
1974	0.522300E+04	0.211853E+04	0.902352E+00
1975	0.319184E+04	0.408042E+04	-0.245603E+00
1976	0.232133E+04	0.348635E+04	-0.406714E+00
1977	0.169264E+04	0.270530E+04	-0.468923E+00
1978	0.608029E+05	0.301388E+05	0.701825E+00
1979	0.337132E+04	0.496859E+04	-0.387832E+00
1980	0.119118E+03	0.233608E+04	-0.297612E+01
1981	0.412887E+05	0.162468E+05	0.932692E+00
1982	0.674265E+04	0.328820E+04	0.718112E+00
1983	0.430414E+04	0.222055E+04	0.661825E+00
1984	0.677056E+03	0.878354E+03	-0.260296E+00
1985	0.285331E+04	0.121139E+04	0.856712E+00
1986	0.496594E+04	0.566785E+04	-0.132206E+00
1987	0.292114E+03	0.938122E+03	-0.116673E+01
1988	0.256411E+04	0.539146E+04	-0.743203E+00
1989	0.584229E+03	0.976916E+03	-0.514109E+00
1990	0.878290E+04	0.692282E+04	0.237984E+00
1991	0.798446E+02	0.517276E+03	-0.186849E+01
1992	0.771831E+03	0.103322E+04	-0.291666E+00
1993	0.746514E+03	0.905811E+03	-0.193416E+00
1994	0.652064E+04	0.392505E+04	0.507594E+00
1995	0.262189E+04	0.573007E+04	-0.781832E+00
1996	0.159170E+05	0.591756E+04	0.989462E+00
1997	0.300521E+04	0.489383E+04	-0.487628E+00
1998	0.476211E+04	0.450365E+04	0.558020E-01
1999	0.802763E+04	0.901789E+04	-0.116322E+00
2000	0.109342E+05	0.570892E+04	0.649862E+00
2001	0.177907E+05	0.191663E+05	-0.744770E-01
2002	0.545864E+04	0.452145E+04	0.188367E+00
2003	0.722756E+05	0.373292E+05	0.660710E+00
2004	0.146414E+04	0.220671E+04	-0.410232E+00
2005	0.710811E+03	0.108760E+04	-0.425318E+00

2006	0.250707E+06	0.189278E+06	0.281069E+00
2007	0.237424E+04	0.307007E+04	-0.257024E+00
2008	N/A	0.998820E+04	N/A

Survey Index: 20 Tag: US_Au3 AGE = 4
Time = JAN-1 Type = NUMBER
Catchability = 0.653808E+00 % Variance Contribution = 3.6457
Residual = LN(Observed) - LN(Predicted)

Year	Observed	Predicted	Residual
1931	N/A	0.115495E+05	N/A
1932	N/A	0.633563E+04	N/A
1933	N/A	0.158720E+05	N/A
1934	N/A	0.909200E+04	N/A
1935	N/A	0.895270E+04	N/A
1936	N/A	0.110989E+05	N/A
1937	N/A	0.880811E+04	N/A
1938	N/A	0.810548E+04	N/A
1939	N/A	0.102961E+05	N/A
1940	N/A	0.160761E+05	N/A
1941	N/A	0.136667E+05	N/A
1942	N/A	0.118526E+05	N/A
1943	N/A	0.182328E+05	N/A
1944	N/A	0.233832E+05	N/A
1945	N/A	0.150962E+05	N/A
1946	N/A	0.679241E+04	N/A
1947	N/A	0.103509E+05	N/A
1948	N/A	0.889284E+04	N/A
1949	N/A	0.143557E+05	N/A
1950	N/A	0.848588E+04	N/A
1951	N/A	0.626691E+04	N/A
1952	N/A	0.150389E+05	N/A
1953	N/A	0.112926E+05	N/A
1954	N/A	0.146191E+05	N/A
1955	N/A	0.112954E+05	N/A
1956	N/A	0.206259E+05	N/A
1957	N/A	0.128758E+05	N/A
1958	N/A	0.182193E+05	N/A
1959	N/A	0.142537E+05	N/A
1960	N/A	0.139961E+05	N/A
1961	N/A	0.146443E+05	N/A
1962	N/A	0.300572E+05	N/A
1963	N/A	0.290545E+05	N/A
1964	0.221010E+05	0.129535E+05	0.534260E+00
1965	0.189092E+05	0.935209E+04	0.704049E+00
1966	0.314831E+05	0.326765E+05	-0.372052E-01
1967	0.596777E+05	0.422867E+05	0.344484E+00
1968	0.324020E+04	0.291566E+04	0.105539E+00
1969	0.435250E+03	0.948422E+03	-0.778878E+00
1970	0.918862E+03	0.213835E+04	-0.844655E+00
1971	0.483611E+02	0.176635E+03	-0.129539E+01
1972	0.241806E+03	0.191108E+03	0.235294E+00
1973	0.169264E+04	0.708235E+03	0.871268E+00
1974	N/A	0.924584E+02	N/A
1975	0.101558E+04	0.158029E+04	-0.442146E+00
1976	0.157657E+05	0.268401E+04	0.177053E+01
1977	0.174100E+04	0.292422E+04	-0.518568E+00
1978	0.182442E+04	0.241814E+04	-0.281740E+00
1979	0.301040E+05	0.196681E+05	0.425659E+00
1980	0.293510E+04	0.362183E+04	-0.210238E+00
1981	0.146739E+04	0.197902E+04	-0.299117E+00
1982	0.120179E+05	0.871236E+04	0.321655E+00
1983	0.111231E+04	0.210963E+04	-0.640075E+00
1984	0.870501E+03	0.159387E+04	-0.604852E+00
1985	0.773778E+03	0.644629E+03	0.182611E+00
1986	0.714057E+03	0.802180E+03	-0.116371E+00
1987	0.392731E+04	0.362897E+04	0.790058E-01
1988	0.324571E+03	0.799742E+03	-0.901784E+00
1989	0.421943E+04	0.360960E+04	0.156103E+00
1990	0.638757E+03	0.841377E+03	-0.275517E+00
1991	0.385915E+04	0.547486E+04	-0.349719E+00
1992	0.159689E+03	0.411433E+03	-0.946418E+00
1993	0.778971E+03	0.726744E+03	0.694004E-01
1994	0.984750E+03	0.589350E+03	0.513367E+00
1995	0.216587E+04	0.296954E+04	-0.315586E+00
1996	0.751902E+04	0.499646E+04	0.408706E+00
1997	0.336970E+04	0.520008E+04	-0.433851E+00
1998	0.243072E+04	0.441565E+04	-0.596969E+00
1999	0.234763E+04	0.393409E+04	-0.516275E+00
2000	0.261299E+05	0.789917E+04	0.119632E+01
2001	0.100766E+05	0.497003E+04	0.706794E+00
2002	0.241468E+05	0.165131E+05	0.380000E+00
2003	0.176729E+05	0.402477E+04	0.147957E+01
2004	0.277606E+05	0.337641E+05	-0.195780E+00
2005	0.274068E+04	0.199191E+04	0.319111E+00
2006	0.904256E+03	0.992460E+03	-0.930746E-01
2007	0.156979E+06	0.175147E+06	-0.109516E+00
2008	N/A	0.272956E+04	N/A

Survey Index: 21 Tag: US_Au4 AGE = 5
Time = JAN-1 Type = NUMBER
Catchability = 0.571735E+00 % Variance Contribution = 4.0993
Residual = LN(Observed) - LN(Predicted)

Year	Observed	Predicted	Residual
1931	N/A	0.980210E+04	N/A
1932	N/A	0.530305E+04	N/A
1933	N/A	0.329229E+04	N/A
1934	N/A	0.622646E+04	N/A
1935	N/A	0.459211E+04	N/A
1936	N/A	0.450685E+04	N/A
1937	N/A	0.516135E+04	N/A
1938	N/A	0.342812E+04	N/A
1939	N/A	0.387675E+04	N/A
1940	N/A	0.472460E+04	N/A
1941	N/A	0.727957E+04	N/A
1942	N/A	0.567314E+04	N/A
1943	N/A	0.514076E+04	N/A
1944	N/A	0.876259E+04	N/A
1945	N/A	0.915144E+04	N/A
1946	N/A	0.752979E+04	N/A
1947	N/A	0.345695E+04	N/A
1948	N/A	0.374350E+04	N/A
1949	N/A	0.374768E+04	N/A
1950	N/A	0.536864E+04	N/A
1951	N/A	0.388544E+04	N/A
1952	N/A	0.336782E+04	N/A
1953	N/A	0.642222E+04	N/A
1954	N/A	0.514972E+04	N/A
1955	N/A	0.758420E+04	N/A
1956	N/A	0.638114E+04	N/A
1957	N/A	0.859109E+04	N/A
1958	N/A	0.689374E+04	N/A
1959	N/A	0.961929E+04	N/A
1960	N/A	0.754871E+04	N/A
1961	N/A	0.767484E+04	N/A
1962	N/A	0.832486E+04	N/A
1963	N/A	0.161533E+05	N/A
1964	0.270822E+05	0.150728E+05	0.585986E+00
1965	0.580334E+04	0.682002E+04	-0.161429E+00
1966	0.348200E+04	0.395348E+04	-0.126988E+00
1967	0.108813E+05	0.135843E+05	-0.221875E+00
1968	0.219560E+05	0.196775E+05	0.109562E+00
1969	0.106395E+04	0.110569E+04	-0.384851E-01
1970	0.435250E+03	0.449229E+03	-0.316116E-01
1971	0.918862E+03	0.123762E+04	-0.297807E+00
1972	0.483611E+02	0.105865E+03	-0.783470E+00
1973	0.290167E+03	0.942736E+02	0.112425E+01
1974	0.628695E+03	0.305734E+03	0.720932E+00
1975	N/A	0.651118E+02	N/A
1976	0.299839E+04	0.931726E+03	0.116879E+01
1977	0.265986E+04	0.145249E+04	0.604996E+00
1978	0.186401E+04	0.173860E+04	0.696495E-01
1979	0.594939E+03	0.157277E+04	-0.972135E+00
1980	0.123746E+05	0.103625E+05	0.177449E+00
1981	0.594939E+03	0.208854E+04	-0.125576E+01
1982	0.674135E+03	0.987239E+03	-0.381482E+00
1983	0.454595E+04	0.430727E+04	0.539319E-01
1984	0.967223E+03	0.115209E+04	-0.174900E+00
1985	0.918862E+03	0.763645E+03	0.185032E+00
1986	0.162286E+03	0.359329E+03	-0.794880E+00
1987	0.194743E+03	0.458042E+03	-0.855280E+00
1988	0.249920E+04	0.175386E+04	0.354154E+00
1989	0.389486E+03	0.501927E+03	-0.253627E+00
1990	0.215580E+04	0.206016E+04	0.453777E-01
1991	0.159689E+03	0.464111E+03	-0.106689E+01
1992	0.718601E+03	0.270320E+04	-0.132488E+01
1993	N/A	0.193428E+03	N/A
1994	N/A	0.345698E+03	N/A
1995	0.401819E+03	0.297939E+03	0.299113E+00
1996	0.122169E+04	0.188339E+04	-0.432841E+00
1997	0.158261E+04	0.310393E+04	-0.673595E+00
1998	0.177670E+04	0.333890E+04	-0.630882E+00
1999	0.133756E+04	0.287388E+04	-0.764816E+00
2000	0.114295E+05	0.253765E+04	0.150495E+01
2001	0.356185E+04	0.484621E+04	-0.307918E+00
2002	0.687734E+04	0.304519E+04	0.814668E+00
2003	0.277093E+05	0.101857E+05	0.100079E+01
2004	0.575887E+04	0.264375E+04	0.778544E+00
2005	0.442063E+05	0.215366E+05	0.719114E+00
2006	0.226032E+04	0.125142E+04	0.591227E+00
2007	0.128206E+04	0.673971E+03	0.643034E+00
2008	N/A	0.119609E+06	N/A

Survey Index: 22 Tag: US_Au5 AGE = 6
 Time = JAN-1 Type = NUMBER
 Catchability = 0.560770E+00 % Variance Contribution = 5.0763
 Residual = LN(Observed) - LN(Predicted)

Year	Observed	Predicted	Residual
1931	N/A	0.571844E+04	N/A
1932	N/A	0.332626E+04	N/A
1933	N/A	0.241376E+04	N/A
1934	N/A	0.159292E+04	N/A

1935	N/A	0.341492E+04	N/A
1936	N/A	0.220886E+04	N/A
1937	N/A	0.254093E+04	N/A
1938	N/A	0.206989E+04	N/A
1939	N/A	0.169111E+04	N/A
1940	N/A	0.203071E+04	N/A
1941	N/A	0.253102E+04	N/A
1942	N/A	0.295846E+04	N/A
1943	N/A	0.255077E+04	N/A
1944	N/A	0.256911E+04	N/A
1945	N/A	0.417951E+04	N/A
1946	N/A	0.443774E+04	N/A
1947	N/A	0.314755E+04	N/A
1948	N/A	0.170721E+04	N/A
1949	N/A	0.163010E+04	N/A
1950	N/A	0.183034E+04	N/A
1951	N/A	0.264544E+04	N/A
1952	N/A	0.189030E+04	N/A
1953	N/A	0.201837E+04	N/A
1954	N/A	0.326840E+04	N/A
1955	N/A	0.296911E+04	N/A
1956	N/A	0.443852E+04	N/A
1957	N/A	0.341099E+04	N/A
1958	N/A	0.397643E+04	N/A
1959	N/A	0.363238E+04	N/A
1960	N/A	0.574154E+04	N/A
1961	N/A	0.451578E+04	N/A
1962	N/A	0.469215E+04	N/A
1963	N/A	0.494718E+04	N/A
1964	0.192961E+05	0.884507E+04	0.780042E+00
1965	0.123805E+05	0.771846E+04	0.472503E+00
1966	0.261150E+04	0.327124E+04	-0.225243E+00
1967	0.169264E+04	0.178585E+04	-0.536073E-01
1968	0.527136E+04	0.572712E+04	-0.829237E-01
1969	0.125255E+05	0.852140E+04	0.385189E+00
1970	0.531973E+03	0.559136E+03	-0.498011E-01
1971	0.870501E+03	0.266993E+03	0.118185E+01
1972	0.725417E+03	0.847831E+03	-0.155935E+00
1973	N/A	0.685075E+02	N/A
1974	0.145083E+03	0.485506E+02	0.109470E+01
1975	0.483611E+02	0.208835E+03	-0.146285E+01
1976	N/A	0.502111E+02	N/A
1977	0.967223E+03	0.635041E+03	0.420739E+00
1978	0.206233E+04	0.902986E+03	0.825883E+00
1979	0.832850E+03	0.110776E+04	-0.285241E+00
1980	0.832850E+03	0.995563E+03	-0.178454E+00
1981	0.551317E+04	0.526115E+04	0.467905E-01
1982	0.134859E+04	0.120175E+04	0.115281E+00
1983	0.435250E+03	0.594200E+03	-0.311294E+00
1984	0.304675E+04	0.232088E+04	0.272132E+00
1985	0.193445E+03	0.722456E+03	-0.131767E+01
1986	0.324571E+03	0.376009E+03	-0.147108E+00
1987	0.421943E+03	0.213952E+03	0.679120E+00
1988	0.194743E+03	0.304950E+03	-0.448467E+00
1989	0.129829E+04	0.929210E+03	0.334465E+00
1990	0.292763E+03	0.293563E+03	-0.272834E-02
1991	0.558912E+03	0.108888E+04	-0.666912E+00
1992	0.532297E+02	0.299861E+03	-0.172870E+01
1993	0.152549E+04	0.118767E+04	0.250320E+00
1994	0.186304E+03	0.949832E+02	0.673680E+00
1995	0.147031E+03	0.205979E+03	-0.337130E+00
1996	0.386240E+02	0.209483E+03	-0.169077E+01
1997	0.462839E+03	0.128493E+04	-0.102108E+01
1998	0.105648E+04	0.220878E+04	-0.737500E+00
1999	0.570921E+03	0.229361E+04	-0.139063E+01
2000	0.753557E+04	0.200171E+04	0.132564E+01
2001	0.214315E+04	0.174073E+04	0.207970E+00
2002	0.377412E+04	0.324490E+04	0.151082E+00
2003	0.607468E+04	0.197785E+04	0.112212E+01
2004	0.108926E+05	0.682280E+04	0.467816E+00
2005	0.381404E+04	0.175469E+04	0.776398E+00
2006	0.153704E+05	0.130063E+05	0.167008E+00
2007	0.140410E+04	0.815521E+03	0.543322E+00
2008	N/A	0.443170E+03	N/A

Survey Index: 23 Tag: Can_Sp AGE = 1
 Time = JAN-1 Type = NUMBER
 Catchability = 0.282518E+00 % Variance Contribution = 4.8049
 Residual = LN(Observed) - LN(Predicted)

Year	Observed	Predicted	Residual
1931	N/A	0.112833E+05	N/A
1932	N/A	0.128022E+05	N/A
1933	N/A	0.145822E+05	N/A
1934	N/A	0.168294E+05	N/A
1935	N/A	0.164464E+05	N/A
1936	N/A	0.161450E+05	N/A
1937	N/A	0.297522E+05	N/A
1938	N/A	0.220507E+05	N/A
1939	N/A	0.168060E+05	N/A
1940	N/A	0.314235E+05	N/A
1941	N/A	0.322825E+05	N/A
1942	N/A	0.174807E+05	N/A

1943	N/A	0.658448E+04	N/A
1944	N/A	0.184062E+05	N/A
1945	N/A	0.146363E+05	N/A
1946	N/A	0.265282E+05	N/A
1947	N/A	0.167069E+05	N/A
1948	N/A	0.931032E+04	N/A
1949	N/A	0.350722E+05	N/A
1950	N/A	0.161635E+05	N/A
1951	N/A	0.293199E+05	N/A
1952	N/A	0.119476E+05	N/A
1953	N/A	0.375157E+05	N/A
1954	N/A	0.147702E+05	N/A
1955	N/A	0.253905E+05	N/A
1956	N/A	0.170249E+05	N/A
1957	N/A	0.168466E+05	N/A
1958	N/A	0.165769E+05	N/A
1959	N/A	0.366840E+05	N/A
1960	N/A	0.345365E+05	N/A
1961	N/A	0.153441E+05	N/A
1962	N/A	0.110323E+05	N/A
1963	N/A	0.531816E+05	N/A
1964	N/A	0.130189E+06	N/A
1965	N/A	0.918553E+04	N/A
1966	N/A	0.117388E+04	N/A
1967	N/A	0.395893E+04	N/A
1968	N/A	0.153188E+03	N/A
1969	N/A	0.313847E+03	N/A
1970	N/A	0.130398E+04	N/A
1971	N/A	0.753121E+02	N/A
1972	N/A	0.240872E+04	N/A
1973	N/A	0.550861E+04	N/A
1974	N/A	0.298824E+04	N/A
1975	N/A	0.224039E+04	N/A
1976	N/A	0.297630E+05	N/A
1977	N/A	0.395066E+04	N/A
1978	N/A	0.173046E+04	N/A
1979	N/A	0.237002E+05	N/A
1980	N/A	0.308939E+04	N/A
1981	N/A	0.208048E+04	N/A
1982	N/A	0.729199E+03	N/A
1983	N/A	0.927902E+03	N/A
1984	N/A	0.510887E+04	N/A
1985	N/A	0.711673E+03	N/A
1986	0.571399E+04	0.474443E+04	0.185946E+00
1987	0.422216E+02	0.739672E+03	-0.286327E+01
1988	0.206886E+04	0.565463E+04	-0.100548E+01
1989	0.422216E+02	0.385904E+03	-0.221266E+01
1990	0.130887E+04	0.964812E+03	0.304985E+00
1991	0.105554E+04	0.769870E+03	0.315585E+00
1992	0.464437E+04	0.305447E+04	0.419049E+00
1993	0.557325E+04	0.443410E+04	0.228653E+00
1994	0.467252E+04	0.440150E+04	0.597535E-01
1995	0.273033E+04	0.363034E+04	-0.284904E+00
1996	0.859913E+04	0.337293E+04	0.935879E+00
1997	0.244885E+04	0.673243E+04	-0.101132E+01
1998	0.339180E+04	0.422208E+04	-0.218967E+00
1999	0.277959E+05	0.142693E+05	0.666775E+00
2000	0.257974E+05	0.338510E+04	0.203089E+01
2001	0.313566E+05	0.276428E+05	0.126060E+00
2002	0.278662E+04	0.163255E+04	0.534687E+00
2003	0.192207E+04	0.814815E+03	0.858195E+00
2004	0.207872E+06	0.139809E+06	0.396644E+00
2005	N/A	0.227373E+04	N/A
2006	N/A	0.747252E+04	N/A
2007	0.421513E+04	0.209650E+04	0.698410E+00
2008	0.392321E+04	0.462661E+04	-0.164913E+00

Survey Index: 24 Tag: Can_Sp AGE = 2
 Time = JAN-1 Type = NUMBER
 Catchability = 0.399130E+00 % Variance Contribution = 3.8554
 Residual = LN(Observed) - LN(Predicted)

Year	Observed	Predicted	Residual
1931	N/A	0.320850E+05	N/A
1932	N/A	0.124187E+05	N/A
1933	N/A	0.147654E+05	N/A
1934	N/A	0.167788E+05	N/A
1935	N/A	0.193430E+05	N/A
1936	N/A	0.185916E+05	N/A
1937	N/A	0.183572E+05	N/A
1938	N/A	0.339491E+05	N/A
1939	N/A	0.251341E+05	N/A
1940	N/A	0.192201E+05	N/A
1941	N/A	0.356113E+05	N/A
1942	N/A	0.370590E+05	N/A
1943	N/A	0.201077E+05	N/A
1944	N/A	0.760921E+04	N/A
1945	N/A	0.212668E+05	N/A
1946	N/A	0.168857E+05	N/A
1947	N/A	0.306089E+05	N/A
1948	N/A	0.192919E+05	N/A
1949	N/A	0.107401E+05	N/A
1950	N/A	0.404486E+05	N/A

1951	N/A	0.186641E+05	N/A
1952	N/A	0.336809E+05	N/A
1953	N/A	0.138180E+05	N/A
1954	N/A	0.430028E+05	N/A
1955	N/A	0.170453E+05	N/A
1956	N/A	0.293452E+05	N/A
1957	N/A	0.196734E+05	N/A
1958	N/A	0.194734E+05	N/A
1959	N/A	0.191289E+05	N/A
1960	N/A	0.423973E+05	N/A
1961	N/A	0.398542E+05	N/A
1962	N/A	0.177257E+05	N/A
1963	N/A	0.127340E+05	N/A
1964	N/A	0.604646E+05	N/A
1965	N/A	0.146945E+06	N/A
1966	N/A	0.718538E+04	N/A
1967	N/A	0.131671E+04	N/A
1968	N/A	0.416520E+04	N/A
1969	N/A	0.174304E+03	N/A
1970	N/A	0.362295E+03	N/A
1971	N/A	0.149169E+04	N/A
1972	N/A	0.867506E+02	N/A
1973	N/A	0.272857E+04	N/A
1974	N/A	0.543414E+04	N/A
1975	N/A	0.343920E+04	N/A
1976	N/A	0.251982E+04	N/A
1977	N/A	0.343721E+05	N/A
1978	N/A	0.456915E+04	N/A
1979	N/A	0.200121E+04	N/A
1980	N/A	0.274105E+05	N/A
1981	N/A	0.357052E+04	N/A
1982	N/A	0.240607E+04	N/A
1983	N/A	0.843081E+03	N/A
1984	N/A	0.107317E+04	N/A
1985	N/A	0.590868E+04	N/A
1986	0.309625E+03	0.823087E+03	-0.977700E+00
1987	0.427845E+04	0.548553E+04	-0.248522E+00
1988	0.703693E+02	0.855469E+03	-0.249789E+01
1989	0.751544E+04	0.653906E+04	0.139166E+00
1990	0.154812E+03	0.445678E+03	-0.105738E+01
1991	0.235033E+04	0.109330E+04	0.765360E+00
1992	0.415179E+04	0.887961E+03	0.154237E+01
1993	0.303995E+04	0.350288E+04	-0.141742E+00
1994	0.162131E+05	0.511689E+04	0.115327E+01
1995	0.368735E+04	0.508123E+04	-0.320646E+00
1996	0.406735E+04	0.419297E+04	-0.304192E-01
1997	0.163257E+04	0.389891E+04	-0.870543E+00
1998	0.115124E+05	0.778196E+04	0.391617E+00
1999	0.479919E+04	0.488139E+04	-0.169828E-01
2000	0.965467E+05	0.165032E+05	0.176647E+01
2001	0.398290E+04	0.391486E+04	0.172310E-01
2002	0.446141E+05	0.319685E+05	0.333301E+00
2003	0.358236E+04	0.188728E+04	0.640887E+00
2004	0.579843E+03	0.940849E+03	-0.484025E+00
2005	N/A	0.161480E+06	N/A
2006	N/A	0.262293E+04	N/A
2007	0.150013E+05	0.858396E+04	0.558241E+00
2008	0.124835E+04	0.242027E+04	-0.662057E+00

Survey Index: 25 Tag: Can_Sp AGE = 3
 Time = JAN-1 Type = NUMBER
 Catchability = 0.655467E+00 % Variance Contribution = 1.4135
 Residual = LN(Observed) - LN(Predicted)

Year	Observed	Predicted	Residual
1931	N/A	0.922977E+04	N/A
1932	N/A	0.379400E+05	N/A
1933	N/A	0.154653E+05	N/A
1934	N/A	0.148583E+05	N/A
1935	N/A	0.199281E+05	N/A
1936	N/A	0.190147E+05	N/A
1937	N/A	0.177399E+05	N/A
1938	N/A	0.181820E+05	N/A
1939	N/A	0.337463E+05	N/A
1940	N/A	0.255800E+05	N/A
1941	N/A	0.215603E+05	N/A
1942	N/A	0.340664E+05	N/A
1943	N/A	0.413827E+05	N/A
1944	N/A	0.245582E+05	N/A
1945	N/A	0.978072E+04	N/A
1946	N/A	0.235646E+05	N/A
1947	N/A	0.182989E+05	N/A
1948	N/A	0.313583E+05	N/A
1949	N/A	0.193238E+05	N/A
1950	N/A	0.106280E+05	N/A
1951	N/A	0.373381E+05	N/A
1952	N/A	0.202181E+05	N/A
1953	N/A	0.305091E+05	N/A
1954	N/A	0.175102E+05	N/A
1955	N/A	0.390784E+05	N/A
1956	N/A	0.205889E+05	N/A
1957	N/A	0.324048E+05	N/A
1958	N/A	0.225579E+05	N/A

1959	N/A	0.228917E+05	N/A
1960	N/A	0.223433E+05	N/A
1961	N/A	0.475544E+05	N/A
1962	N/A	0.472703E+05	N/A
1963	N/A	0.212004E+05	N/A
1964	N/A	0.147313E+05	N/A
1965	N/A	0.718819E+05	N/A
1966	N/A	0.123654E+06	N/A
1967	N/A	0.564518E+04	N/A
1968	N/A	0.167100E+04	N/A
1969	N/A	0.383864E+04	N/A
1970	N/A	0.227851E+03	N/A
1971	N/A	0.393902E+03	N/A
1972	N/A	0.119841E+04	N/A
1973	N/A	0.115457E+03	N/A
1974	N/A	0.242608E+04	N/A
1975	N/A	0.467278E+04	N/A
1976	N/A	0.399247E+04	N/A
1977	N/A	0.309803E+04	N/A
1978	N/A	0.345141E+05	N/A
1979	N/A	0.568990E+04	N/A
1980	N/A	0.267522E+04	N/A
1981	N/A	0.186054E+05	N/A
1982	N/A	0.376555E+04	N/A
1983	N/A	0.254291E+04	N/A
1984	N/A	0.100587E+04	N/A
1985	N/A	0.138725E+04	N/A
1986	0.851469E+04	0.649066E+04	0.271428E+00
1987	0.971096E+03	0.107431E+04	-0.101009E+00
1988	0.120050E+05	0.617415E+04	0.664953E+00
1989	0.101332E+04	0.111874E+04	-0.989705E-01
1990	0.138909E+05	0.792782E+04	0.560856E+00
1991	0.197034E+03	0.592370E+03	-0.110075E+01
1992	0.159035E+04	0.118321E+04	0.295721E+00
1993	0.774062E+03	0.103731E+04	-0.292733E+00
1994	0.574214E+04	0.449485E+04	0.244898E+00
1995	0.605176E+04	0.656191E+04	-0.809330E-01
1996	0.681175E+04	0.677663E+04	0.516942E-02
1997	0.139331E+04	0.560428E+04	-0.139185E+01
1998	0.433475E+04	0.515746E+04	-0.173781E+00
1999	0.100769E+05	0.103270E+05	-0.245214E-01
2000	0.131168E+05	0.653770E+04	0.696312E+00
2001	0.153124E+05	0.219487E+05	-0.360049E+00
2002	0.935912E+04	0.517784E+04	0.591963E+00
2003	0.975669E+05	0.427484E+05	0.825207E+00
2004	0.280689E+04	0.252706E+04	0.105021E+00
2005	N/A	0.124549E+04	N/A
2006	N/A	0.216756E+06	N/A
2007	0.441898E+04	0.351576E+04	0.228653E+00
2008	0.481327E+04	0.114382E+05	-0.865583E+00

Survey Index: 26 Tag: Can_Sp AGE = 4
 Time = JAN-1 Type = NUMBER
 Catchability = 0.620509E+00 % Variance Contribution = 1.5804
 Residual = LN(Observed) - LN(Predicted)

Year	Observed	Predicted	Residual
1931	N/A	0.109612E+05	N/A
1932	N/A	0.601294E+04	N/A
1933	N/A	0.150636E+05	N/A
1934	N/A	0.862892E+04	N/A
1935	N/A	0.849672E+04	N/A
1936	N/A	0.105336E+05	N/A
1937	N/A	0.835950E+04	N/A
1938	N/A	0.769265E+04	N/A
1939	N/A	0.977169E+04	N/A
1940	N/A	0.152573E+05	N/A
1941	N/A	0.129706E+05	N/A
1942	N/A	0.112490E+05	N/A
1943	N/A	0.173042E+05	N/A
1944	N/A	0.221922E+05	N/A
1945	N/A	0.143274E+05	N/A
1946	N/A	0.644645E+04	N/A
1947	N/A	0.982369E+04	N/A
1948	N/A	0.843991E+04	N/A
1949	N/A	0.136245E+05	N/A
1950	N/A	0.805368E+04	N/A
1951	N/A	0.594773E+04	N/A
1952	N/A	0.142729E+05	N/A
1953	N/A	0.107174E+05	N/A
1954	N/A	0.138745E+05	N/A
1955	N/A	0.107201E+05	N/A
1956	N/A	0.195754E+05	N/A
1957	N/A	0.122200E+05	N/A
1958	N/A	0.172913E+05	N/A
1959	N/A	0.135277E+05	N/A
1960	N/A	0.132832E+05	N/A
1961	N/A	0.138985E+05	N/A
1962	N/A	0.285263E+05	N/A
1963	N/A	0.275747E+05	N/A
1964	N/A	0.122937E+05	N/A
1965	N/A	0.887577E+04	N/A
1966	N/A	0.310122E+05	N/A

1967	N/A	0.401330E+05	N/A
1968	N/A	0.276715E+04	N/A
1969	N/A	0.900117E+03	N/A
1970	N/A	0.202944E+04	N/A
1971	N/A	0.167639E+03	N/A
1972	N/A	0.181375E+03	N/A
1973	N/A	0.672163E+03	N/A
1974	N/A	0.877493E+02	N/A
1975	N/A	0.149980E+04	N/A
1976	N/A	0.254731E+04	N/A
1977	N/A	0.277528E+04	N/A
1978	N/A	0.229498E+04	N/A
1979	N/A	0.186664E+05	N/A
1980	N/A	0.343736E+04	N/A
1981	N/A	0.187822E+04	N/A
1982	N/A	0.826862E+04	N/A
1983	N/A	0.200218E+04	N/A
1984	N/A	0.151269E+04	N/A
1985	N/A	0.611796E+03	N/A
1986	0.150590E+04	0.761324E+03	0.682089E+00
1987	0.353254E+04	0.344414E+04	0.253419E-01
1988	0.239256E+03	0.759010E+03	-0.115448E+01
1989	0.298366E+04	0.342576E+04	-0.138172E+00
1990	0.182960E+03	0.798524E+03	-0.147350E+01
1991	0.126524E+05	0.519602E+04	0.889955E+00
1992	0.239256E+03	0.390478E+03	-0.489839E+00
1993	0.633324E+03	0.689729E+03	-0.853172E-01
1994	0.591102E+03	0.559333E+03	0.552437E-01
1995	0.312440E+04	0.281829E+04	0.103111E+00
1996	0.709323E+04	0.474198E+04	0.402685E+00
1997	0.329328E+04	0.493523E+04	-0.404515E+00
1998	0.361698E+04	0.419075E+04	-0.147239E+00
1999	0.311032E+04	0.373372E+04	-0.182678E+00
2000	0.125398E+05	0.749685E+04	0.514426E+00
2001	0.434882E+04	0.471690E+04	-0.812458E-01
2002	0.216174E+05	0.156720E+05	0.321623E+00
2003	0.722862E+04	0.381978E+04	0.637856E+00
2004	0.556924E+05	0.320444E+05	0.552721E+00
2005	N/A	0.189046E+04	N/A
2006	N/A	0.941912E+03	N/A
2007	0.804604E+05	0.166226E+06	-0.725586E+00
2008	0.520377E+04	0.259053E+04	0.697519E+00

Survey Index: 27 Tag: Can_Sp AGE = 5
 Time = JAN-1 Type = NUMBER
 Catchability = 0.707918E+00 % Variance Contribution = 1.7340
 Residual = LN(Observed) - LN(Predicted)

Year	Observed	Predicted	Residual
1931	N/A	0.121369E+05	N/A
1932	N/A	0.656620E+04	N/A
1933	N/A	0.407649E+04	N/A
1934	N/A	0.770956E+04	N/A
1935	N/A	0.568591E+04	N/A
1936	N/A	0.558035E+04	N/A
1937	N/A	0.639074E+04	N/A
1938	N/A	0.424467E+04	N/A
1939	N/A	0.480016E+04	N/A
1940	N/A	0.584996E+04	N/A
1941	N/A	0.901351E+04	N/A
1942	N/A	0.702444E+04	N/A
1943	N/A	0.636525E+04	N/A
1944	N/A	0.108498E+05	N/A
1945	N/A	0.113312E+05	N/A
1946	N/A	0.932333E+04	N/A
1947	N/A	0.428037E+04	N/A
1948	N/A	0.463517E+04	N/A
1949	N/A	0.464035E+04	N/A
1950	N/A	0.664741E+04	N/A
1951	N/A	0.481092E+04	N/A
1952	N/A	0.417001E+04	N/A
1953	N/A	0.795195E+04	N/A
1954	N/A	0.637634E+04	N/A
1955	N/A	0.939069E+04	N/A
1956	N/A	0.790108E+04	N/A
1957	N/A	0.106374E+05	N/A
1958	N/A	0.853578E+04	N/A
1959	N/A	0.119105E+05	N/A
1960	N/A	0.934675E+04	N/A
1961	N/A	0.950293E+04	N/A
1962	N/A	0.103078E+05	N/A
1963	N/A	0.200009E+05	N/A
1964	N/A	0.186630E+05	N/A
1965	N/A	0.844449E+04	N/A
1966	N/A	0.489516E+04	N/A
1967	N/A	0.168200E+05	N/A
1968	N/A	0.243645E+05	N/A
1969	N/A	0.136906E+04	N/A
1970	N/A	0.556232E+03	N/A
1971	N/A	0.153241E+04	N/A
1972	N/A	0.131081E+03	N/A
1973	N/A	0.116729E+03	N/A
1974	N/A	0.378557E+03	N/A

1975	N/A	0.806209E+02	N/A
1976	N/A	0.115366E+04	N/A
1977	N/A	0.179846E+04	N/A
1978	N/A	0.215273E+04	N/A
1979	N/A	0.194739E+04	N/A
1980	N/A	0.128308E+05	N/A
1981	N/A	0.258602E+04	N/A
1982	N/A	0.122239E+04	N/A
1983	N/A	0.533323E+04	N/A
1984	N/A	0.142650E+04	N/A
1985	N/A	0.945540E+03	N/A
1986	0.267403E+03	0.444918E+03	-0.509132E+00
1987	0.942949E+03	0.567143E+03	0.508400E+00
1988	0.401105E+04	0.217161E+04	0.613584E+00
1989	0.267403E+03	0.621482E+03	-0.843348E+00
1990	0.472882E+04	0.255088E+04	0.617237E+00
1991	0.154812E+03	0.574658E+03	-0.131156E+01
1992	0.537621E+04	0.334708E+04	0.473897E+00
1993	0.562954E+02	0.239501E+03	-0.144794E+01
1994	0.337773E+03	0.428040E+03	-0.236845E+00
1995	0.788136E+03	0.368906E+03	0.759129E+00
1996	0.410957E+04	0.233200E+04	0.566592E+00
1997	0.333550E+04	0.384327E+04	-0.141699E+00
1998	0.529177E+04	0.413420E+04	0.246859E+00
1999	0.197034E+04	0.355841E+04	-0.591108E+00
2000	0.296958E+04	0.314210E+04	-0.564704E-01
2001	0.581250E+04	0.600054E+04	-0.318380E-01
2002	0.607991E+04	0.377054E+04	0.477772E+00
2003	0.186403E+05	0.126118E+05	0.390691E+00
2004	0.554130E+04	0.327347E+04	0.526379E+00
2005	N/A	0.266664E+05	N/A
2006	N/A	0.154950E+04	N/A
2007	0.112062E+04	0.834506E+03	0.294800E+00
2008	0.109124E+06	0.148099E+06	-0.305394E+00

Survey Index: 28 Tag: Can_Sp AGE = 6
 Time = JAN-1 Type = NUMBER
 Catchability = 0.523142E+00 % Variance Contribution = 3.1484
 Residual = LN(Observed) - LN(Predicted)

Year	Observed	Predicted	Residual
1931	N/A	0.533473E+04	N/A
1932	N/A	0.310307E+04	N/A
1933	N/A	0.225180E+04	N/A
1934	N/A	0.148604E+04	N/A
1935	N/A	0.318577E+04	N/A
1936	N/A	0.206065E+04	N/A
1937	N/A	0.237043E+04	N/A
1938	N/A	0.193100E+04	N/A
1939	N/A	0.157763E+04	N/A
1940	N/A	0.189445E+04	N/A
1941	N/A	0.236119E+04	N/A
1942	N/A	0.275994E+04	N/A
1943	N/A	0.237961E+04	N/A
1944	N/A	0.239672E+04	N/A
1945	N/A	0.389906E+04	N/A
1946	N/A	0.413996E+04	N/A
1947	N/A	0.293635E+04	N/A
1948	N/A	0.159266E+04	N/A
1949	N/A	0.152072E+04	N/A
1950	N/A	0.170752E+04	N/A
1951	N/A	0.246793E+04	N/A
1952	N/A	0.176345E+04	N/A
1953	N/A	0.188294E+04	N/A
1954	N/A	0.304909E+04	N/A
1955	N/A	0.276988E+04	N/A
1956	N/A	0.414069E+04	N/A
1957	N/A	0.318211E+04	N/A
1958	N/A	0.370960E+04	N/A
1959	N/A	0.338864E+04	N/A
1960	N/A	0.535628E+04	N/A
1961	N/A	0.421277E+04	N/A
1962	N/A	0.437731E+04	N/A
1963	N/A	0.461522E+04	N/A
1964	N/A	0.825156E+04	N/A
1965	N/A	0.720055E+04	N/A
1966	N/A	0.305173E+04	N/A
1967	N/A	0.166602E+04	N/A
1968	N/A	0.534283E+04	N/A
1969	N/A	0.794961E+04	N/A
1970	N/A	0.521618E+03	N/A
1971	N/A	0.249077E+03	N/A
1972	N/A	0.790941E+03	N/A
1973	N/A	0.639106E+02	N/A
1974	N/A	0.452928E+02	N/A
1975	N/A	0.194822E+03	N/A
1976	N/A	0.468419E+02	N/A
1977	N/A	0.592430E+03	N/A
1978	N/A	0.842395E+03	N/A
1979	N/A	0.103343E+04	N/A
1980	N/A	0.928759E+03	N/A
1981	N/A	0.490812E+04	N/A
1982	N/A	0.112111E+04	N/A

1983	N/A	0.554328E+03	N/A
1984	N/A	0.216514E+04	N/A
1985	N/A	0.673979E+03	N/A
1986	0.408142E+03	0.350779E+03	0.151459E+00
1987	0.112591E+03	0.199595E+03	-0.572531E+00
1988	0.253329E+03	0.284487E+03	-0.115998E+00
1989	0.591102E+03	0.866859E+03	-0.382888E+00
1990	0.323699E+03	0.273865E+03	0.167178E+00
1991	0.225182E+04	0.101581E+04	0.796048E+00
1992	0.422216E+02	0.279740E+03	-0.189093E+01
1993	0.180145E+04	0.110798E+04	0.486060E+00
1994	0.281477E+02	0.886098E+02	-0.114678E+01
1995	0.422216E+02	0.192157E+03	-0.151538E+01
1996	0.365920E+03	0.195427E+03	0.627231E+00
1997	0.239256E+04	0.119871E+04	0.691118E+00
1998	0.516511E+04	0.206057E+04	0.918942E+00
1999	0.189997E+04	0.213970E+04	-0.118829E+00
2000	0.218145E+04	0.186739E+04	0.155448E+00
2001	0.181553E+04	0.162392E+04	0.111530E+00
2002	0.748729E+04	0.302716E+04	0.905581E+00
2003	0.413293E+04	0.184514E+04	0.806433E+00
2004	0.103840E+05	0.636498E+04	0.489453E+00
2005	N/A	0.163695E+04	N/A
2006	N/A	0.121336E+05	N/A
2007	0.177506E+03	0.760799E+03	-0.145536E+01
2008	0.100900E+04	0.413433E+03	0.892218E+00

Survey Index: 29 Tag: Can_Sp AGE = 7
 Time = JAN-1 Type = NUMBER
 Catchability = 0.679959E+00 % Variance Contribution = 2.5699
 Residual = LN(Observed) - LN(Predicted)

Year	Observed	Predicted	Residual
1931	N/A	0.373337E+04	N/A
1932	N/A	0.202576E+04	N/A
1933	N/A	0.154659E+04	N/A
1934	N/A	0.143459E+04	N/A
1935	N/A	0.941333E+03	N/A
1936	N/A	0.189482E+04	N/A
1937	N/A	0.135378E+04	N/A
1938	N/A	0.138221E+04	N/A
1939	N/A	0.108245E+04	N/A
1940	N/A	0.108913E+04	N/A
1941	N/A	0.111636E+04	N/A
1942	N/A	0.142888E+04	N/A
1943	N/A	0.152069E+04	N/A
1944	N/A	0.905630E+03	N/A
1945	N/A	0.116730E+04	N/A
1946	N/A	0.273703E+04	N/A
1947	N/A	0.207592E+04	N/A
1948	N/A	0.146321E+04	N/A
1949	N/A	0.990454E+03	N/A
1950	N/A	0.972057E+03	N/A
1951	N/A	0.112784E+04	N/A
1952	N/A	0.132771E+04	N/A
1953	N/A	0.130027E+04	N/A
1954	N/A	0.138593E+04	N/A
1955	N/A	0.194679E+04	N/A
1956	N/A	0.194170E+04	N/A
1957	N/A	0.235283E+04	N/A
1958	N/A	0.195165E+04	N/A
1959	N/A	0.250523E+04	N/A
1960	N/A	0.253254E+04	N/A
1961	N/A	0.460312E+04	N/A
1962	N/A	0.334854E+04	N/A
1963	N/A	0.338181E+04	N/A
1964	N/A	0.356413E+04	N/A
1965	N/A	0.525222E+04	N/A
1966	N/A	0.360395E+04	N/A
1967	N/A	0.167335E+04	N/A
1968	N/A	0.103686E+04	N/A
1969	N/A	0.355307E+04	N/A
1970	N/A	0.483613E+04	N/A
1971	N/A	0.424223E+03	N/A
1972	N/A	0.115991E+03	N/A
1973	N/A	0.766374E+03	N/A
1974	N/A	0.493154E+02	N/A
1975	N/A	0.469093E+02	N/A
1976	N/A	0.180724E+03	N/A
1977	N/A	0.498420E+02	N/A
1978	N/A	0.409668E+03	N/A
1979	N/A	0.578677E+03	N/A
1980	N/A	0.846601E+03	N/A
1981	N/A	0.624246E+03	N/A
1982	N/A	0.364145E+04	N/A
1983	N/A	0.842987E+03	N/A
1984	N/A	0.422097E+03	N/A
1985	N/A	0.139043E+04	N/A
1986	0.478511E+03	0.574324E+03	-0.182514E+00
1987	0.422216E+03	0.266150E+03	0.461455E+00
1988	0.239256E+03	0.166824E+03	0.360596E+00
1989	0.422216E+02	0.209698E+03	-0.160274E+01
1990	0.153405E+04	0.630838E+03	0.888619E+00

1991	0.126665E+03	0.197270E+03	-0.443032E+00
1992	0.149183E+04	0.764878E+03	0.668042E+00
1993	0.281477E+02	0.187240E+03	-0.189492E+01
1994	0.985170E+03	0.727295E+03	0.303482E+00
1995	N/A	0.496840E+02	N/A
1996	0.337773E+03	0.186454E+03	0.594186E+00
1997	0.323699E+03	0.167570E+03	0.658410E+00
1998	0.278662E+04	0.114202E+04	0.892035E+00
1999	0.177331E+04	0.184324E+04	-0.386785E-01
2000	0.273033E+04	0.193058E+04	0.346601E+00
2001	0.161849E+04	0.166402E+04	-0.277391E-01
2002	0.223774E+04	0.132718E+04	0.522411E+00
2003	0.377939E+04	0.254506E+04	0.395411E+00
2004	0.173897E+04	0.159325E+04	0.875131E-01
2005	N/A	0.497950E+04	N/A
2006	N/A	0.126680E+04	N/A
2007	0.417721E+04	0.960028E+04	-0.832149E+00
2008	0.194692E+03	0.619187E+03	-0.115699E+01

Survey Index: 30 Tag: Can_Sp AGE = 8
 Time = JAN-1 Type = NUMBER
 Catchability = 0.620286E+00 % Variance Contribution = 2.2809
 Residual = LN(Observed) - LN(Predicted)

Year	Observed	Predicted	Residual
1931	N/A	0.191396E+04	N/A
1932	N/A	0.928022E+03	N/A
1933	N/A	0.781384E+03	N/A
1934	N/A	0.486658E+03	N/A
1935	N/A	0.726851E+03	N/A
1936	N/A	0.425771E+03	N/A
1937	N/A	0.661519E+03	N/A
1938	N/A	0.484105E+03	N/A
1939	N/A	0.508964E+03	N/A
1940	N/A	0.345945E+03	N/A
1941	N/A	0.397030E+03	N/A
1942	N/A	0.314839E+03	N/A
1943	N/A	0.494007E+03	N/A
1944	N/A	0.696681E+03	N/A
1945	N/A	0.400320E+03	N/A
1946	N/A	0.366907E+03	N/A
1947	N/A	0.103198E+04	N/A
1948	N/A	0.719949E+03	N/A
1949	N/A	0.659423E+03	N/A
1950	N/A	0.393726E+03	N/A
1951	N/A	0.437076E+03	N/A
1952	N/A	0.432253E+03	N/A
1953	N/A	0.696401E+03	N/A
1954	N/A	0.669322E+03	N/A
1955	N/A	0.634936E+03	N/A
1956	N/A	0.860759E+03	N/A
1957	N/A	0.703832E+03	N/A
1958	N/A	0.854722E+03	N/A
1959	N/A	0.955204E+03	N/A
1960	N/A	0.121905E+04	N/A
1961	N/A	0.145246E+04	N/A
1962	N/A	0.273131E+04	N/A
1963	N/A	0.162969E+04	N/A
1964	N/A	0.174338E+04	N/A
1965	N/A	0.150630E+04	N/A
1966	N/A	0.183546E+04	N/A
1967	N/A	0.139906E+04	N/A
1968	N/A	0.698705E+03	N/A
1969	N/A	0.404651E+03	N/A
1970	N/A	0.177760E+04	N/A
1971	N/A	0.232815E+04	N/A
1972	N/A	0.158955E+03	N/A
1973	N/A	0.424396E+02	N/A
1974	N/A	0.528518E+03	N/A
1975	N/A	0.356566E+02	N/A
1976	N/A	0.327408E+02	N/A
1977	N/A	0.121611E+03	N/A
1978	N/A	0.349311E+02	N/A
1979	N/A	0.227855E+03	N/A
1980	N/A	0.255560E+03	N/A
1981	N/A	0.328001E+03	N/A
1982	N/A	0.280983E+03	N/A
1983	N/A	0.209083E+04	N/A
1984	N/A	0.524643E+03	N/A
1985	N/A	0.183750E+03	N/A
1986	0.520733E+03	0.738397E+03	-0.349244E+00
1987	0.140739E+03	0.344093E+03	-0.894008E+00
1988	0.154812E+03	0.148153E+03	0.439719E-01
1989	0.422216E+02	0.932026E+02	-0.791844E+00
1990	0.182960E+03	0.122190E+03	0.403693E+00
1991	0.619250E+03	0.349835E+03	0.571049E+00
1992	0.562954E+02	0.764428E+02	-0.305929E+00
1993	0.450364E+03	0.334839E+03	0.296404E+00
1994	0.140739E+02	0.104936E+03	-0.200903E+01
1995	0.675545E+03	0.368721E+03	0.605480E+00
1996	0.562954E+02	0.323560E+02	0.553813E+00
1997	0.126665E+03	0.126895E+03	-0.181633E-02
1998	0.337773E+03	0.115362E+03	0.107429E+01

1999	0.464437E+03	0.758495E+03	-0.490509E+00
2000	0.160442E+04	0.116240E+04	0.322278E+00
2001	0.198441E+04	0.123122E+04	0.477315E+00
2002	0.185775E+04	0.998514E+03	0.620853E+00
2003	0.169745E+04	0.767174E+03	0.794167E+00
2004	0.102345E+04	0.149951E+04	-0.381956E+00
2005	N/A	0.807658E+03	N/A
2006	N/A	0.269216E+04	N/A
2007	0.299037E+03	0.763849E+03	-0.937801E+00
2008	0.859467E+04	0.576797E+04	0.398822E+00

Plus Group Diagnostic Report

Calculation Method Selected = Backward

Year	Population Backward	Population Forward	F Forward	F Backward	Ratio
1931	961.	961.	0.997338	0.997338	1.000000
1932	881.	1222.	0.431489	0.662343	1.535018
1933	1515.	1282.	0.797975	0.628024	0.787022
1934	527.	1023.	0.199216	0.429368	2.155290
1935	289.	1104.	0.115073	0.531930	4.622531
1936	329.	1369.	0.105061	0.532164	5.065289
1937	492.	1339.	0.201204	0.677471	3.367082
1938	413.	1340.	0.153215	0.611821	3.993205
1939	602.	1288.	0.228104	0.569606	2.497133
1940	342.	1220.	0.130993	0.571032	4.359253
1941	801.	1134.	0.463332	0.739804	1.596702
1942	394.	834.	0.263676	0.669485	2.539046
1943	400.	737.	0.307844	0.663752	2.156132
1944	259.	780.	0.165397	0.609012	3.682115
1945	499.	1041.	0.243833	0.595311	2.441468
1946	50.	959.	0.026798	0.696294	25.982882
1947	1021.	1006.	0.684379	0.670668	0.979966
1948	952.	1112.	0.451606	0.551452	1.221091
1949	918.	1127.	0.420336	0.545878	1.298672
1950	705.	1110.	0.284028	0.490916	1.728409
1951	510.	1002.	0.268664	0.616813	2.295855
1952	410.	939.	0.134093	0.337640	2.517965
1953	506.	1079.	0.168389	0.398986	2.369426
1954	300.	1363.	0.082512	0.443634	5.376612
1955	553.	1595.	0.127195	0.419358	3.296968
1956	495.	1701.	0.139372	0.585777	4.202980
1957	878.	1844.	0.246063	0.607592	2.469251
1958	443.	1686.	0.097350	0.432913	4.446967
1959	1213.	1984.	0.204673	0.359507	1.756495
1960	1685.	2204.	0.190751	0.257421	1.349512
1961	3182.	2735.	0.315374	0.264856	0.839813
1962	3337.	3105.	0.381446	0.349849	0.917164
1963	3994.	4277.	0.330192	0.358086	1.084478
1964	3642.	4020.	0.450717	0.511085	1.133936
1965	3032.	3478.	0.561041	0.676381	1.205583
1966	2023.	2636.	0.446717	0.630925	1.412359
1967	1717.	2670.	0.338098	0.587421	1.737430
1968	2094.	2585.	0.441266	0.578910	1.311930
1969	1653.	1878.	0.404375	0.474116	1.172465
1970	1782.	1359.	0.468203	0.336330	0.718342
1971	2371.	2373.	0.557867	0.558371	1.000903
1972	4801.	2870.	0.655735	0.341057	0.520114
1973	2036.	1369.	0.452785	0.281800	0.622371
1974	4002.	755.	0.469353	0.073789	0.157215
1975	1276.	1035.	0.101909	0.081847	0.803140
1976	1495.	808.	0.172004	0.089460	0.520102
1977	558.	597.	0.232196	0.250219	1.077616
1978	270.	512.	0.156647	0.321284	2.051003
1979	176.	392.	0.139579	0.341648	2.447705
1980	218.	493.	0.200414	0.524776	2.618460
1981	315.	530.	0.218758	0.400135	1.829126
1982	470.	639.	0.211610	0.299537	1.415513
1983	320.	698.	0.129109	0.305359	2.365130
1984	1720.	2536.	0.271873	0.430723	1.584282
1985	577.	2032.	0.088132	0.350782	3.980209
1986	268.	1694.	0.040374	0.285942	7.082384
1987	707.	2064.	0.076342	0.240983	3.156647
1988	395.	1923.	0.064146	0.357793	5.577774
1989	230.	1613.	0.039524	0.315082	7.972007
1990	174.	1359.	0.040470	0.368750	9.111686
1991	213.	1180.	0.062614	0.406510	6.492349
1992	263.	1215.	0.094522	0.533648	5.645729
1993	262.	964.	0.098590	0.420721	4.267376
1994	336.	1006.	0.127947	0.442203	3.456140
1995	157.	813.	0.022209	0.120740	5.436524
1996	591.	1083.	0.082924	0.157314	1.897093
1997	543.	852.	0.065176	0.104321	1.600621
1998	386.	805.	0.068873	0.149052	2.164142
1999	357.	746.	0.072888	0.158837	2.179195
2000	715.	1422.	0.079388	0.164339	2.070067
2001	1451.	2377.	0.129461	0.221529	1.711162
2002	2896.	3012.	0.224577	0.234696	1.045057
2003	2265.	3012.	0.153201	0.209156	1.365239
2004	1753.	2937.	0.165935	0.295248	1.779301
2005	1418.	3511.	0.113909	0.308869	2.711543
2006	1173.	3348.	0.077874	0.239744	3.078605

2007	3036.	5331.	0.123935	0.228544	1.844055
2008	300.	4658.	N/A	N/A	

Warning **** Infeasible Mass Balance in Plus Group
Year = 1947
Year = 1974
Year = 1976

YPR input GB haddock

```
##
##   YPR Version 2.6
##
TITLE
Georges_Bank_Haddock_vpa_Garm3_rev flat5
AGES
1 9 100 1
FMORT
2.0 0.01 0.0001
MMORT
0.2000
TSPAWN
0.2500 0.2500
REFMSP
0.4000
BIODATA
1 0.0139 1.0000 0.1126 0.1883 0.1126 0.0630
2 0.0298 1.0000 0.3633 0.5937 0.3633 0.4690
3 0.1484 1.0000 0.8029 1.0900 0.8029 0.9200
4 0.3958 1.0000 1.2505 1.3772 1.2505 0.9930
5 1.0000 1.0000 1.5597 1.6560 1.5597 0.9990
6 1.0000 1.0000 1.8176 1.8887 1.8176 1.0000
7 1.0000 1.0000 2.0522 2.0880 2.0522 1.0000
8 1.0000 1.0000 2.3401 2.3539 2.3401 1.0000
9 1.0000 1.0000 2.6388 2.6388 2.6388 1.0000
```

YPR output GB haddock

```
## Yield per Recruit and Spawning Stock Biomass per Recruit
##
##   YPR Version 2.7
##
##   Date of Run: 12 Jul 2008   15:57
##
##   Input Data File: C:\X-APPS\YPR_TOOLBOX\V27\GARM3-REVIEW\VPA_GARM3_BRP.DAT
##
```

Model Title: Georges_Bank_Haddock_vpa_Garm3_rev flat5

Start Age = 1
End Age = 9 - Includes Plus Group with Maximum Age = 100

Fishing Mortality Upper Bound = 2.0000
Fishing Mortality Calculation Increment = 0.0001
Fishing Mortality Printing Increment = 0.01

Natural Mortality = 0.2000

Proportion Fishing Mortality Before Spawning = 0.2500
Proportion Natural Mortality Before Spawning = 0.2500

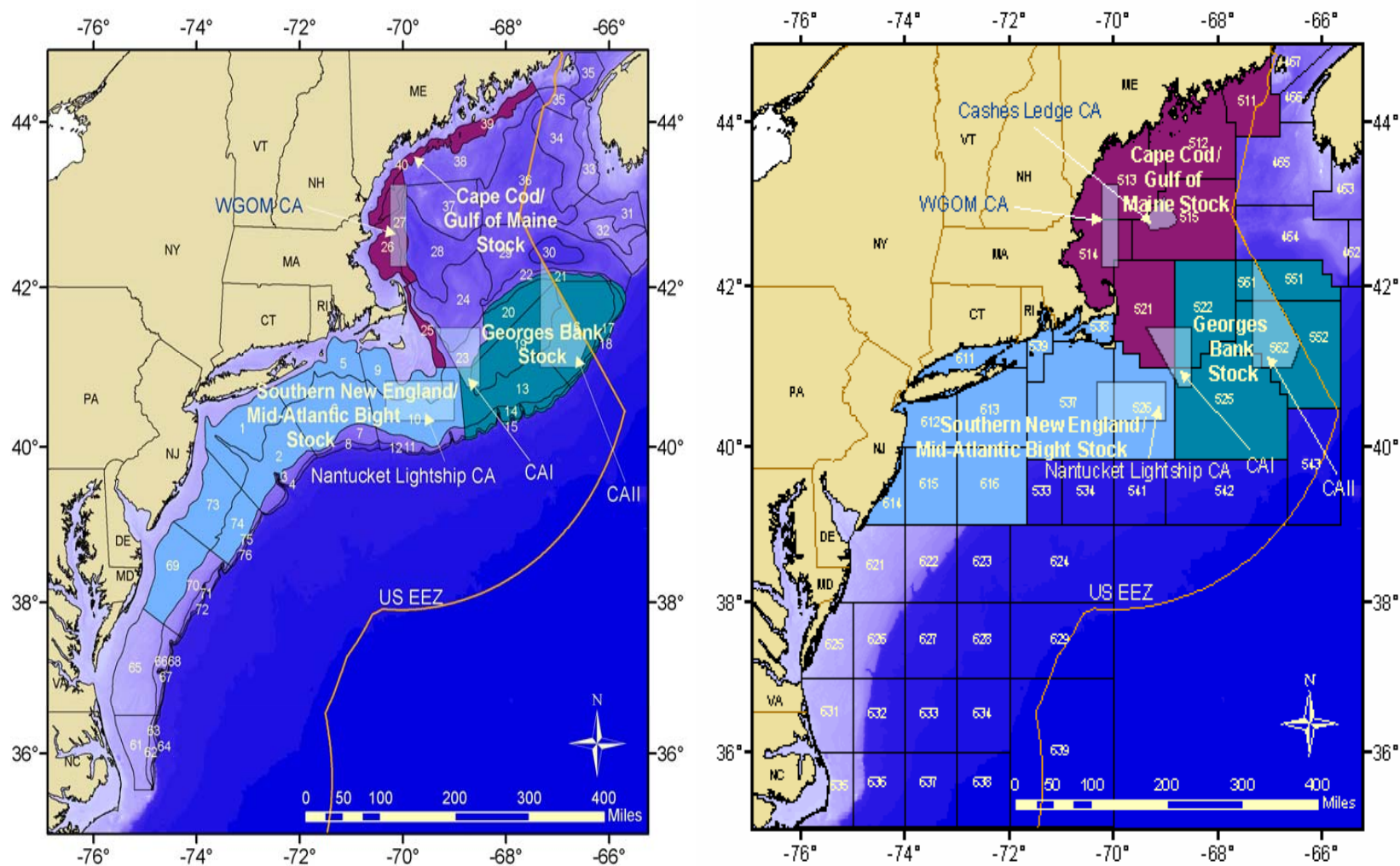
Age	Selectivity F	Selectivity M	Stock Weight	Catch Weight	SSB Weight	Maturity
1	0.0139	1.0000	0.1126	0.1883	0.1126	0.0630
2	0.0298	1.0000	0.3633	0.5937	0.3633	0.4690
3	0.1484	1.0000	0.8029	1.0900	0.8029	0.9200
4	0.3958	1.0000	1.2505	1.3772	1.2505	0.9930
5	1.0000	1.0000	1.5597	1.6560	1.5597	0.9990
6	1.0000	1.0000	1.8176	1.8887	1.8176	1.0000
7	1.0000	1.0000	2.0522	2.0880	2.0522	1.0000
8	1.0000	1.0000	2.3401	2.3539	2.3401	1.0000
9	1.0000	1.0000	2.6388	2.6388	2.6388	1.0000

Reference Point	F	YPR	SSBR	TSBR	Mean Age	Mean GT	Exp Spawn
-----------------	---	-----	------	------	----------	---------	-----------

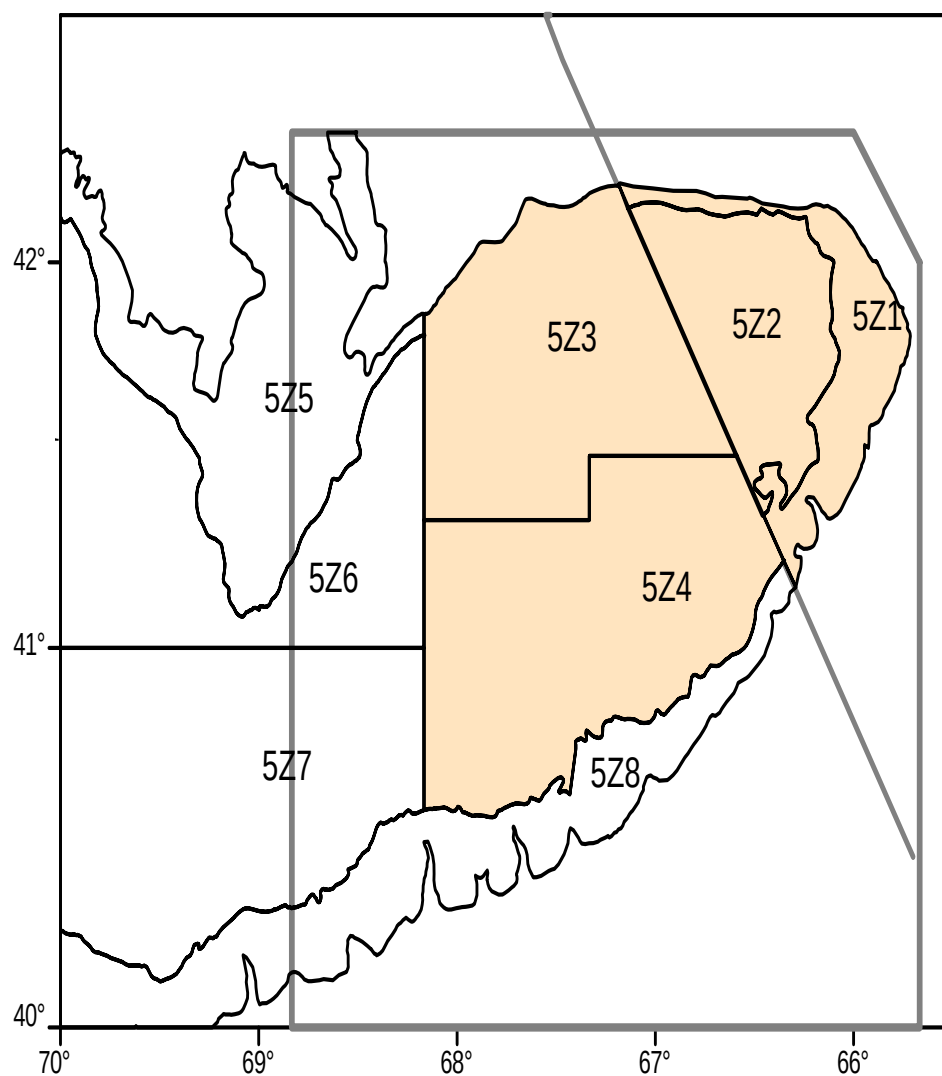
1.83000	0.51584	0.65805	2.97950	1.66422	1.32722	1.09072	16.79752	2.31781	3.69278	0.87105
1.84000	0.51634	0.65799	2.97708	1.66088	1.32481	1.08754	16.74861	2.31601	3.68992	0.86895
1.85000	0.51684	0.65793	2.97468	1.65757	1.32241	1.08439	16.70008	2.31422	3.68708	0.86685
1.86000	0.51734	0.65787	2.97229	1.65429	1.32002	1.08126	16.65192	2.31244	3.68426	0.86477
1.87000	0.51784	0.65781	2.96991	1.65102	1.31765	1.07816	16.60411	2.31067	3.68147	0.86271
1.88000	0.51833	0.65774	2.96754	1.64778	1.31530	1.07508	16.55667	2.30891	3.67870	0.86066
1.89000	0.51882	0.65768	2.96519	1.64456	1.31296	1.07202	16.50958	2.30717	3.67594	0.85862
1.90000	0.51931	0.65761	2.96285	1.64137	1.31063	1.06899	16.46284	2.30544	3.67321	0.85659
1.91000	0.51980	0.65755	2.96053	1.63819	1.30832	1.06597	16.41644	2.30372	3.67051	0.85458
1.92000	0.52028	0.65748	2.95822	1.63504	1.30602	1.06298	16.37038	2.30201	3.66782	0.85258
1.93000	0.52076	0.65741	2.95592	1.63191	1.30374	1.06001	16.32466	2.30031	3.66515	0.85059
1.94000	0.52124	0.65734	2.95363	1.62880	1.30146	1.05707	16.27927	2.29862	3.66250	0.84862
1.95000	0.52171	0.65727	2.95136	1.62572	1.29920	1.05414	16.23420	2.29695	3.65987	0.84665
1.96000	0.52218	0.65720	2.94910	1.62265	1.29696	1.05123	16.18946	2.29528	3.65726	0.84470
1.97000	0.52265	0.65713	2.94685	1.61960	1.29473	1.04835	16.14503	2.29363	3.65467	0.84276
1.98000	0.52312	0.65705	2.94461	1.61657	1.29251	1.04549	16.10092	2.29198	3.65210	0.84084
1.99000	0.52359	0.65698	2.94238	1.61357	1.29030	1.04264	16.05712	2.29035	3.64955	0.83892
2.00000	0.52405	0.65690	2.94017	1.61058	1.28811	1.03982	16.01362	2.28873	3.64701	0.83702

Appendix C. Georges Bank yellowtail flounder

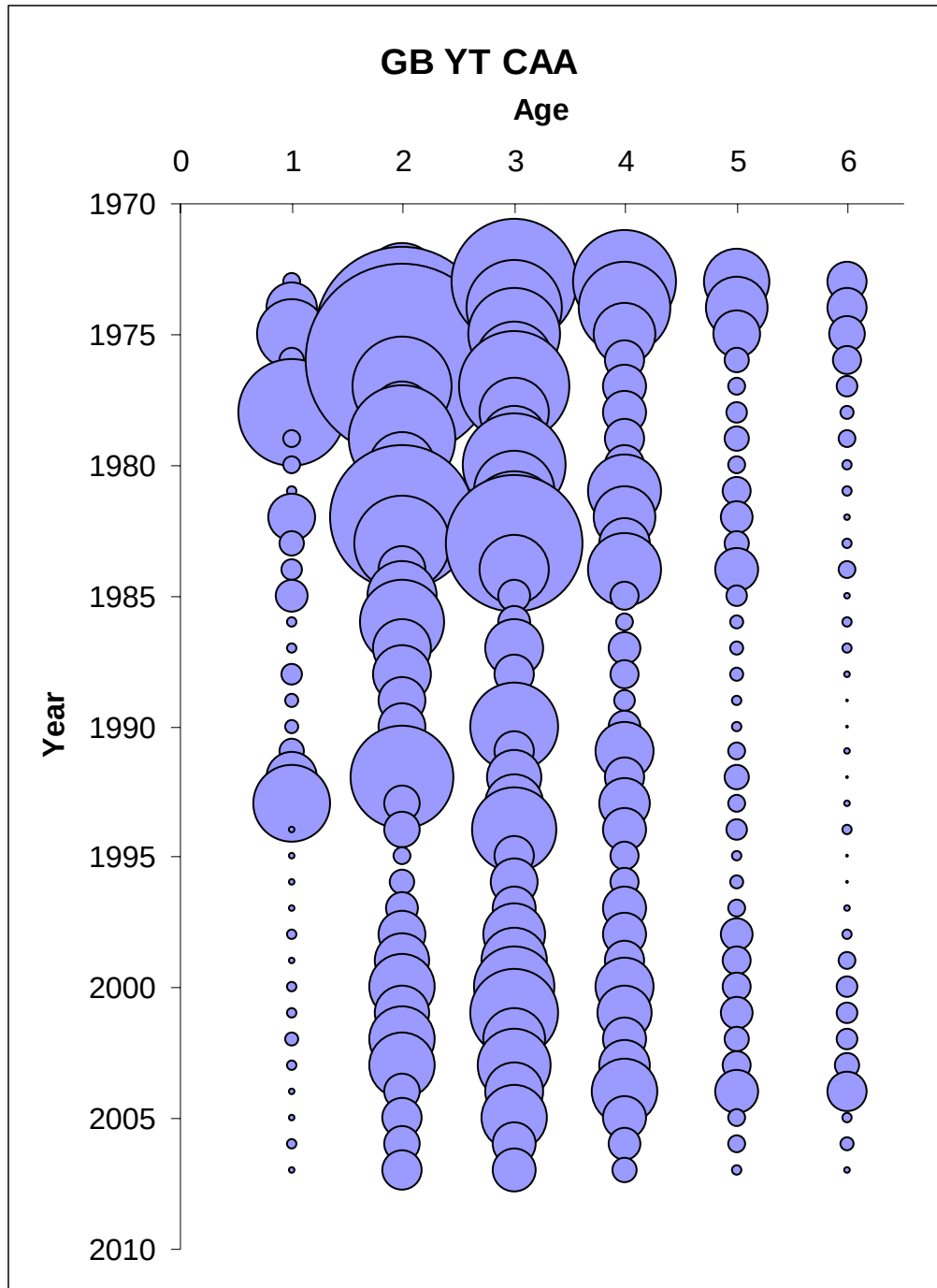
by Chris Legault, Larry Alade, Heath Stone, Stratis Gavaris, and Christa Waters



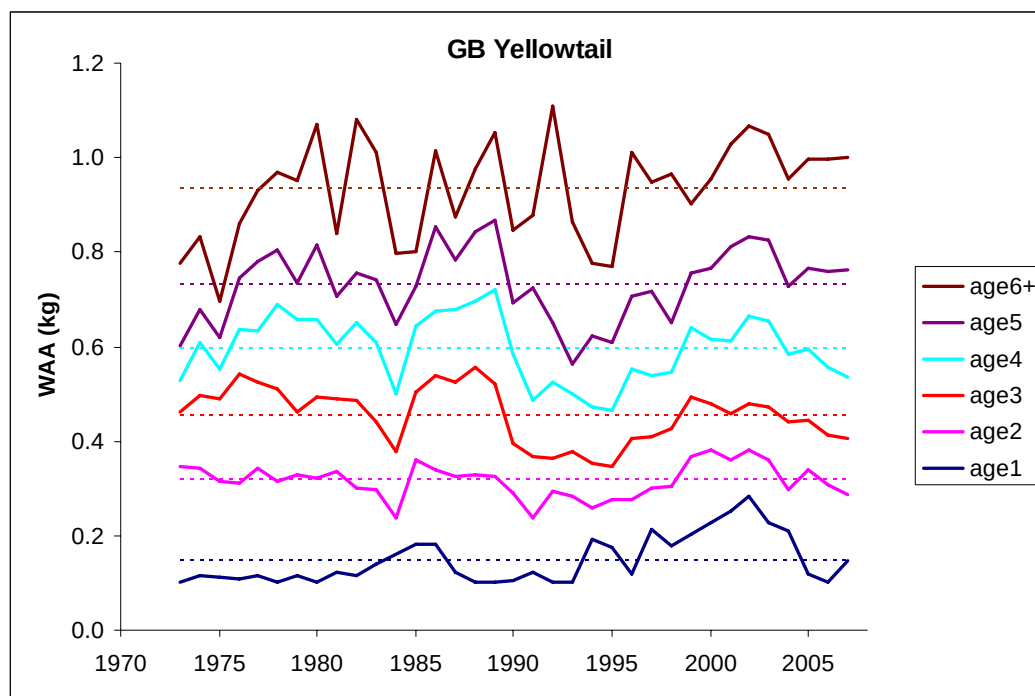
Appendix Figure C.1. Offshore Survey strata (13-21) used by NEFSC to estimate spring and fall survey indices [Left] for Georges Bank yellowtail flounder and commercial statistical areas [Right] for all three yellowtail flounder stocks.



Appendix Figure C.2 Canadian Department of Fisheries and Oceans (DFO) winter survey strata , 5Z1-5Z4 for Georges Bank yellowtail flounder.

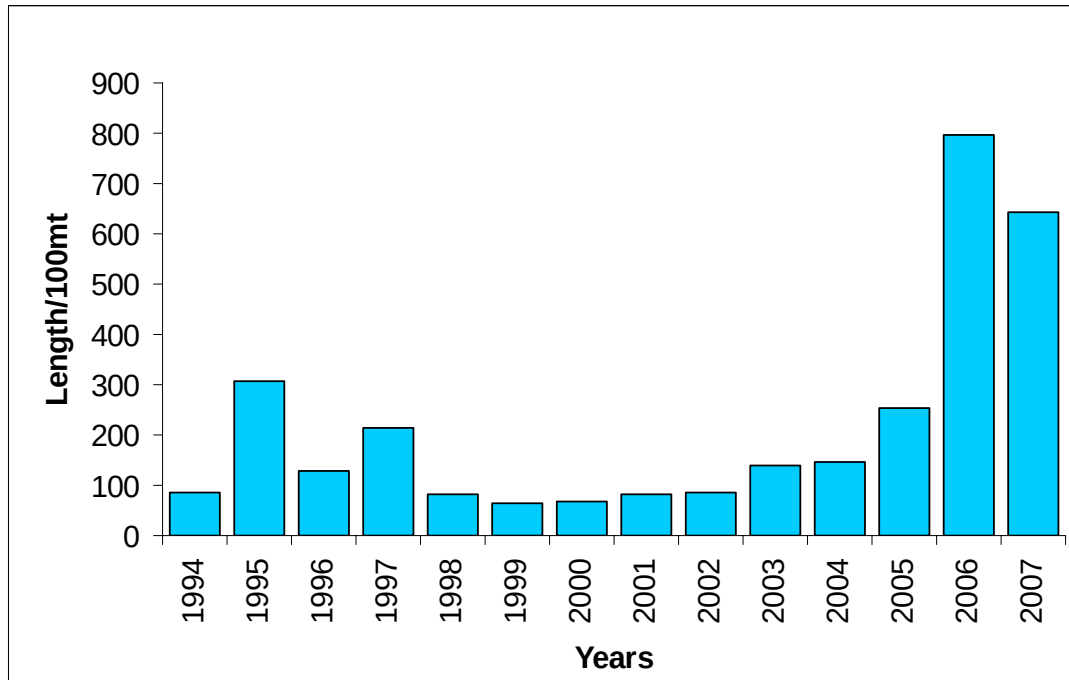


Appendix Figure C.3 Catch at age bubble plot for Georges Bank yellowtail flounder.

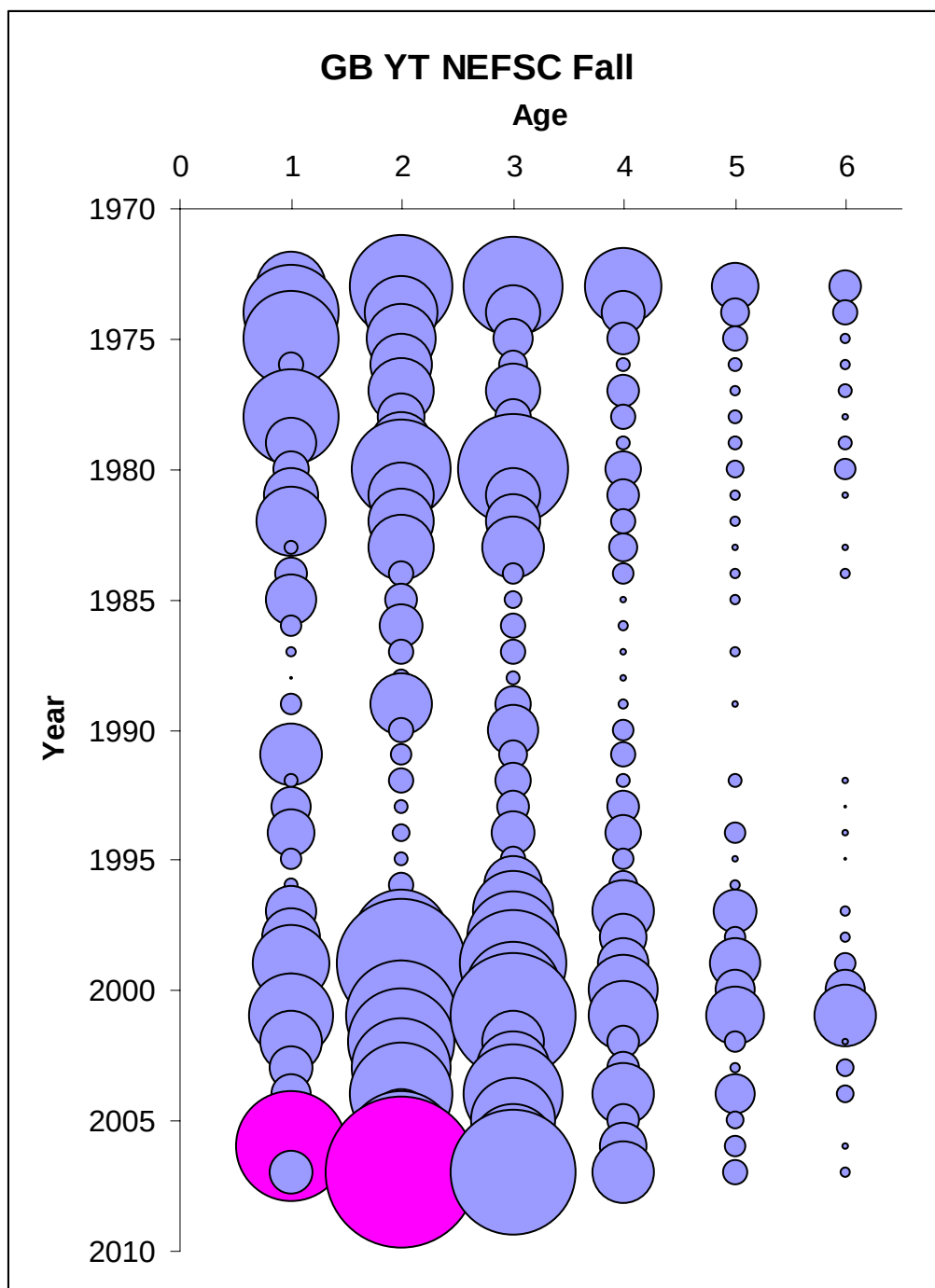


Appendix Figure C.4 Catch weight at age (kg) for Georges Bank yellowtail flounder.

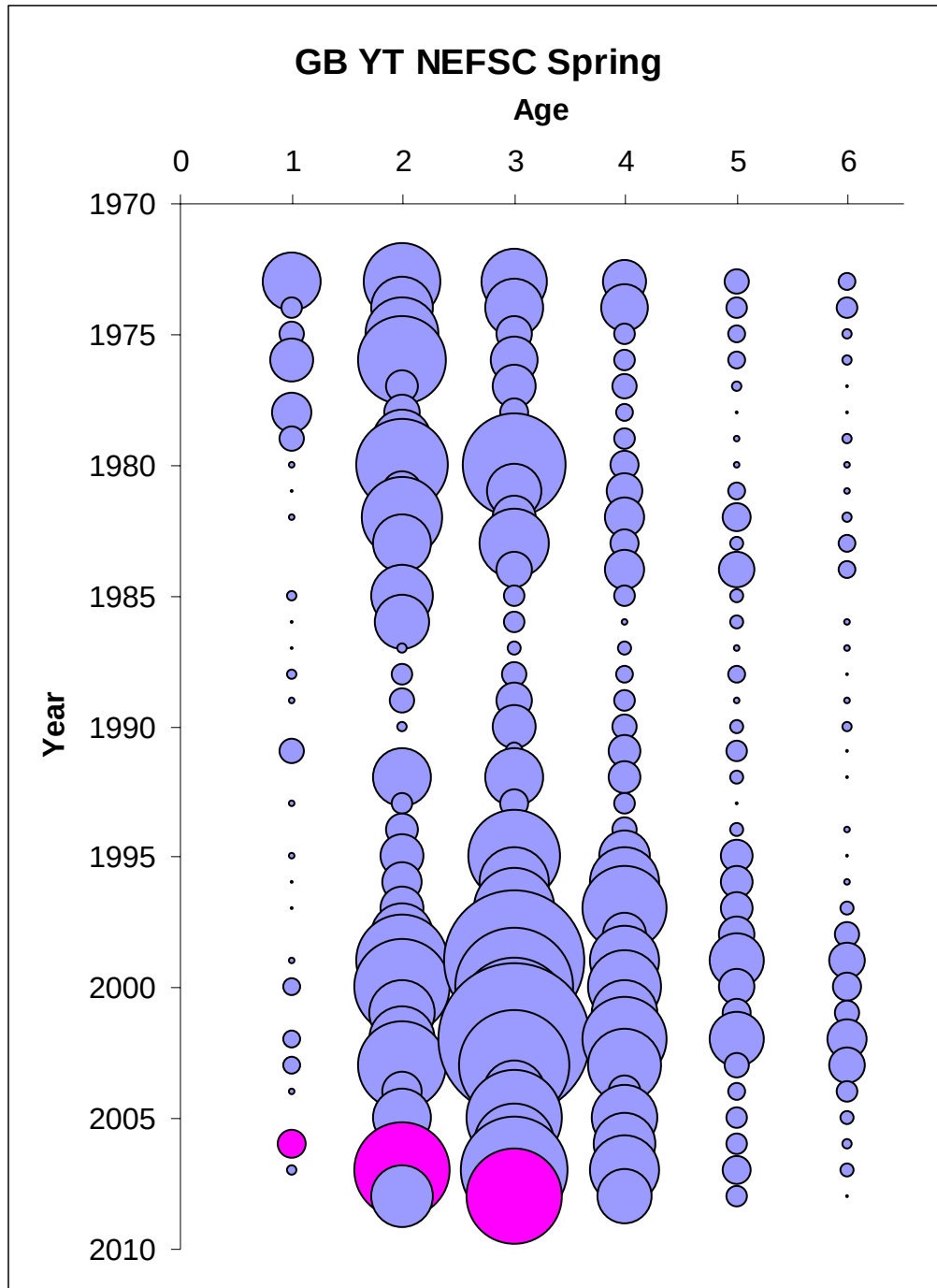
Georges Bank yellowtail flounder Biological Sampling



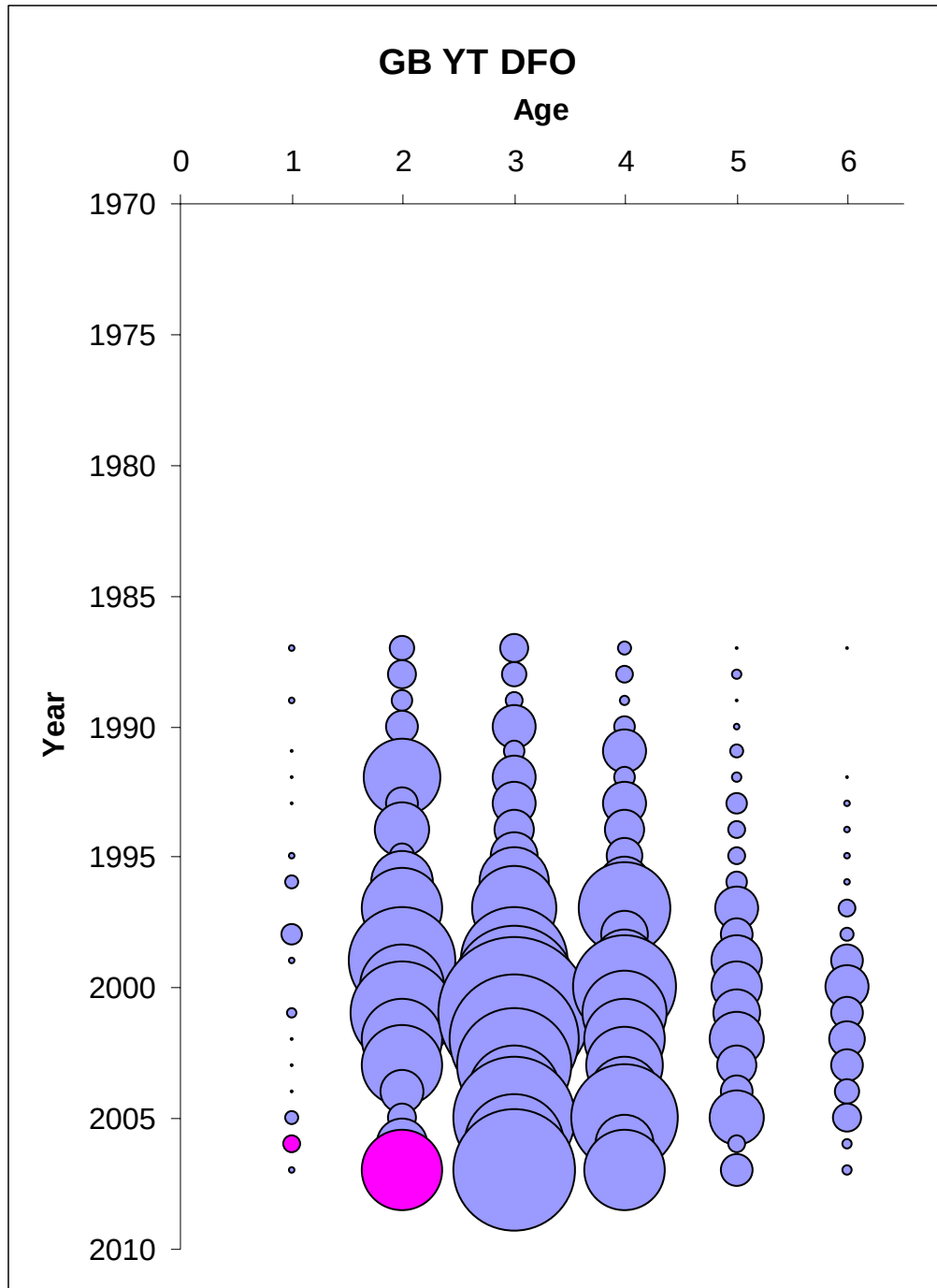
Appendix Figure C.5. Biological sampling for Georges Bank yellowtail flounder.



Appendix Figure C.6.a Survey bubble plot for GB yellowtail NEFSC Fall survey. Note the 2005 year class is highlighted in pink.

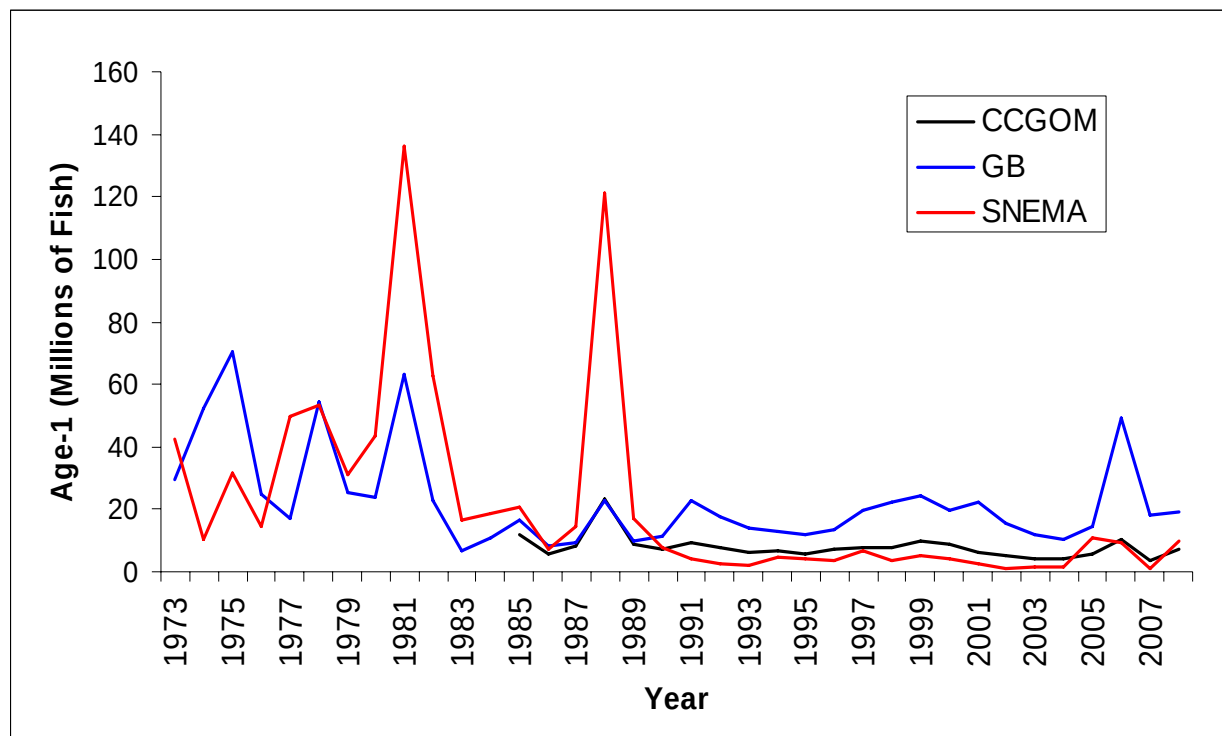


Appendix Figure C.6.b Survey bubble plot for GB yellowtail NEFSC Spring survey. Note the 2005 year class is highlighted in pink.

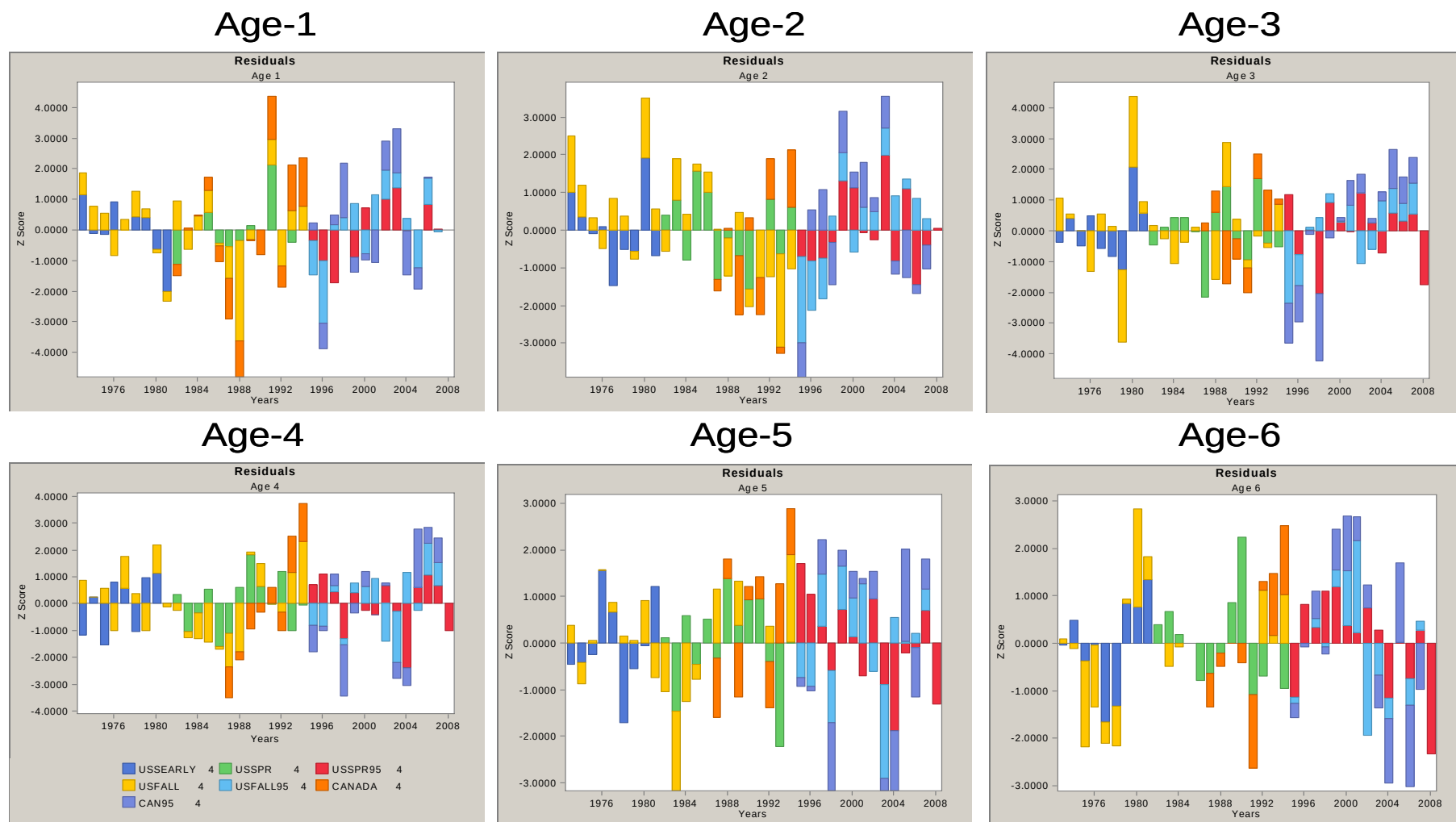


Appendix Figure C.6.c Survey bubble plot for GB yellowtail DFO survey. Note the 2005 year class is highlighted in pink.

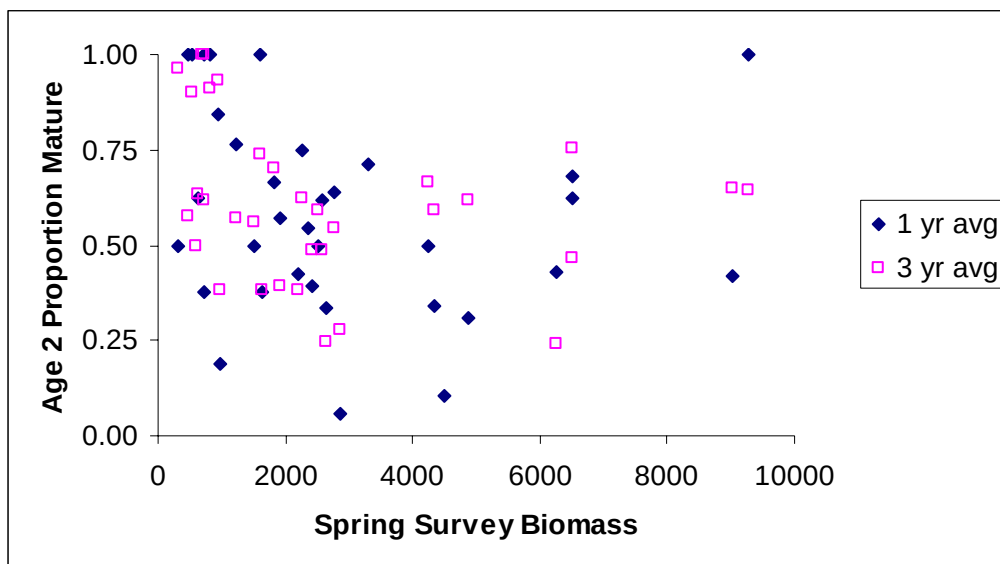
Age-1 Recruitment



Appendix Figure C.7. Comparison of recruitment trends from the three yellowtail flounder stocks.



Appendix Figure C.8. Standardized residuals for all indices by age



Appendix Figure C.9. Comparison of age-2 maturity to total spring biomass index showing an independence between abundance and maturity. The solid diamonds are annual estimates of age-2 maturity while the open squares are three year averages of age-2 maturity.

Appendix VPA Output Report

VPA Version 2.8.0

Model ID: Georges Bank yellowtail flounder Major Change model DFO 2008 survey not include

Input File:

C:\WORKING\ASSESSMENTS\GARM3THEFINALE\YTASSESSMENTS\GB\VPA\MAJORCHANGE_NO2008DFO

Date of Run: 10-JUL-2008

Time of Run: 01:27

Levenburg-Marquardt Algorithm Completed 24 Iterations
Residual Sum of Squares = 304.527

Number of Residuals = 527
Number of Parameters = 4
Degrees of Freedom = 523
Mean Squared Residual = 0.582269
Standard Deviation = 0.763066

Number of Years = 35
Number of Ages = 6
First Year = 1973
Youngest Age = 1
Oldest True Age = 5

Number of Survey Indices Available = 44
Number of Survey Indices Used in Estimate = 42

VPA Classic Method - Auto Estimated Q's

Stock Numbers Predicted in Terminal Year Plus One (2008)

Age	Stock Predicted	Std. Error	CV
2	14994.456	0.692698E+04	0.461969E+00
3	31703.890	0.989341E+04	0.312057E+00
4	5338.999	0.184456E+04	0.345489E+00
5	1875.118	0.475791E+03	0.253739E+00

Catchability Values for Each Survey Used in Estimate

INDEX	Catchability	Std. Error	CV
1	0.746089E-02	0.488991E-02	0.655406E+00
2	0.755206E-01	0.140767E-01	0.186396E+00
3	0.956073E-01	0.168706E-01	0.176457E+00
4	0.926548E-01	0.115114E-01	0.124240E+00
5	0.760134E-01	0.154063E-01	0.202679E+00
6	0.720239E-01	0.226512E-01	0.314496E+00
7	0.423531E-02	0.103998E-02	0.245551E+00
8	0.455643E-01	0.144064E-01	0.316177E+00
9	0.954470E-01	0.152217E-01	0.159478E+00
10	0.152428E+00	0.200966E-01	0.131843E+00
11	0.228532E+00	0.460786E-01	0.201629E+00
12	0.422932E+00	0.931600E-01	0.220272E+00
13	0.458156E-02	0.135354E-02	0.295431E+00
14	0.143683E+00	0.165030E-01	0.114857E+00
15	0.499530E+00	0.884174E-01	0.177001E+00
16	0.593361E+00	0.988542E-01	0.166600E+00
17	0.480729E+00	0.108514E+00	0.225728E+00
18	0.391240E+00	0.921357E-01	0.235497E+00
19	0.396438E-01	0.100565E-01	0.253671E+00

20	0.875114E-01	0.142533E-01	0.162874E+00
21	0.150362E+00	0.158113E-01	0.105155E+00
22	0.156082E+00	0.215926E-01	0.138341E+00
23	0.204982E+00	0.410944E-01	0.200478E+00
24	0.306257E+00	0.653913E-01	0.213518E+00
25	0.654075E-01	0.150808E-01	0.230567E+00
26	0.212258E+00	0.737061E-01	0.347248E+00
27	0.556137E+00	0.108427E+00	0.194965E+00
28	0.471055E+00	0.826395E-01	0.175435E+00
29	0.490130E+00	0.127709E+00	0.260561E+00
30	0.361645E+00	0.131052E+00	0.362377E+00
32	0.229939E-03	0.738135E-04	0.321013E+00
33	0.369401E-03	0.535163E-04	0.144873E+00
34	0.619069E-03	0.114554E-03	0.185042E+00
35	0.693342E-03	0.154791E-03	0.223253E+00
36	0.402918E-03	0.101179E-03	0.251116E+00
38	0.496646E-03	0.106388E-03	0.214214E+00
39	0.206205E-02	0.317553E-03	0.153999E+00
40	0.263975E-02	0.360480E-03	0.136558E+00
41	0.240473E-02	0.440468E-03	0.183167E+00
42	0.186002E-02	0.338706E-03	0.182098E+00
43	0.233364E-04	0.687469E-05	0.294590E+00
44	0.539497E-04	0.469360E-05	0.869995E-01

-- Non-Linear Least Squares Fit --

Default Tolerances Used

Scaled Gradient Tolerance	=	6.055454E-06
Scaled Step Tolerance	=	3.666853E-11
Relative Function Tolerance	=	3.666853E-11
Absolute Function Tolerance	=	4.930381E-32

VPA Method Options

- Catchability Values Estimated as an Analytic Function of N
- Catch Equation Used in Cohort Solution
- Plus Group Backward Calculation Method Used
- Rivard Weights Used for JAN-1 Biomass
- Rivard Weights Calculation Used 3 Years for Terminal Year Plus One

- Heincke Rule Used in F-Oldest Calculation
- F-Oldest Calculation in Years Prior to Terminal Year
Uses Stock Sizes in Ages 4 to 5
- Calculation of Population of Age 1 In Year 2008
= Geometric Mean of First Age Populations
Year Range Applied = 1973 to 2007

Stock Estimates

Age 2
Age 3
Age 4
Age 5

Full F in Terminal Year = 0.2892

F in Oldest True Age in Terminal Year = 0.2892

Full F Calculated Using Classic Method

Age	Input Partial Recruitment	Calc Partial Recruitment	Fishing Mortality	Used In Full F	Comments
1	0.000	0.011	0.0032	NO	Stock Estimate in T+1

2	0.030	0.141	0.0408	NO	Stock Estimate in T+1
3	0.630	0.900	0.2603	NO	Stock Estimate in T+1
4	1.000	1.000	0.2892	YES	Stock Estimate in T+1
5	1.000	1.000	0.2892		Input PR * Full F

Catch At Age - Input Data

AGE	1973	1974	1975	1976	1977
1	359.3	2367.5	4636.2	635.1	377.9
2	5175.0	9500.0	26393.9	31938.1	9094.2
3	13565.3	8294.2	7375.1	5501.9	10567.1
4	9473.0	7657.9	3540.2	1425.7	1846.2
5	3814.6	3642.6	2175.2	574.2	418.6
6	1649.7	1519.6	1207.2	918.1	495.0
AGE	1978	1979	1980	1981	1982
1	9962.0	320.6	317.8	107.4	2163.5
2	3542.1	10516.6	3994.4	1097.1	18091.3
3	4579.7	3789.4	9685.3	5963.4	7480.3
4	1913.8	1432.1	1538.4	4920.2	3400.5
5	539.5	623.0	351.9	854.4	1095.2
6	210.8	324.6	112.6	145.3	95.8
AGE	1983	1984	1985	1986	1987
1	702.8	514.3	970.3	178.8	156.4
2	7998.1	2017.7	4373.6	6402.1	3284.2
3	16660.9	4534.6	1057.6	1127.5	3136.7
4	2475.9	5043.0	818.4	388.8	983.3
5	679.6	1796.3	516.6	203.6	192.3
6	154.6	379.5	80.7	113.4	137.3
AGE	1988	1989	1990	1991	1992
1	499.0	189.8	230.6	663.3	2413.9
2	3002.6	2175.4	2114.4	147.3	9167.4
3	1544.1	1120.6	6995.7	1491.2	2971.5
4	846.1	428.2	978.3	3011.1	1473.0
5	227.0	110.1	140.2	383.2	603.1
6	53.3	30.4	26.1	71.2	42.0
AGE	1993	1994	1995	1996	1997
1	5233.5	71.2	46.9	100.6	81.8
2	1385.8	1336.3	312.7	680.9	1132.3
3	3326.9	6302.4	1435.3	2064.3	1832.4
4	2325.5	1819.3	878.6	885.0	1856.8
5	411.0	476.7	170.1	201.2	378.2
6	90.5	143.9	36.9	27.6	89.6

Catch At Age - Input Data

AGE	1998	1999	2000	2001	2002
1	168.5	60.1	131.8	175.9	211.9
2	1991.4	2752.9	3863.5	2883.5	4168.9
3	3387.8	4195.0	5713.9	6956.4	3446.3
4	1884.9	1547.6	3173.0	2893.2	1915.8
5	1121.3	793.5	826.3	1003.9	683.0
6	146.2	301.4	528.5	525.1	485.3
AGE	2003	2004	2005	2006	2007
1	159.7	63.9	59.9	153.9	53.0
2	3919.1	1201.3	1528.8	1300.2	1463.5
3	4710.0	3170.8	4086.2	1697.7	1764.9
4	2319.9	3803.8	1712.5	1003.0	699.5
5	782.4	1970.1	411.3	373.2	142.2
6	693.5	1450.7	178.1	214.0	57.6

Weight At Age - Input Data

AGE	1973	1974	1975	1976	1977
1	0.1010	0.1150	0.1130	0.1080	0.1160
2	0.3480	0.3440	0.3160	0.3120	0.3420
3	0.4620	0.4960	0.4890	0.5440	0.5240
4	0.5270	0.6070	0.5540	0.6350	0.6330
5	0.6030	0.6780	0.6190	0.7440	0.7800
6	0.7780	0.8320	0.6950	0.8610	0.9310
AGE	1978	1979	1980	1981	1982
1	0.1020	0.1140	0.1010	0.1220	0.1150
2	0.3140	0.3290	0.3220	0.3350	0.3010
3	0.5100	0.4620	0.4930	0.4890	0.4850
4	0.6900	0.6560	0.6560	0.6040	0.6500
5	0.8030	0.7360	0.8160	0.7070	0.7540
6	0.9700	0.9500	1.0720	0.8400	1.0820
AGE	1983	1984	1985	1986	1987
1	0.1400	0.1620	0.1810	0.1810	0.1210
2	0.2960	0.2390	0.3610	0.3410	0.3240
3	0.4410	0.3790	0.5050	0.5400	0.5240
4	0.6070	0.5000	0.6420	0.6740	0.6800
5	0.7400	0.6470	0.7290	0.8540	0.7840
6	1.0100	0.7970	0.8000	1.0150	0.8750
AGE	1988	1989	1990	1991	1992
1	0.1030	0.1000	0.1050	0.1210	0.1010
2	0.3280	0.3270	0.2900	0.2370	0.2930
3	0.5570	0.5200	0.3950	0.3690	0.3650
4	0.6960	0.7200	0.5850	0.4860	0.5260
5	0.8440	0.8660	0.6930	0.7230	0.6510
6	0.9750	1.0530	0.8450	0.8770	1.1100

AGE	1993	1994	1995	1996	1997
1	0.1000	0.1930	0.1740	0.1190	0.2140
2	0.2850	0.2600	0.2750	0.2760	0.3020
3	0.3790	0.3530	0.3470	0.4070	0.4080
4	0.5010	0.4720	0.4650	0.5520	0.5380
5	0.5640	0.6210	0.6070	0.7070	0.7180
6	0.8630	0.7750	0.7680	1.0120	0.9470

Weight At Age - Input Data

AGE	1998	1999	2000	2001	2002
1	0.1780	0.2020	0.2290	0.2510	0.2820
2	0.3050	0.3680	0.3830	0.3620	0.3810
3	0.4280	0.4950	0.4800	0.4600	0.4800
4	0.5460	0.6400	0.6150	0.6120	0.6650
5	0.6490	0.7550	0.7660	0.8120	0.8330
6	0.9660	0.9010	0.9540	1.0270	1.0680
AGE	2003	2004	2005	2006	2007
1	0.2280	0.2110	0.1190	0.1000	0.1480
2	0.3590	0.2960	0.3410	0.3090	0.2880
3	0.4740	0.4400	0.4450	0.4110	0.4060
4	0.6530	0.5860	0.5940	0.5550	0.5360
5	0.8240	0.7280	0.7670	0.7600	0.7640
6	1.0480	0.9560	0.9970	0.9980	1.0020

JAN-1 Weights at Age - Input Data

AGE	1973	1974	1975	1976	1977
1	0.0547	0.0694	0.0680	0.0607	0.0705
2	0.2915	0.1864	0.1906	0.1878	0.1922
3	0.4031	0.4155	0.4101	0.4146	0.4043
4	0.4646	0.5296	0.5242	0.5572	0.5868
5	0.5637	0.5978	0.6130	0.6420	0.7038
6	0.7780	0.8320	0.6950	0.8610	0.9310
AGE	1978	1979	1980	1981	1982
1	0.0568	0.0678	0.0555	0.0777	0.0717
2	0.1909	0.1832	0.1916	0.1839	0.1916
3	0.4176	0.3809	0.4027	0.3968	0.4031
4	0.6013	0.5784	0.5505	0.5457	0.5638
5	0.7130	0.7126	0.7316	0.6810	0.6748
6	0.9700	0.9500	1.0720	0.8400	1.0820
AGE	1983	1984	1985	1986	1987
1	0.1072	0.1085	0.1319	0.1353	0.0735
2	0.1845	0.1829	0.2418	0.2484	0.2422
3	0.3643	0.3349	0.3474	0.4415	0.4227
4	0.5426	0.4696	0.4933	0.5834	0.6060
5	0.6935	0.6267	0.6037	0.7405	0.7269
6	1.0100	0.7970	0.8000	1.0150	0.8750

AGE	1988	1989	1990	1991	1992
1	0.0578	0.0587	0.0699	0.0778	0.0601
2	0.1992	0.1835	0.1703	0.1577	0.1883
3	0.4248	0.4130	0.3594	0.3271	0.2941
4	0.6039	0.6333	0.5515	0.4381	0.4406
5	0.7576	0.7764	0.7064	0.6503	0.5625
6	0.9750	1.0530	0.8450	0.8770	1.1100
AGE	1993	1994	1995	1996	1997
1	0.0620	0.1617	0.1382	0.0747	0.1793
2	0.1697	0.1612	0.2304	0.2191	0.1896
3	0.3332	0.3172	0.3004	0.3346	0.3356
4	0.4276	0.4230	0.4051	0.4377	0.4679
5	0.5447	0.5578	0.5353	0.5734	0.6296
6	0.8630	0.7750	0.7680	1.0120	0.9470

JAN-1 Weights at Age - Input Data

AGE	1998	1999	2000	2001	2002
1	0.1238	0.1467	0.1821	0.2037	0.2499
2	0.2555	0.2559	0.2781	0.2879	0.3092
3	0.3595	0.3886	0.4203	0.4197	0.4168
4	0.4720	0.5234	0.5517	0.5420	0.5531
5	0.5909	0.6421	0.7002	0.7067	0.7140
6	0.9660	0.9010	0.9540	1.0270	1.0680
AGE	2003	2004	2005	2006	2007
1	0.2001	0.1660	0.0738	0.0589	0.1291
2	0.3182	0.2598	0.2682	0.1918	0.1697
3	0.4250	0.3974	0.3629	0.3744	0.3542
4	0.5599	0.5270	0.5112	0.4970	0.4694
5	0.7402	0.6895	0.6704	0.6719	0.6512
6	1.0480	0.9560	0.9970	0.9980	1.0020
AGE	2008				
1	0.0873				
2	0.2099				
3	0.3638				
4	0.4925				
5	0.6645				
6	0.9990				

SSB Weight At Age - Input Data

AGE	1973	1974	1975	1976	1977
1	0.1010	0.1150	0.1130	0.1080	0.1160
2	0.3480	0.3440	0.3160	0.3120	0.3420
3	0.4620	0.4960	0.4890	0.5440	0.5240
4	0.5270	0.6070	0.5540	0.6350	0.6330
5	0.6030	0.6780	0.6190	0.7440	0.7800
6	0.7780	0.8320	0.6950	0.8610	0.9310
AGE	1978	1979	1980	1981	1982
1	0.1020	0.1140	0.1010	0.1220	0.1150
2	0.3140	0.3290	0.3220	0.3350	0.3010
3	0.5100	0.4620	0.4930	0.4890	0.4850
4	0.6900	0.6560	0.6560	0.6040	0.6500
5	0.8030	0.7360	0.8160	0.7070	0.7540
6	0.9700	0.9500	1.0720	0.8400	1.0820
AGE	1983	1984	1985	1986	1987
1	0.1400	0.1620	0.1810	0.1810	0.1210
2	0.2960	0.2390	0.3610	0.3410	0.3240
3	0.4410	0.3790	0.5050	0.5400	0.5240
4	0.6070	0.5000	0.6420	0.6740	0.6800
5	0.7400	0.6470	0.7290	0.8540	0.7840
6	1.0100	0.7970	0.8000	1.0150	0.8750
AGE	1988	1989	1990	1991	1992
1	0.1030	0.1000	0.1050	0.1210	0.1010
2	0.3280	0.3270	0.2900	0.2370	0.2930
3	0.5570	0.5200	0.3950	0.3690	0.3650
4	0.6960	0.7200	0.5850	0.4860	0.5260
5	0.8440	0.8660	0.6930	0.7230	0.6510
6	0.9750	1.0530	0.8450	0.8770	1.1100
AGE	1993	1994	1995	1996	1997
1	0.1000	0.1930	0.1740	0.1190	0.2140
2	0.2850	0.2600	0.2750	0.2760	0.3020
3	0.3790	0.3530	0.3470	0.4070	0.4080
4	0.5010	0.4720	0.4650	0.5520	0.5380
5	0.5640	0.6210	0.6070	0.7070	0.7180
6	0.8630	0.7750	0.7680	1.0120	0.9470

SSB Weight At Age - Input Data

AGE	1998	1999	2000	2001	2002
1	0.1780	0.2020	0.2290	0.2510	0.2820
2	0.3050	0.3680	0.3830	0.3620	0.3810
3	0.4280	0.4950	0.4800	0.4600	0.4800
4	0.5460	0.6400	0.6150	0.6120	0.6650
5	0.6490	0.7550	0.7660	0.8120	0.8330
6	0.9660	0.9010	0.9540	1.0270	1.0680
AGE	2003	2004	2005	2006	2007
1	0.2280	0.2110	0.1190	0.1000	0.1480
2	0.3590	0.2960	0.3410	0.3090	0.2880
3	0.4740	0.4400	0.4450	0.4110	0.4060
4	0.6530	0.5860	0.5940	0.5550	0.5360
5	0.8240	0.7280	0.7670	0.7600	0.7640
6	1.0480	0.9560	0.9970	0.9980	1.0020

Natural Mortality - Input Data

AGE	1973	1974	1975	1976	1977
1	0.2000	0.2000	0.2000	0.2000	0.2000
2	0.2000	0.2000	0.2000	0.2000	0.2000
3	0.2000	0.2000	0.2000	0.2000	0.2000
4	0.2000	0.2000	0.2000	0.2000	0.2000
5	0.2000	0.2000	0.2000	0.2000	0.2000
6	0.2000	0.2000	0.2000	0.2000	0.2000
AGE	1978	1979	1980	1981	1982
1	0.2000	0.2000	0.2000	0.2000	0.2000
2	0.2000	0.2000	0.2000	0.2000	0.2000
3	0.2000	0.2000	0.2000	0.2000	0.2000
4	0.2000	0.2000	0.2000	0.2000	0.2000
5	0.2000	0.2000	0.2000	0.2000	0.2000
6	0.2000	0.2000	0.2000	0.2000	0.2000
AGE	1983	1984	1985	1986	1987
1	0.2000	0.2000	0.2000	0.2000	0.2000
2	0.2000	0.2000	0.2000	0.2000	0.2000
3	0.2000	0.2000	0.2000	0.2000	0.2000
4	0.2000	0.2000	0.2000	0.2000	0.2000
5	0.2000	0.2000	0.2000	0.2000	0.2000
6	0.2000	0.2000	0.2000	0.2000	0.2000
AGE	1988	1989	1990	1991	1992
1	0.2000	0.2000	0.2000	0.2000	0.2000
2	0.2000	0.2000	0.2000	0.2000	0.2000
3	0.2000	0.2000	0.2000	0.2000	0.2000
4	0.2000	0.2000	0.2000	0.2000	0.2000
5	0.2000	0.2000	0.2000	0.2000	0.2000
6	0.2000	0.2000	0.2000	0.2000	0.2000

AGE	1993	1994	1995	1996	1997
1	0.2000	0.2000	0.2000	0.2000	0.2000
2	0.2000	0.2000	0.2000	0.2000	0.2000
3	0.2000	0.2000	0.2000	0.2000	0.2000
4	0.2000	0.2000	0.2000	0.2000	0.2000
5	0.2000	0.2000	0.2000	0.2000	0.2000
6	0.2000	0.2000	0.2000	0.2000	0.2000

Natural Mortality - Input Data

AGE	1998	1999	2000	2001	2002
1	0.2000	0.2000	0.2000	0.2000	0.2000
2	0.2000	0.2000	0.2000	0.2000	0.2000
3	0.2000	0.2000	0.2000	0.2000	0.2000
4	0.2000	0.2000	0.2000	0.2000	0.2000
5	0.2000	0.2000	0.2000	0.2000	0.2000
6	0.2000	0.2000	0.2000	0.2000	0.2000

AGE	2003	2004	2005	2006	2007
1	0.2000	0.2000	0.2000	0.2000	0.2000
2	0.2000	0.2000	0.2000	0.2000	0.2000
3	0.2000	0.2000	0.2000	0.2000	0.2000
4	0.2000	0.2000	0.2000	0.2000	0.2000
5	0.2000	0.2000	0.2000	0.2000	0.2000
6	0.2000	0.2000	0.2000	0.2000	0.2000

Proportion of Natural Mortality Before Spawning = 0.4167
Proportion of Fishing Mortality Before Spawning = 0.4167

Maturity - Input Data

AGE	1973	1974	1975	1976	1977
1	0.0000	0.0000	0.0000	0.0000	0.0000
2	0.4620	0.4620	0.4620	0.4620	0.4620
3	0.9670	0.9670	0.9670	0.9670	0.9670
4	1.0000	1.0000	1.0000	1.0000	1.0000
5	1.0000	1.0000	1.0000	1.0000	1.0000
6	1.0000	1.0000	1.0000	1.0000	1.0000

AGE	1978	1979	1980	1981	1982
1	0.0000	0.0000	0.0000	0.0000	0.0000
2	0.4620	0.4620	0.4620	0.4620	0.4620
3	0.9670	0.9670	0.9670	0.9670	0.9670
4	1.0000	1.0000	1.0000	1.0000	1.0000
5	1.0000	1.0000	1.0000	1.0000	1.0000
6	1.0000	1.0000	1.0000	1.0000	1.0000

AGE	1983	1984	1985	1986	1987
1	0.0000	0.0000	0.0000	0.0000	0.0000
2	0.4620	0.4620	0.4620	0.4620	0.4620
3	0.9670	0.9670	0.9670	0.9670	0.9670

4	1.0000	1.0000	1.0000	1.0000	1.0000
5	1.0000	1.0000	1.0000	1.0000	1.0000
6	1.0000	1.0000	1.0000	1.0000	1.0000
AGE	1988	1989	1990	1991	1992
1	0.0000	0.0000	0.0000	0.0000	0.0000
2	0.4620	0.4620	0.4620	0.4620	0.4620
3	0.9670	0.9670	0.9670	0.9670	0.9670
4	1.0000	1.0000	1.0000	1.0000	1.0000
5	1.0000	1.0000	1.0000	1.0000	1.0000
6	1.0000	1.0000	1.0000	1.0000	1.0000
AGE	1993	1994	1995	1996	1997
1	0.0000	0.0000	0.0000	0.0000	0.0000
2	0.4620	0.4620	0.4620	0.4620	0.4620
3	0.9670	0.9670	0.9670	0.9670	0.9670
4	1.0000	1.0000	1.0000	1.0000	1.0000
5	1.0000	1.0000	1.0000	1.0000	1.0000
6	1.0000	1.0000	1.0000	1.0000	1.0000

Maturity - Input Data

AGE	1998	1999	2000	2001	2002
1	0.0000	0.0000	0.0000	0.0000	0.0000
2	0.4620	0.4620	0.4620	0.4620	0.4620
3	0.9670	0.9670	0.9670	0.9670	0.9670
4	1.0000	1.0000	1.0000	1.0000	1.0000
5	1.0000	1.0000	1.0000	1.0000	1.0000
6	1.0000	1.0000	1.0000	1.0000	1.0000
AGE	2003	2004	2005	2006	2007
1	0.0000	0.0000	0.0000	0.0000	0.0000
2	0.4620	0.4620	0.4620	0.4620	0.4620
3	0.9670	0.9670	0.9670	0.9670	0.9670
4	1.0000	1.0000	1.0000	1.0000	1.0000
5	1.0000	1.0000	1.0000	1.0000	1.0000
6	1.0000	1.0000	1.0000	1.0000	1.0000

Input Partial Recruitment

AGE

1	0.0000
2	0.0300
3	0.6300
4	1.0000
5	1.0000

Input F-Plus Ratio

YEAR

1973	1.0000
1974	1.0000
1975	1.0000
1976	1.0000
1977	1.0000
1978	1.0000
1979	1.0000
1980	1.0000
1981	1.0000
1982	1.0000
1983	1.0000
1984	1.0000
1985	1.0000
1986	1.0000
1987	1.0000
1988	1.0000
1989	1.0000
1990	1.0000
1991	1.0000
1992	1.0000
1993	1.0000
1994	1.0000
1995	1.0000
1996	1.0000
1997	1.0000
1998	1.0000
1999	1.0000
2000	1.0000
2001	1.0000
2002	1.0000
2003	1.0000
2004	1.0000
2005	1.0000
2006	1.0000
2007	1.0000

SURVEY - INPUT DATA

INDEX	1	2	3	4	5
SURVEY TAG	USsearly	USsearly	USsearly	USsearly	USsearly
AGE	1	2	3	4	5
TIME	JAN-1	JAN-1	JAN-1	JAN-1	JAN-1
TYPE	NUMBERS	NUMBERS	NUMBERS	NUMBERS	NUMBERS
RETRO FLAG	0	0	0	0	0
1973	1882.9150	3184.3290	2309.4080	1036.7250	399.4120
1974	308.1730	2168.4730	1795.4620	1225.0260	336.9040
1975	409.2160	2917.9900	809.1130	262.5540	201.5020
1976	1008.3820	4259.0050	1215.9990	302.4470	191.2130
1977	0.0000	654.0070	1097.6800	363.6930	81.9210
1978	912.1930	778.4410	494.4360	213.9260	25.7220
1979	393.9770	1956.7800	395.2390	328.2650	58.7230
1980	55.3260	4528.6450	5617.2010	460.5620	55.0340
1981	11.3560	995.8610	1724.2180	698.8500	206.9370
1982	0.0000	0.0000	0.0000	0.0000	0.0000
1983	0.0000	0.0000	0.0000	0.0000	0.0000
1984	0.0000	0.0000	0.0000	0.0000	0.0000
1985	0.0000	0.0000	0.0000	0.0000	0.0000
1986	0.0000	0.0000	0.0000	0.0000	0.0000
1987	0.0000	0.0000	0.0000	0.0000	0.0000
1988	0.0000	0.0000	0.0000	0.0000	0.0000
1989	0.0000	0.0000	0.0000	0.0000	0.0000
1990	0.0000	0.0000	0.0000	0.0000	0.0000
1991	0.0000	0.0000	0.0000	0.0000	0.0000
1992	0.0000	0.0000	0.0000	0.0000	0.0000
1993	0.0000	0.0000	0.0000	0.0000	0.0000
1994	0.0000	0.0000	0.0000	0.0000	0.0000
1995	0.0000	0.0000	0.0000	0.0000	0.0000
1996	0.0000	0.0000	0.0000	0.0000	0.0000
1997	0.0000	0.0000	0.0000	0.0000	0.0000
1998	0.0000	0.0000	0.0000	0.0000	0.0000
1999	0.0000	0.0000	0.0000	0.0000	0.0000
2000	0.0000	0.0000	0.0000	0.0000	0.0000
2001	0.0000	0.0000	0.0000	0.0000	0.0000
2002	0.0000	0.0000	0.0000	0.0000	0.0000
2003	0.0000	0.0000	0.0000	0.0000	0.0000
2004	0.0000	0.0000	0.0000	0.0000	0.0000
2005	0.0000	0.0000	0.0000	0.0000	0.0000
2006	0.0000	0.0000	0.0000	0.0000	0.0000
2007	0.0000	0.0000	0.0000	0.0000	0.0000
2008	0.0000	0.0000	0.0000	0.0000	0.0000

SURVEY - INPUT DATA

INDEX	6	7	8	9	10
SURVEY TAG	USsearly	USspr	USspr	USspr	USspr
AGE	6	1	2	3	4
TIME	JAN-1	JAN-1	JAN-1	JAN-1	JAN-1
TYPE	NUMBERS	NUMBERS	NUMBERS	NUMBERS	NUMBERS
RETRO FLAG	0	1	1	1	1
1973	210.2370	0.0000	0.0000	0.0000	0.0000
1974	273.8130	0.0000	0.0000	0.0000	0.0000
1975	86.2890	0.0000	0.0000	0.0000	0.0000
1976	108.4190	0.0000	0.0000	0.0000	0.0000
1977	12.8120	0.0000	0.0000	0.0000	0.0000
1978	7.6680	0.0000	0.0000	0.0000	0.0000
1979	88.7150	0.0000	0.0000	0.0000	0.0000
1980	35.3310	0.0000	0.0000	0.0000	0.0000
1981	56.8790	0.0000	0.0000	0.0000	0.0000
1982	0.0000	44.0660	3656.5390	1096.5150	992.4640
1983	0.0000	0.0000	1810.0220	2647.7680	514.4310
1984	0.0000	0.0000	90.2680	806.0070	837.9410
1985	0.0000	106.3810	2134.2100	254.4010	273.4250
1986	0.0000	26.5950	1753.0460	282.6460	54.6460
1987	0.0000	26.5950	73.2820	132.9760	129.2870
1988	0.0000	75.5150	266.9220	355.2490	234.6970
1989	0.0000	45.2310	391.2590	737.6750	280.9960
1990	0.0000	0.0000	63.6730	1074.6760	358.3550
1991	0.0000	422.5130	0.0000	246.9270	665.0720
1992	0.0000	0.0000	1987.7430	1840.6930	621.7820
1993	0.0000	44.7460	281.0930	485.7980	307.8820
1994	0.0000	0.0000	602.2730	614.6970	343.6010
1995	0.0000	0.0000	0.0000	0.0000	0.0000
1996	0.0000	0.0000	0.0000	0.0000	0.0000
1997	0.0000	0.0000	0.0000	0.0000	0.0000
1998	0.0000	0.0000	0.0000	0.0000	0.0000
1999	0.0000	0.0000	0.0000	0.0000	0.0000
2000	0.0000	0.0000	0.0000	0.0000	0.0000
2001	0.0000	0.0000	0.0000	0.0000	0.0000
2002	0.0000	0.0000	0.0000	0.0000	0.0000
2003	0.0000	0.0000	0.0000	0.0000	0.0000
2004	0.0000	0.0000	0.0000	0.0000	0.0000
2005	0.0000	0.0000	0.0000	0.0000	0.0000
2006	0.0000	0.0000	0.0000	0.0000	0.0000
2007	0.0000	0.0000	0.0000	0.0000	0.0000
2008	0.0000	0.0000	0.0000	0.0000	0.0000

SURVEY - INPUT DATA

INDEX	11	12	13	14	15
SURVEY TAG	USspr	USspr	USspr95	USspr95	USspr95
AGE	5	6	1	2	3
TIME	JAN-1	JAN-1	JAN-1	JAN-1	JAN-1
TYPE	NUMBERS	NUMBERS	NUMBERS	NUMBERS	NUMBERS
RETRO FLAG	1	1	1	1	1
1973	0.0000	0.0000	0.0000	0.0000	0.0000
1974	0.0000	0.0000	0.0000	0.0000	0.0000
1975	0.0000	0.0000	0.0000	0.0000	0.0000
1976	0.0000	0.0000	0.0000	0.0000	0.0000
1977	0.0000	0.0000	0.0000	0.0000	0.0000
1978	0.0000	0.0000	0.0000	0.0000	0.0000
1979	0.0000	0.0000	0.0000	0.0000	0.0000
1980	0.0000	0.0000	0.0000	0.0000	0.0000
1981	0.0000	0.0000	0.0000	0.0000	0.0000
1982	444.5460	88.3270	0.0000	0.0000	0.0000
1983	119.5810	237.3180	0.0000	0.0000	0.0000
1984	810.3750	236.5410	0.0000	0.0000	0.0000
1985	143.3610	0.0000	0.0000	0.0000	0.0000
1986	132.8790	53.1900	0.0000	0.0000	0.0000
1987	50.9580	53.1900	0.0000	0.0000	0.0000
1988	193.1540	26.5950	0.0000	0.0000	0.0000
1989	59.3050	43.4840	0.0000	0.0000	0.0000
1990	112.2040	100.7510	0.0000	0.0000	0.0000
1991	255.4690	19.9950	0.0000	0.0000	0.0000
1992	159.9590	16.6950	0.0000	0.0000	0.0000
1993	26.0130	0.0000	0.0000	0.0000	0.0000
1994	140.4490	38.7280	0.0000	0.0000	0.0000
1995	0.0000	0.0000	39.0190	1144.5610	4670.3560
1996	0.0000	0.0000	24.3630	958.1040	2548.5700
1997	0.0000	0.0000	18.1510	1134.4670	3623.0520
1998	0.0000	0.0000	0.0000	2020.0650	1022.1650
1999	0.0000	0.0000	48.7250	4606.2950	10501.6770
2000	0.0000	0.0000	177.3330	4677.6360	7440.5200
2001	0.0000	0.0000	0.0000	2246.7060	6370.5030
2002	0.0000	0.0000	182.3800	2341.5360	11971.1060
2003	0.0000	0.0000	196.0660	4241.4370	6564.9190
2004	0.0000	0.0000	47.0750	957.3270	2114.4100
2005	0.0000	0.0000	0.0000	1953.4800	4930.9690
2006	0.0000	0.0000	493.4660	907.8260	3419.2210
2007	0.0000	0.0000	87.0650	4899.7150	6079.1210
2008	0.0000	0.0000	0.0000	2206.7110	4921.4560

SURVEY - INPUT DATA

INDEX	16	17	18	19	20
SURVEY TAG	USspr95	USspr95	USspr95	USfall	USfall
AGE	4	5	6	1	2
TIME	JAN-1	JAN-1	JAN-1	MEAN	MEAN
TYPE	NUMBERS	NUMBERS	NUMBERS	NUMBERS	NUMBERS
RETRO FLAG	1	1	1	0	0
1973	0.0000	0.0000	0.0000	2420.4480	5336.0110
1974	0.0000	0.0000	0.0000	4486.7140	2779.4820
1975	0.0000	0.0000	0.0000	4548.6400	2437.3360
1976	0.0000	0.0000	0.0000	333.5070	1863.8910
1977	0.0000	0.0000	0.0000	906.6610	2147.1200
1978	0.0000	0.0000	0.0000	4620.5630	1243.2740
1979	0.0000	0.0000	0.0000	1282.0020	2008.5140
1980	0.0000	0.0000	0.0000	743.5960	4969.9880
1981	0.0000	0.0000	0.0000	1548.2440	2279.4160
1982	0.0000	0.0000	0.0000	2353.2800	2120.3300
1983	0.0000	0.0000	0.0000	105.7010	2216.4220
1984	0.0000	0.0000	0.0000	641.5830	388.0560
1985	0.0000	0.0000	0.0000	1310.2470	527.5350
1986	0.0000	0.0000	0.0000	273.4250	1075.0640
1987	0.0000	0.0000	0.0000	98.7130	388.8320
1988	0.0000	0.0000	0.0000	18.1510	206.7430
1989	0.0000	0.0000	0.0000	241.0060	1934.0670
1990	0.0000	0.0000	0.0000	0.0000	359.2280
1991	0.0000	0.0000	0.0000	2038.7980	267.0190
1992	0.0000	0.0000	0.0000	146.7590	383.8820
1993	0.0000	0.0000	0.0000	814.6460	135.2080
1994	0.0000	0.0000	0.0000	1159.8000	214.6050
1995	1441.6690	621.4910	9.5120	0.0000	0.0000
1996	2621.7550	591.5960	56.1990	0.0000	0.0000
1997	3960.7320	682.3490	129.6760	0.0000	0.0000
1998	1123.4010	737.0930	339.6220	0.0000	0.0000
1999	2640.4880	1575.2270	756.3110	0.0000	0.0000
2000	2828.4980	789.2150	508.4130	0.0000	0.0000
2001	2339.9830	469.2000	439.6930	0.0000	0.0000
2002	3958.4030	1690.3430	845.4140	0.0000	0.0000
2003	2791.9060	428.6280	836.8730	0.0000	0.0000
2004	659.9280	247.7040	263.8160	0.0000	0.0000
2005	2332.7030	261.7780	111.4280	0.0000	0.0000
2006	2112.6620	307.6880	79.7850	0.0000	0.0000
2007	2762.3020	539.9590	125.2110	0.0000	0.0000
2008	1681.1040	300.3020	26.6070	0.0000	0.0000

SURVEY - INPUT DATA

INDEX	21	22	23	24	25
SURVEY TAG	USfall	USfall	USfall	USfall	USfall95
AGE	3	4	5	6	1
TIME	MEAN	MEAN	MEAN	MEAN	MEAN
TYPE	NUMBERS	NUMBERS	NUMBERS	NUMBERS	NUMBERS
RETRO FLAG	0	0	0	0	0
1973	4954.4580	2857.4230	1181.1540	599.9430	0.0000
1974	1471.5650	1029.0570	444.2550	368.0610	0.0000
1975	851.7230	555.1980	324.3830	61.1490	0.0000
1976	460.2700	113.5630	118.5130	97.2570	0.0000
1977	1572.8010	615.3760	102.3040	105.7010	0.0000
1978	757.1850	399.2180	131.6170	34.9430	0.0000
1979	253.7210	116.6690	134.3350	108.6130	0.0000
1980	5911.9800	661.9660	212.2760	250.9070	0.0000
1981	1592.7960	570.5330	76.3880	52.8020	0.0000
1982	1543.3910	410.3800	86.5800	0.0000	0.0000
1983	1858.4560	495.6980	29.8950	47.6580	0.0000
1984	296.7200	235.9590	72.7000	60.6640	0.0000
1985	165.8800	49.1140	78.3290	0.0000	0.0000
1986	338.6510	71.9230	0.0000	0.0000	0.0000
1987	384.5620	51.4430	77.0680	0.0000	0.0000
1988	103.9540	26.5950	0.0000	0.0000	0.0000
1989	750.3900	76.5820	53.9670	0.0000	0.0000
1990	1429.9250	285.8490	0.0000	0.0000	0.0000
1991	426.2010	347.1930	0.0000	0.0000	0.0000
1992	690.9880	157.1440	139.3820	26.5950	0.0000
1993	568.7860	520.3520	0.0000	21.3540	0.0000
1994	954.1240	692.1530	254.8860	54.8400	0.0000
1995	0.0000	0.0000	0.0000	0.0000	267.6980
1996	0.0000	0.0000	0.0000	0.0000	144.3320
1997	0.0000	0.0000	0.0000	0.0000	1351.7890
1998	0.0000	0.0000	0.0000	0.0000	1844.3820
1999	0.0000	0.0000	0.0000	0.0000	2998.7460
2000	0.0000	0.0000	0.0000	0.0000	610.8140
2001	0.0000	0.0000	0.0000	0.0000	3414.1730
2002	0.0000	0.0000	0.0000	0.0000	2031.4210
2003	0.0000	0.0000	0.0000	0.0000	1045.2660
2004	0.0000	0.0000	0.0000	0.0000	850.2680
2005	0.0000	0.0000	0.0000	0.0000	304.0000
2006	0.0000	0.0000	0.0000	0.0000	6012.0510
2007	0.0000	0.0000	0.0000	0.0000	1026.5330
2008	0.0000	0.0000	0.0000	0.0000	0.0000

SURVEY - INPUT DATA

INDEX	26	27	28	29	30
SURVEY TAG	USfall95	USfall95	USfall95	USfall95	USfall95
AGE	2	3	4	5	6
TIME	MEAN	MEAN	MEAN	MEAN	MEAN
TYPE	NUMBERS	NUMBERS	NUMBERS	NUMBERS	NUMBERS
RETRO FLAG	0	0	0	0	0
1973	0.0000	0.0000	0.0000	0.0000	0.0000
1974	0.0000	0.0000	0.0000	0.0000	0.0000
1975	0.0000	0.0000	0.0000	0.0000	0.0000
1976	0.0000	0.0000	0.0000	0.0000	0.0000
1977	0.0000	0.0000	0.0000	0.0000	0.0000
1978	0.0000	0.0000	0.0000	0.0000	0.0000
1979	0.0000	0.0000	0.0000	0.0000	0.0000
1980	0.0000	0.0000	0.0000	0.0000	0.0000
1981	0.0000	0.0000	0.0000	0.0000	0.0000
1982	0.0000	0.0000	0.0000	0.0000	0.0000
1983	0.0000	0.0000	0.0000	0.0000	0.0000
1984	0.0000	0.0000	0.0000	0.0000	0.0000
1985	0.0000	0.0000	0.0000	0.0000	0.0000
1986	0.0000	0.0000	0.0000	0.0000	0.0000
1987	0.0000	0.0000	0.0000	0.0000	0.0000
1988	0.0000	0.0000	0.0000	0.0000	0.0000
1989	0.0000	0.0000	0.0000	0.0000	0.0000
1990	0.0000	0.0000	0.0000	0.0000	0.0000
1991	0.0000	0.0000	0.0000	0.0000	0.0000
1992	0.0000	0.0000	0.0000	0.0000	0.0000
1993	0.0000	0.0000	0.0000	0.0000	0.0000
1994	0.0000	0.0000	0.0000	0.0000	0.0000
1995	115.4070	335.1570	267.2130	44.6490	12.1330
1996	341.2720	1813.8070	433.4810	72.7000	0.0000
1997	517.7310	3340.9880	2028.5090	1039.8310	79.7850
1998	4675.3070	4078.8570	1154.5580	289.5370	71.7290
1999	8175.8660	5558.8660	1390.3230	1394.2060	252.7510
2000	1647.5390	4672.4920	2350.2710	919.6670	802.6100
2001	6083.5860	7853.7150	2524.7900	1667.8250	1988.2280
2002	5581.7730	2064.5190	576.0660	295.5550	26.5950
2003	4882.8260	2725.9030	548.0150	96.9650	185.6810
2004	5346.1050	4862.4430	2044.4270	897.0520	170.7330
2005	2033.5560	3652.0740	595.8670	179.2740	0.0000
2006	6067.1830	3556.6610	1132.9140	247.7040	44.3580
2007	11110.9390	7634.7420	1939.6000	371.2640	90.8510
2008	0.0000	0.0000	0.0000	0.0000	0.0000

SURVEY - INPUT DATA

INDEX	31	32	33	34	35
SURVEY TAG	Canada	Canada	Canada	Canada	Canada
AGE	1	2	3	4	5
TIME	JAN-1	JAN-1	JAN-1	JAN-1	JAN-1
TYPE	NUMBERS	NUMBERS	NUMBERS	NUMBERS	NUMBERS
RETRO FLAG	1	1	1	1	1
1973	0.0000	0.0000	0.0000	0.0000	0.0000
1974	0.0000	0.0000	0.0000	0.0000	0.0000
1975	0.0000	0.0000	0.0000	0.0000	0.0000
1976	0.0000	0.0000	0.0000	0.0000	0.0000
1977	0.0000	0.0000	0.0000	0.0000	0.0000
1978	0.0000	0.0000	0.0000	0.0000	0.0000
1979	0.0000	0.0000	0.0000	0.0000	0.0000
1980	0.0000	0.0000	0.0000	0.0000	0.0000
1981	0.0000	0.0000	0.0000	0.0000	0.0000
1982	0.0000	0.0000	0.0000	0.0000	0.0000
1983	0.0000	0.0000	0.0000	0.0000	0.0000
1984	0.0000	0.0000	0.0000	0.0000	0.0000
1985	0.0000	0.0000	0.0000	0.0000	0.0000
1986	0.0000	0.0000	0.0000	0.0000	0.0000
1987	0.1200	1.1940	1.9700	0.4920	0.0870
1988	0.0000	1.7760	1.2750	0.6100	0.2780
1989	0.1140	1.0270	0.6090	0.2940	0.0660
1990	0.0000	2.3870	3.6280	0.9140	0.2090
1991	0.0240	0.8580	1.1860	3.7590	0.5250
1992	0.0550	11.0390	3.6770	0.9900	0.3500
1993	0.0790	2.4310	4.0850	4.0760	0.8870
1994	0.0000	6.0560	3.4640	3.0060	0.7810
1995	0.0000	0.0000	0.0000	0.0000	0.0000
1996	0.0000	0.0000	0.0000	0.0000	0.0000
1997	0.0000	0.0000	0.0000	0.0000	0.0000
1998	0.0000	0.0000	0.0000	0.0000	0.0000
1999	0.0000	0.0000	0.0000	0.0000	0.0000
2000	0.0000	0.0000	0.0000	0.0000	0.0000
2001	0.0000	0.0000	0.0000	0.0000	0.0000
2002	0.0000	0.0000	0.0000	0.0000	0.0000
2003	0.0000	0.0000	0.0000	0.0000	0.0000
2004	0.0000	0.0000	0.0000	0.0000	0.0000
2005	0.0000	0.0000	0.0000	0.0000	0.0000
2006	0.0000	0.0000	0.0000	0.0000	0.0000
2007	0.0000	0.0000	0.0000	0.0000	0.0000
2008	0.0000	0.0000	0.0000	0.0000	0.0000

SURVEY - INPUT DATA

INDEX	36	37	38	39	40
SURVEY TAG	Canada	Can95	Can95	Can95	Can95
AGE	6	1	2	3	4
TIME	JAN-1	JAN-1	JAN-1	JAN-1	JAN-1
TYPE	NUMBERS	NUMBERS	NUMBERS	NUMBERS	NUMBERS
RETRO FLAG	1	1	1	1	1
1973	0.0000	0.0000	0.0000	0.0000	0.0000
1974	0.0000	0.0000	0.0000	0.0000	0.0000
1975	0.0000	0.0000	0.0000	0.0000	0.0000
1976	0.0000	0.0000	0.0000	0.0000	0.0000
1977	0.0000	0.0000	0.0000	0.0000	0.0000
1978	0.0000	0.0000	0.0000	0.0000	0.0000
1979	0.0000	0.0000	0.0000	0.0000	0.0000
1980	0.0000	0.0000	0.0000	0.0000	0.0000
1981	0.0000	0.0000	0.0000	0.0000	0.0000
1982	0.0000	0.0000	0.0000	0.0000	0.0000
1983	0.0000	0.0000	0.0000	0.0000	0.0000
1984	0.0000	0.0000	0.0000	0.0000	0.0000
1985	0.0000	0.0000	0.0000	0.0000	0.0000
1986	0.0000	0.0000	0.0000	0.0000	0.0000
1987	0.0490	0.0000	0.0000	0.0000	0.0000
1988	0.0240	0.0000	0.0000	0.0000	0.0000
1989	0.0220	0.0000	0.0000	0.0000	0.0000
1990	0.0140	0.0000	0.0000	0.0000	0.0000
1991	0.0140	0.0000	0.0000	0.0000	0.0000
1992	0.0300	0.0000	0.0000	0.0000	0.0000
1993	0.1300	0.0000	0.0000	0.0000	0.0000
1994	0.2070	0.0000	0.0000	0.0000	0.0000
1995	0.0000	0.2100	1.2510	4.3530	2.5460
1996	0.0000	0.4460	7.1420	9.1740	5.4060
1997	0.0000	0.0220	12.4820	13.9020	16.3690
1998	0.0000	0.8930	3.3300	4.9070	4.3340
1999	0.0000	0.1590	20.8610	20.8340	7.6690
2000	0.0000	0.0110	13.7650	27.4420	19.2430
2001	0.0000	0.2910	19.8960	42.1240	13.3070
2002	0.0000	0.0880	11.9620	31.0150	12.2340
2003	0.0000	0.0890	11.8890	24.6180	11.0860
2004	0.0000	0.0330	3.5990	16.2600	9.2050
2005	0.0000	0.6000	1.6020	27.9590	20.5640
2006	0.0000	0.6230	4.8930	18.6000	6.5720
2007	0.0000	0.1730	12.1590	27.7080	12.7990
2008	0.0000	0.0000	0.0000	0.0000	0.0000

SURVEY - INPUT DATA

INDEX	41	42	43	44	
SURVEY TAG	Can95	Can95	Scall	Scall95	
AGE	5	6	1	1	NUMBERS
TIME	JAN-1	JAN-1	MEAN	MEAN	NUMBERS
TYPE	NUMBERS	NUMBERS	NUMBERS	NUMBERS	NUMBERS
RETRO FLAG	1	1	0	0	
1973	0.0000	0.0000	0.0000	0.0000	
1974	0.0000	0.0000	0.0000	0.0000	
1975	0.0000	0.0000	0.0000	0.0000	
1976	0.0000	0.0000	0.0000	0.0000	
1977	0.0000	0.0000	0.0000	0.0000	
1978	0.0000	0.0000	0.0000	0.0000	
1979	0.0000	0.0000	0.0000	0.0000	
1980	0.0000	0.0000	0.0000	0.0000	
1981	0.0000	0.0000	0.0000	0.0000	
1982	0.0000	0.0000	0.3130	0.0000	
1983	0.0000	0.0000	0.1400	0.0000	
1984	0.0000	0.0000	0.2330	0.0000	
1985	0.0000	0.0000	0.5490	0.0000	
1986	0.0000	0.0000	0.1030	0.0000	
1987	0.0000	0.0000	0.0470	0.0000	
1988	0.0000	0.0000	0.1160	0.0000	
1989	0.0000	0.0000	0.1950	0.0000	
1990	0.0000	0.0000	0.1000	0.0000	
1991	0.0000	0.0000	2.1170	0.0000	
1992	0.0000	0.0000	0.1670	0.0000	
1993	0.0000	0.0000	1.1290	0.0000	
1994	0.0000	0.0000	1.5030	0.0000	
1995	0.6470	0.1010	0.0000	0.6090	
1996	1.1550	0.1230	0.0000	0.5080	
1997	4.0440	0.6700	0.0000	1.0620	
1998	1.9880	0.5580	0.0000	1.8720	
1999	5.3500	2.2000	0.0000	1.0380	
2000	5.0690	3.6890	0.0000	0.9120	
2001	4.5810	2.3970	0.0000	0.7890	
2002	5.5530	2.8330	0.0000	1.0050	
2003	3.4210	1.9880	0.0000	0.8800	
2004	2.2730	1.4160	0.0000	0.3300	
2005	5.6960	1.5650	0.0000	0.5730	
2006	0.8200	0.2380	0.0000	2.4220	
2007	2.2880	0.2480	0.0000	0.0000	
2008	0.0000	0.0000	0.0000	0.0000	

Additional Output Files

Population File C:\WORKING\ASSESSMENTS\GARM3THEFINALE\YTASSESSMENTS\GB\VPA\MAJOR
 Auxilliary File C:\WORKING\ASSESSMENTS\GARM3THEFINALE\YTASSESSMENTS\GB\VPA\MAJOR
 Covariance File C:\WORKING\ASSESSMENTS\GARM3THEFINALE\YTASSESSMENTS\GB\VPA\MAJOR
 Residuals File C:\WORKING\ASSESSMENTS\GARM3THEFINALE\YTASSESSMENTS\GB\VPA\MAJOR
 Log File C:\WORKING\ASSESSMENTS\GARM3THEFINALE\YTASSESSMENTS\GB\VPA\MAJOR

Estimation Results

JAN-1 Population Numbers

AGE	1973	1974	1975	1976	1977
1	29384.	52184.	70632.	24731.	17283.
2	24172.	23733.	40588.	53646.	19674.
3	29516.	15136.	10930.	9852.	15554.
4	17300.	12051.	5010.	2425.	3171.
5	6966.	5732.	3079.	977.	719.
6	3013.	2391.	1709.	1562.	850.
Total	110351.	111229.	131948.	93193.	57252.
AGE	1978	1979	1980	1981	1982
1	54437.	25508.	24034.	62997.	22846.
2	13809.	35604.	20595.	19390.	51480.
3	7987.	8124.	19711.	13268.	14885.
4	3390.	2468.	3268.	7499.	5535.
5	956.	1073.	747.	1302.	1783.
6	373.	559.	239.	221.	156.
Total	80953.	73336.	68594.	104677.	96685.
AGE	1983	1984	1985	1986	1987
1	6581.	10843.	16749.	8473.	9193.
2	16754.	4755.	8414.	12837.	6776.
3	25937.	6579.	2089.	2991.	4801.
4	5517.	6472.	1379.	767.	1440.
5	1514.	2305.	870.	402.	282.
6	345.	487.	136.	224.	201.
Total	56648.	31441.	29636.	25695.	22692.
AGE	1988	1989	1990	1991	1992
1	22841.	9661.	11217.	22557.	17518.
2	7386.	18250.	7738.	8975.	17869.
3	2617.	3361.	12981.	4437.	7215.
4	1153.	771.	1747.	4399.	2296.
5	309.	198.	250.	560.	940.
6	73.	55.	47.	104.	65.
Total	34379.	32296.	33980.	41032.	45904.
AGE	1993	1994	1995	1996	1997
1	13938.	13180.	11672.	13470.	19801.
2	12168.	6725.	10726.	9514.	10938.
3	6459.	8713.	4304.	8500.	7175.
4	3250.	2323.	1576.	2237.	5104.
5	574.	609.	305.	509.	1040.
6	126.	184.	66.	70.	246.
Total	36516.	31734.	28650.	34299.	44303.

JAN-1 Population Numbers

AGE	1998	1999	2000	2001	2002
1	22402.	24564.	19880.	22331.	15547.
2	16138.	18189.	20057.	16157.	18124.
3	7934.	11418.	12412.	12945.	10633.
4	4228.	3467.	5591.	5060.	4404.
5	2515.	1778.	1456.	1756.	1570.
6	328.	675.	931.	918.	1116.
Total	53545.	60091.	60327.	59167.	51394.
AGE	2003	2004	2005	2006	2007
1	11770.	10472.	14435.	49437.	18373.
2	12537.	9492.	8516.	11764.	40337.
3	11091.	6749.	6689.	5596.	8460.
4	5615.	4870.	2695.	1850.	3058.
5	1894.	2522.	647.	688.	622.
6	1678.	1857.	280.	395.	252.
Total	44585.	35962.	33263.	69731.	71101.
AGE	2008				
1	19120.				
2	14994.				
3	31704.				
4	5339.				
5	1875.				
6	536.				
Total	73568.				

Fishing Mortality Calculated

AGE	1973	1974	1975	1976	1977
1	0.0136	0.0513	0.0751	0.0287	0.0244
2	0.2681	0.5753	1.2158	1.0381	0.7015
3	0.6958	0.9056	1.3055	0.9335	1.3234
4	0.9046	1.1647	1.4350	1.0158	0.9995
5	0.9046	1.1647	1.4350	1.0158	0.9995
6	0.9046	1.1647	1.4350	1.0158	0.9995
AGE	1978	1979	1980	1981	1982
1	0.2246	0.0140	0.0147	0.0019	0.1101
2	0.3305	0.3913	0.2397	0.0644	0.4855
3	0.9746	0.7107	0.7665	0.6742	0.7925
4	0.9500	0.9943	0.7201	1.2366	1.0961
5	0.9500	0.9943	0.7201	1.2366	1.0961
6	0.9500	0.9943	0.7201	1.2366	1.0961
AGE	1983	1984	1985	1986	1987
1	0.1251	0.0537	0.0660	0.0235	0.0189
2	0.7348	0.6226	0.8341	0.7835	0.7512
3	1.1882	1.3628	0.8015	0.5314	1.2266
4	0.6727	1.8064	1.0330	0.8025	1.3378
5	0.6727	1.8064	1.0330	0.8025	1.3378
6	0.6727	1.8064	1.0330	0.8025	1.3378
AGE	1988	1989	1990	1991	1992
1	0.0244	0.0219	0.0229	0.0330	0.1644
2	0.5874	0.1407	0.3562	0.0183	0.8176
3	1.0221	0.4544	0.8820	0.4589	0.5977
4	1.5603	0.9250	0.9378	1.3434	1.1856
5	1.5603	0.9250	0.9378	1.3434	1.1856
6	1.5603	0.9250	0.9378	1.3434	1.1856
AGE	1993	1994	1995	1996	1997
1	0.5288	0.0060	0.0044	0.0083	0.0046
2	0.1340	0.2463	0.0327	0.0821	0.1210
3	0.8225	1.5100	0.4544	0.3100	0.3288
4	1.4749	1.8301	0.9310	0.5664	0.5076
5	1.4749	1.8301	0.9310	0.5664	0.5076
6	1.4749	1.8301	0.9310	0.5664	0.5076

Fishing Mortality Calculated

AGE	1998	1999	2000	2001	2002
1	0.0083	0.0027	0.0073	0.0087	0.0151
2	0.1460	0.1821	0.2379	0.2184	0.2911
3	0.6278	0.5141	0.6974	0.8781	0.4385
4	0.6665	0.6677	0.9583	0.9701	0.6441
5	0.6665	0.6677	0.9583	0.9701	0.6441
6	0.6665	0.6677	0.9583	0.9701	0.6441
AGE	2003	2004	2005	2006	2007
1	0.0151	0.0068	0.0046	0.0034	0.0032
2	0.4193	0.1500	0.2198	0.1297	0.0408
3	0.6232	0.7180	1.0853	0.4042	0.2603
4	0.6003	1.8180	1.1648	0.8904	0.2892
5	0.6003	1.8180	1.1648	0.8904	0.2892
6	0.6003	1.8180	1.1648	0.8904	0.2892

Average Fishing Mortality For Ages 4- 5

Year	Average F	N Weighted	Biomass Wtd	Catch Wtd
1973	0.9046	0.9046	0.9046	0.9046
1974	1.1647	1.1647	1.1647	1.1647
1975	1.4350	1.4350	1.4350	1.4350
1976	1.0158	1.0158	1.0158	1.0158
1977	0.9995	0.9995	0.9995	0.9995
1978	0.9500	0.9500	0.9500	0.9500
1979	0.9943	0.9943	0.9943	0.9943
1980	0.7201	0.7201	0.7201	0.7201
1981	1.2366	1.2366	1.2366	1.2366
1982	1.0961	1.0961	1.0961	1.0961
1983	0.6727	0.6727	0.6727	0.6727
1984	1.8064	1.8064	1.8064	1.8064
1985	1.0330	1.0330	1.0330	1.0330
1986	0.8025	0.8025	0.8025	0.8025
1987	1.3378	1.3378	1.3378	1.3378
1988	1.5603	1.5603	1.5603	1.5603
1989	0.9250	0.9250	0.9250	0.9250
1990	0.9378	0.9378	0.9378	0.9378
1991	1.3434	1.3434	1.3434	1.3434
1992	1.1856	1.1856	1.1856	1.1856
1993	1.4749	1.4749	1.4749	1.4749
1994	1.8301	1.8301	1.8301	1.8301
1995	0.9310	0.9310	0.9310	0.9310
1996	0.5664	0.5664	0.5664	0.5664
1997	0.5076	0.5076	0.5076	0.5076
1998	0.6665	0.6665	0.6665	0.6665
1999	0.6677	0.6677	0.6677	0.6677
2000	0.9583	0.9583	0.9583	0.9583
2001	0.9701	0.9701	0.9701	0.9701
2002	0.6441	0.6441	0.6441	0.6441
2003	0.6003	0.6003	0.6003	0.6003
2004	1.8180	1.8180	1.8180	1.8180
2005	1.1648	1.1648	1.1648	1.1648
2006	0.8904	0.8904	0.8904	0.8904
2007	0.2892	0.2892	0.2892	0.2892

Back Calculated Partial Recruitment

AGE	1973	1974	1975	1976	1977
1	0.0150	0.0441	0.0523	0.0277	0.0184
2	0.2964	0.4940	0.8473	1.0000	0.5300
3	0.7692	0.7775	0.9098	0.8993	1.0000
4	1.0000	1.0000	1.0000	0.9786	0.7552
5	1.0000	1.0000	1.0000	0.9786	0.7552
6	1.0000	1.0000	1.0000	0.9786	0.7552
AGE	1978	1979	1980	1981	1982
1	0.2305	0.0140	0.0192	0.0015	0.1005
2	0.3392	0.3935	0.3127	0.0521	0.4429
3	1.0000	0.7147	1.0000	0.5452	0.7230
4	0.9748	1.0000	0.9395	1.0000	1.0000
5	0.9748	1.0000	0.9395	1.0000	1.0000
6	0.9748	1.0000	0.9395	1.0000	1.0000
AGE	1983	1984	1985	1986	1987
1	0.1053	0.0297	0.0639	0.0293	0.0142
2	0.6184	0.3446	0.8075	0.9763	0.5615
3	1.0000	0.7544	0.7759	0.6622	0.9169
4	0.5661	1.0000	1.0000	1.0000	1.0000
5	0.5661	1.0000	1.0000	1.0000	1.0000
6	0.5661	1.0000	1.0000	1.0000	1.0000
AGE	1988	1989	1990	1991	1992
1	0.0156	0.0237	0.0245	0.0245	0.1387
2	0.3765	0.1521	0.3799	0.0136	0.6896
3	0.6550	0.4912	0.9405	0.3416	0.5041
4	1.0000	1.0000	1.0000	1.0000	1.0000
5	1.0000	1.0000	1.0000	1.0000	1.0000
6	1.0000	1.0000	1.0000	1.0000	1.0000
AGE	1993	1994	1995	1996	1997
1	0.3585	0.0033	0.0048	0.0146	0.0090
2	0.0908	0.1346	0.0351	0.1450	0.2384
3	0.5577	0.8251	0.4881	0.5474	0.6479
4	1.0000	1.0000	1.0000	1.0000	1.0000
5	1.0000	1.0000	1.0000	1.0000	1.0000
6	1.0000	1.0000	1.0000	1.0000	1.0000

Back Calculated Partial Recruitment

AGE	1998	1999	2000	2001	2002
1	0.0125	0.0040	0.0077	0.0090	0.0235
2	0.2190	0.2727	0.2482	0.2251	0.4520
3	0.9421	0.7699	0.7277	0.9052	0.6809
4	1.0000	1.0000	1.0000	1.0000	1.0000
5	1.0000	1.0000	1.0000	1.0000	1.0000
6	1.0000	1.0000	1.0000	1.0000	1.0000

AGE	2003	2004	2005	2006	2007
1	0.0242	0.0037	0.0039	0.0039	0.0110
2	0.6729	0.0825	0.1887	0.1457	0.1412
3	1.0000	0.3949	0.9317	0.4539	0.9001
4	0.9634	1.0000	1.0000	1.0000	1.0000
5	0.9634	1.0000	1.0000	1.0000	1.0000
6	0.9634	1.0000	1.0000	1.0000	1.0000

JAN-1 Biomass

AGE	1973	1974	1975	1976	1977
1	1607.	3622.	4803.	1501.	1218.
2	7046.	4424.	7736.	10075.	3781.
3	11898.	6289.	4483.	4085.	6289.
4	8038.	6382.	2626.	1351.	1861.
5	3927.	3427.	1887.	627.	506.
6	2344.	1990.	1187.	1345.	792.

=====

Total	34860.	26134.	22723.	18984.	14447.
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AGE	1978	1979	1980	1981	1982
1	3092.	1729.	1334.	4895.	1638.
2	2636.	6523.	3946.	3566.	9864.
3	3335.	3094.	7938.	5265.	6000.
4	2039.	1427.	1799.	4092.	3121.
5	681.	765.	547.	887.	1203.
6	362.	531.	256.	186.	169.

=====

Total	12146.	14070.	15820.	18890.	21994.
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AGE	1983	1984	1985	1986	1987
1	705.	1177.	2209.	1146.	676.
2	3091.	870.	2034.	3189.	1641.
3	9449.	2203.	726.	1321.	2029.
4	2994.	3039.	680.	448.	872.
5	1050.	1445.	525.	298.	205.
6	348.	388.	109.	227.	176.

=====

Total	17637.	9121.	6283.	6628.	5599.
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AGE	1988	1989	1990	1991	1992
1	1320.	567.	784.	1755.	1053.
2	1471.	3349.	1318.	1415.	3365.
3	1112.	1388.	4665.	1451.	2122.
4	696.	488.	963.	1927.	1012.
5	234.	154.	177.	364.	529.
6	71.	58.	39.	91.	73.

=====

Total	4905.	6004.	7947.	7004.	8153.
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AGE	1993	1994	1995	1996	1997
1	864.	2131.	1613.	1006.	3550.
2	2065.	1084.	2471.	2085.	2074.

3	2152.	2764.	1293.	2844.	2408.
4	1390.	983.	638.	979.	2388.
5	313.	340.	163.	292.	655.
6	109.	142.	51.	71.	233.
=====					
Total	6893.	7444.	6230.	7276.	11308.

JAN-1 Biomass

AGE	1998	1999	2000	2001	2002
1	2773.	3604.	3620.	4549.	3885.
2	4123.	4655.	5578.	4652.	5604.
3	2852.	4437.	5217.	5433.	4432.
4	1996.	1815.	3085.	2742.	2436.
5	1486.	1141.	1019.	1241.	1121.
6	317.	608.	888.	943.	1192.
=====					
Total	13548.	16260.	19407.	19560.	18670.

AGE	2003	2004	2005	2006	2007
1	2355.	1738.	1065.	2912.	2372.
2	3989.	2466.	2284.	2256.	6845.
3	4714.	2682.	2428.	2095.	2997.
4	3144.	2566.	1378.	919.	1436.
5	1402.	1739.	434.	463.	405.
6	1759.	1775.	279.	394.	252.
=====					
Total	17363.	12967.	7868.	9039.	14306.

AGE	2008
1	1669.
2	3147.
3	11534.
4	2629.
5	1246.
6	535.
=====	
Total	20761.

Mean Biomass

AGE	1973	1974	1975	1976	1977
1	2672.	5306.	6978.	2387.	1796.
2	6717.	5680.	6860.	9599.	4434.
3	9008.	4543.	2762.	3206.	4184.
4	5519.	3991.	1367.	891.	1169.
5	2543.	2120.	938.	421.	327.
6	1419.	1086.	585.	778.	461.
=====					
Total	27878.	22727.	19490.	17283.	12371.

AGE	1978	1979	1980	1981	1982
1	4524.	2618.	2185.	6959.	2259.

2	3365.	8843.	5366.	5708.	11215.
3	2397.	2464.	6230.	4325.	4578.
4	1390.	945.	1401.	2403.	2016.
5	456.	461.	399.	488.	753.
6	215.	310.	168.	99.	95.

=====

Total	12347.	15641.	15748.	19983.	20917.
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AGE	1983	1984	1985	1986	1987
-----	------	------	------	------	------

1	787.	1552.	2662.	1374.	999.
2	3222.	775.	1893.	2786.	1416.
3	6183.	1261.	666.	1146.	1340.
4	2234.	1396.	509.	327.	500.
5	748.	643.	365.	217.	113.
6	232.	167.	62.	143.	90.

=====

Total	13406.	5794.	6157.	5993.	4458.
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AGE	1988	1989	1990	1991	1992
-----	------	------	------	------	------

1	2107.	866.	1056.	2435.	1483.
2	1677.	5058.	1721.	1911.	3285.
3	841.	1283.	3133.	1199.	1815.
4	377.	333.	610.	1089.	653.
5	123.	103.	104.	206.	331.
6	33.	35.	24.	46.	39.

=====

Total	5159.	7677.	6647.	6887.	7607.
-------	-------	-------	-------	-------	-------

AGE	1993	1994	1995	1996	1997
-----	------	------	------	------	------

1	990.	2299.	1837.	1447.	3832.
2	2948.	1410.	2632.	2288.	2825.
3	1533.	1473.	1096.	2710.	2274.
4	790.	469.	439.	863.	1968.
5	157.	162.	111.	251.	535.
6	53.	61.	30.	49.	167.

=====

Total	6471.	5875.	6145.	7608.	11601.
-------	-------	-------	-------	-------	--------

Mean Biomass

AGE	1998	1999	2000	2001	2002
-----	------	------	------	------	------

1	3600.	4491.	4111.	5059.	3945.
2	4161.	5563.	6221.	4779.	5456.
3	2309.	4040.	3933.	3644.	3772.
4	1544.	1483.	2036.	1825.	1978.
5	1092.	897.	661.	840.	883.
6	212.	407.	526.	556.	805.

=====

Total	12918.	16881.	17488.	16704.	16839.
-------	--------	--------	--------	--------	--------

AGE	2003	2004	2005	2006	2007
-----	------	------	------	------	------

1	2415.	1996.	1553.	4473.	2461.
2	3355.	2371.	2371.	3097.	10324.
3	3583.	1943.	1675.	1726.	2753.
4	2523.	1226.	873.	625.	1296.

5	1074.	789.	271.	319.	376.
6	1211.	763.	152.	240.	200.
=====					
Total	14160.	9088.	6897.	10480.	17409.

Spawning Stock Biomass

AGE	1973	1974	1975	1976	1977
1	0.	0.	0.	0.	0.
2	3198.	2730.	3285.	4616.	2135.
3	9079.	4580.	2760.	3232.	4177.
4	5754.	4142.	1404.	928.	1218.
5	2651.	2201.	964.	438.	340.
6	1479.	1127.	601.	810.	480.
=====					
Total	22161.	14780.	9014.	10024.	8351.
AGE	1978	1979	1980	1981	1982
1	0.	0.	0.	0.	0.
2	1606.	4230.	2551.	2688.	5380.
3	2415.	2483.	6282.	4358.	4616.
4	1449.	984.	1461.	2489.	2096.
5	475.	480.	416.	506.	783.
6	224.	323.	175.	102.	98.
=====					
Total	6169.	8501.	10884.	10144.	12975.
AGE	1983	1984	1985	1986	1987
1	0.	0.	0.	0.	0.
2	1552.	373.	912.	1342.	682.
3	6202.	1257.	672.	1152.	1342.
4	2328.	1402.	529.	341.	516.
5	779.	646.	380.	226.	116.
6	242.	168.	65.	150.	93.
=====					
Total	11103.	3847.	2558.	3210.	2750.
AGE	1988	1989	1990	1991	1992
1	0.	0.	0.	0.	0.
2	806.	2392.	822.	897.	1583.
3	847.	1287.	3159.	1203.	1827.
4	385.	347.	636.	1124.	678.
5	125.	107.	108.	213.	344.
6	34.	36.	25.	48.	41.
=====					
Total	2198.	4170.	4750.	3485.	4472.
AGE	1993	1994	1995	1996	1997
1	0.	0.	0.	0.	0.
2	1394.	671.	1237.	1079.	1335.
3	1546.	1459.	1100.	2705.	2271.
4	810.	471.	457.	897.	2045.
5	161.	162.	116.	261.	556.
6	54.	61.	32.	51.	174.
=====					
Total	3966.	2823.	2941.	4993.	6380.

Spawning Stock Biomass

AGE	1998	1999	2000	2001	2002
1	0.	0.	0.	0.	0.
2	1969.	2637.	2957.	2270.	2600.
3	2326.	4059.	3964.	3674.	3782.
4	1609.	1546.	2122.	1902.	2060.
5	1138.	935.	688.	875.	920.
6	221.	424.	548.	579.	838.
Total	7262.	9600.	10280.	9300.	10201.
AGE	2003	2004	2005	2006	2007
1	0.	0.	0.	0.	0.
2	1606.	1122.	1126.	1464.	4855.
3	3608.	1959.	1685.	1729.	2742.
4	2627.	1231.	906.	652.	1337.
5	1118.	792.	281.	332.	387.
6	1260.	766.	158.	250.	206.
Total	10219.	5869.	4157.	4427.	9526.

Catch Biomass

AGE	1973	1974	1975	1976	1977
1	36.	272.	524.	69.	44.
2	1801.	3268.	8340.	9965.	3110.
3	6267.	4114.	3606.	2993.	5537.
4	4992.	4648.	1961.	905.	1169.
5	2300.	2470.	1346.	427.	327.
6	1283.	1264.	839.	790.	461.
Total	16680.	16037.	16618.	15149.	10647.
AGE	1978	1979	1980	1981	1982
1	1016.	37.	32.	13.	249.
2	1112.	3460.	1286.	368.	5445.
3	2336.	1751.	4775.	2916.	3628.
4	1321.	939.	1009.	2972.	2210.
5	433.	459.	287.	604.	826.
6	204.	308.	121.	122.	104.
Total	6422.	6954.	7510.	6995.	12462.
AGE	1983	1984	1985	1986	1987
1	98.	83.	176.	32.	19.
2	2367.	482.	1579.	2183.	1064.
3	7347.	1719.	534.	609.	1644.
4	1503.	2522.	525.	262.	669.
5	503.	1162.	377.	174.	151.
6	156.	302.	65.	115.	120.
Total	11975.	6270.	3255.	3375.	3666.
AGE	1988	1989	1990	1991	1992

1	51.	19.	24.	80.	244.
2	985.	711.	613.	35.	2686.
3	860.	583.	2763.	550.	1085.
4	589.	308.	572.	1463.	775.
5	192.	95.	97.	277.	393.
6	52.	32.	22.	62.	47.
=====					
Total	2729.	1749.	4092.	2468.	5228.
AGE	1993	1994	1995	1996	1997

1	523.	14.	8.	12.	18.
2	395.	347.	86.	188.	342.
3	1261.	2225.	498.	840.	748.
4	1165.	859.	409.	489.	999.
5	232.	296.	103.	142.	272.
6	78.	112.	28.	28.	85.
=====					
Total	3654.	3852.	1132.	1699.	2462.

Catch Biomass

AGE	1998	1999	2000	2001	2002
1	30.	12.	30.	44.	60.
2	607.	1013.	1480.	1044.	1588.
3	1450.	2077.	2743.	3200.	1654.
4	1029.	990.	1951.	1771.	1274.
5	728.	599.	633.	815.	569.
6	141.	272.	504.	539.	518.
=====					
Total	3985.	4963.	7341.	7413.	5664.
AGE	2003	2004	2005	2006	2007

1	36.	13.	7.	15.	8.
2	1407.	356.	521.	402.	421.
3	2233.	1395.	1818.	698.	717.
4	1515.	2229.	1017.	557.	375.
5	645.	1434.	315.	284.	109.
6	727.	1387.	178.	214.	58.
=====					
Total	6562.	6814.	3857.	2169.	1687.

Catch Numbers

AGE	1973	1974	1975	1976	1977
1	359.3	2367.5	4636.2	635.1	377.9
2	5175.0	9500.0	26393.9	31938.1	9094.2
3	13565.3	8294.2	7375.1	5501.9	10567.1
4	9473.0	7657.9	3540.2	1425.7	1846.2
5	3814.6	3642.6	2175.2	574.2	418.6
6	1649.7	1519.6	1207.2	918.1	495.0
Total	34036.9	32981.8	45327.8	40993.1	22799.0
AGE	1978	1979	1980	1981	1982
1	9962.0	320.6	317.8	107.4	2163.5
2	3542.1	10516.6	3994.4	1097.1	18091.3
3	4579.7	3789.4	9685.3	5963.4	7480.3
4	1913.8	1432.1	1538.4	4920.2	3400.5
5	539.5	623.0	351.9	854.4	1095.2
6	210.8	324.6	112.6	145.3	95.8
Total	20747.9	17006.3	16000.4	13087.8	32326.6
AGE	1983	1984	1985	1986	1987
1	702.8	514.3	970.3	178.8	156.4
2	7998.1	2017.7	4373.6	6402.1	3284.2
3	16660.9	4534.6	1057.6	1127.5	3136.7
4	2475.9	5043.0	818.4	388.8	983.3
5	679.6	1796.3	516.6	203.6	192.3
6	154.6	379.5	80.7	113.4	137.3
Total	28671.9	14285.4	7817.2	8414.2	7890.2
AGE	1988	1989	1990	1991	1992
1	499.0	189.8	230.6	663.3	2413.9
2	3002.6	2175.4	2114.4	147.3	9167.4
3	1544.1	1120.6	6995.7	1491.2	2971.5
4	846.1	428.2	978.3	3011.1	1473.0
5	227.0	110.1	140.2	383.2	603.1
6	53.3	30.4	26.1	71.2	42.0
Total	6172.1	4054.5	10485.3	5767.3	16670.9
AGE	1993	1994	1995	1996	1997
1	5233.5	71.2	46.9	100.6	81.8
2	1385.8	1336.3	312.7	680.9	1132.3
3	3326.9	6302.4	1435.3	2064.3	1832.4
4	2325.5	1819.3	878.6	885.0	1856.8
5	411.0	476.7	170.1	201.2	378.2
6	90.5	143.9	36.9	27.6	89.6
Total	12773.2	10149.8	2880.5	3959.6	5371.1

Catch Numbers

AGE	1998	1999	2000	2001	2002
1	168.5	60.1	131.8	175.9	211.9
2	1991.4	2752.9	3863.5	2883.5	4168.9
3	3387.8	4195.0	5713.9	6956.4	3446.3
4	1884.9	1547.6	3173.0	2893.2	1915.8
5	1121.3	793.5	826.3	1003.9	683.0
6	146.2	301.4	528.5	525.1	485.3
=====					
Total	8700.1	9650.5	14237.0	14438.0	10911.2
AGE	2003	2004	2005	2006	2007
1	159.7	63.9	59.9	153.9	53.0
2	3919.1	1201.3	1528.8	1300.2	1463.5
3	4710.0	3170.8	4086.2	1697.7	1764.9
4	2319.9	3803.8	1712.5	1003.0	699.5
5	782.4	1970.1	411.3	373.2	142.2
6	693.5	1450.7	178.1	214.0	57.6
=====					
Total	12584.6	11660.6	7976.8	4742.0	4180.7

Surplus Production

Average Adjustment Factor (Delta) = 1.0000

Year	Biomass	Delta Biomass	Catch Biomass	Surplus Production
1973	34859.870	-8726.293	16680.299	7954.006
1974	26133.577	-3410.933	16036.521	12625.588
1975	22722.644	-3738.801	16617.511	12878.709
1976	18983.843	-4536.768	15149.320	10612.552
1977	14447.075	-2301.286	10647.211	8345.925
1978	12145.789	1924.223	6422.207	8346.430
1979	14070.012	1749.816	6953.568	8703.384
1980	15819.828	3070.339	7510.196	10580.534
1981	18890.167	3104.265	6994.648	10098.913
1982	21994.432	-4357.319	12461.991	8104.672
1983	17637.113	-8515.924	11975.208	3459.283
1984	9121.189	-2837.769	6270.328	3432.559
1985	6283.420	344.755	3255.156	3599.912
1986	6628.176	-1029.041	3375.356	2346.315
1987	5599.135	-694.543	3666.181	2971.637
1988	4904.592	1099.276	2728.755	3828.030
1989	6003.867	1943.108	1748.710	3691.818
1990	7946.975	-942.640	4092.209	3149.569
1991	7004.335	1148.206	2468.313	3616.519
1992	8152.541	-1259.826	5228.486	3968.660
1993	6892.715	551.072	3654.179	4205.251
1994	7443.787	-1213.834	3852.190	2638.355
1995	6229.953	1046.155	1132.341	2178.496
1996	7276.108	4031.751	1698.769	5730.520
1997	11307.859	2239.872	2462.436	4702.308
1998	13547.731	2711.938	3985.457	6697.395
1999	16259.669	3147.577	4962.850	8110.428
2000	19407.246	152.524	7341.104	7493.629
2001	19559.771	-890.153	7413.005	6522.852
2002	18669.618	-1306.869	5663.577	4356.708
2003	17362.749	-4395.720	6562.289	2166.569
2004	12967.029	-5099.305	6814.349	1715.043
2005	7867.723	1171.626	3857.066	5028.692
2006	9039.350	5267.047	2168.776	7435.822
2007	14306.396	6454.480	1687.169	8141.650
2008	20760.877			

Summary of Survey Indices Used in the Estimate

INDEX	Survey Tag	Age	Time	Type	Catchability	Std. Error	CV
1	USsearly	1	JAN-1	NUMBER	0.7461E-02	0.4890E-02	0.6554E+00
2	USsearly	2	JAN-1	NUMBER	0.7552E-01	0.1408E-01	0.1864E+00
3	USsearly	3	JAN-1	NUMBER	0.9561E-01	0.1687E-01	0.1765E+00
4	USsearly	4	JAN-1	NUMBER	0.9265E-01	0.1151E-01	0.1242E+00
5	USsearly	5	JAN-1	NUMBER	0.7601E-01	0.1541E-01	0.2027E+00
6	USsearly	6	JAN-1	NUMBER	0.7202E-01	0.2265E-01	0.3145E+00
7	USspr	1	JAN-1	NUMBER	0.4235E-02	0.1040E-02	0.2456E+00
8	USspr	2	JAN-1	NUMBER	0.4556E-01	0.1441E-01	0.3162E+00
9	USspr	3	JAN-1	NUMBER	0.9545E-01	0.1522E-01	0.1595E+00
10	USspr	4	JAN-1	NUMBER	0.1524E+00	0.2010E-01	0.1318E+00
11	USspr	5	JAN-1	NUMBER	0.2285E+00	0.4608E-01	0.2016E+00
12	USspr	6	JAN-1	NUMBER	0.4229E+00	0.9316E-01	0.2203E+00
13	USspr95	1	JAN-1	NUMBER	0.4582E-02	0.1354E-02	0.2954E+00
14	USspr95	2	JAN-1	NUMBER	0.1437E+00	0.1650E-01	0.1149E+00
15	USspr95	3	JAN-1	NUMBER	0.4995E+00	0.8842E-01	0.1770E+00
16	USspr95	4	JAN-1	NUMBER	0.5934E+00	0.9885E-01	0.1666E+00
17	USspr95	5	JAN-1	NUMBER	0.4807E+00	0.1085E+00	0.2257E+00
18	USspr95	6	JAN-1	NUMBER	0.3912E+00	0.9214E-01	0.2355E+00
19	USfall	1	MEAN	NUMBER	0.3964E-01	0.1006E-01	0.2537E+00
20	USfall	2	MEAN	NUMBER	0.8751E-01	0.1425E-01	0.1629E+00
21	USfall	3	MEAN	NUMBER	0.1504E+00	0.1581E-01	0.1052E+00
22	USfall	4	MEAN	NUMBER	0.1561E+00	0.2159E-01	0.1383E+00
23	USfall	5	MEAN	NUMBER	0.2050E+00	0.4109E-01	0.2005E+00
24	USfall	6	MEAN	NUMBER	0.3063E+00	0.6539E-01	0.2135E+00
25	USfall95	1	MEAN	NUMBER	0.6541E-01	0.1508E-01	0.2306E+00
26	USfall95	2	MEAN	NUMBER	0.2123E+00	0.7371E-01	0.3472E+00
27	USfall95	3	MEAN	NUMBER	0.5561E+00	0.1084E+00	0.1950E+00
28	USfall95	4	MEAN	NUMBER	0.4711E+00	0.8264E-01	0.1754E+00
29	USfall95	5	MEAN	NUMBER	0.4901E+00	0.1277E+00	0.2606E+00
30	USfall95	6	MEAN	NUMBER	0.3616E+00	0.1311E+00	0.3624E+00
32	Canada	2	JAN-1	NUMBER	0.2299E-03	0.7381E-04	0.3210E+00
33	Canada	3	JAN-1	NUMBER	0.3694E-03	0.5352E-04	0.1449E+00
34	Canada	4	JAN-1	NUMBER	0.6191E-03	0.1146E-03	0.1850E+00
35	Canada	5	JAN-1	NUMBER	0.6933E-03	0.1548E-03	0.2233E+00
36	Canada	6	JAN-1	NUMBER	0.4029E-03	0.1012E-03	0.2511E+00
38	Can95	2	JAN-1	NUMBER	0.4966E-03	0.1064E-03	0.2142E+00
39	Can95	3	JAN-1	NUMBER	0.2062E-02	0.3176E-03	0.1540E+00
40	Can95	4	JAN-1	NUMBER	0.2640E-02	0.3605E-03	0.1366E+00
41	Can95	5	JAN-1	NUMBER	0.2405E-02	0.4405E-03	0.1832E+00
42	Can95	6	JAN-1	NUMBER	0.1860E-02	0.3387E-03	0.1821E+00
43	Scall	1	MEAN	NUMBER	0.2334E-04	0.6875E-05	0.2946E+00
44	Scall95	1	MEAN	NUMBER	0.5395E-04	0.4694E-05	0.8700E-01

Survey Index: 1 Tag: USsearly AGE = 1
 Time = JAN-1 Type = NUMBER
 Catchability = 0.746089E-02 % Variance Contribution = 7.8992
 Residual = LN(Observed) - LN(Predicted)

Year	Observed	Predicted	Residual
1973	0.188291E+04	0.219229E+03	0.215046E+01
1974	0.308173E+03	0.389338E+03	-0.233787E+00
1975	0.409216E+03	0.526977E+03	-0.252913E+00
1976	0.100838E+04	0.184512E+03	0.169839E+01
1977	N/A	0.128948E+03	N/A
1978	0.912193E+03	0.406148E+03	0.809134E+00
1979	0.393977E+03	0.190315E+03	0.727612E+00
1980	0.553260E+02	0.179312E+03	-0.117588E+01
1981	0.113560E+02	0.470010E+03	-0.372301E+01
1982	N/A	0.170450E+03	N/A
1983	N/A	0.491009E+02	N/A
1984	N/A	0.809021E+02	N/A
1985	N/A	0.124961E+03	N/A
1986	N/A	0.632187E+02	N/A
1987	N/A	0.685904E+02	N/A
1988	N/A	0.170414E+03	N/A
1989	N/A	0.720800E+02	N/A
1990	N/A	0.836881E+02	N/A
1991	N/A	0.168293E+03	N/A
1992	N/A	0.130699E+03	N/A
1993	N/A	0.103993E+03	N/A
1994	N/A	0.983325E+02	N/A
1995	N/A	0.870844E+02	N/A
1996	N/A	0.100499E+03	N/A
1997	N/A	0.147734E+03	N/A
1998	N/A	0.167137E+03	N/A
1999	N/A	0.183270E+03	N/A
2000	N/A	0.148319E+03	N/A
2001	N/A	0.166610E+03	N/A
2002	N/A	0.115993E+03	N/A
2003	N/A	0.878157E+02	N/A
2004	N/A	0.781275E+02	N/A
2005	N/A	0.107699E+03	N/A
2006	N/A	0.368846E+03	N/A
2007	N/A	0.137077E+03	N/A
2008	N/A	0.000000E+00	N/A

Survey Index: 2 Tag: USsearly AGE = 2
 Time = JAN-1 Type = NUMBER
 Catchability = 0.755206E-01 % Variance Contribution = 0.8214
 Residual = LN(Observed) - LN(Predicted)

Year	Observed	Predicted	Residual
1973	0.318433E+04	0.182549E+04	0.556392E+00
1974	0.216847E+04	0.179232E+04	0.190510E+00
1975	0.291799E+04	0.306521E+04	-0.492211E-01
1976	0.425901E+04	0.405136E+04	0.499838E-01
1977	0.654007E+03	0.148581E+04	-0.820601E+00
1978	0.778441E+03	0.104287E+04	-0.292435E+00
1979	0.195678E+04	0.268882E+04	-0.317801E+00
1980	0.452865E+04	0.155534E+04	0.106873E+01
1981	0.995861E+03	0.146434E+04	-0.385555E+00
1982	N/A	0.388781E+04	N/A
1983	N/A	0.126526E+04	N/A
1984	N/A	0.359072E+03	N/A
1985	N/A	0.635410E+03	N/A
1986	N/A	0.969476E+03	N/A
1987	N/A	0.511723E+03	N/A
1988	N/A	0.557767E+03	N/A
1989	N/A	0.137825E+04	N/A
1990	N/A	0.584409E+03	N/A
1991	N/A	0.677828E+03	N/A
1992	N/A	0.134948E+04	N/A
1993	N/A	0.918920E+03	N/A
1994	N/A	0.507906E+03	N/A
1995	N/A	0.810059E+03	N/A
1996	N/A	0.718501E+03	N/A
1997	N/A	0.826012E+03	N/A
1998	N/A	0.121874E+04	N/A
1999	N/A	0.137363E+04	N/A
2000	N/A	0.151472E+04	N/A
2001	N/A	0.122018E+04	N/A
2002	N/A	0.136876E+04	N/A
2003	N/A	0.946821E+03	N/A
2004	N/A	0.716868E+03	N/A
2005	N/A	0.643112E+03	N/A
2006	N/A	0.888458E+03	N/A
2007	N/A	0.304626E+04	N/A
2008	N/A	0.113239E+04	N/A

Survey Index: 3 Tag: USsearly AGE = 3
 Time = JAN-1 Type = NUMBER
 Catchability = 0.956073E-01 % Variance Contribution = 0.7362
 Residual = LN(Observed) - LN(Predicted)

Year	Observed	Predicted	Residual
1973	0.230941E+04	0.282197E+04	-0.200443E+00
1974	0.179546E+04	0.144716E+04	0.215660E+00
1975	0.809113E+03	0.104502E+04	-0.255857E+00
1976	0.121600E+04	0.941922E+03	0.255399E+00
1977	0.109768E+04	0.148710E+04	-0.303628E+00
1978	0.494436E+03	0.763635E+03	-0.434673E+00
1979	0.395239E+03	0.776685E+03	-0.675544E+00
1980	0.561720E+04	0.188455E+04	0.109215E+01
1981	0.172422E+04	0.126850E+04	0.306940E+00
1982	N/A	0.142313E+04	N/A
1983	N/A	0.247975E+04	N/A
1984	N/A	0.628975E+03	N/A
1985	N/A	0.199697E+03	N/A
1986	N/A	0.286004E+03	N/A
1987	N/A	0.459008E+03	N/A
1988	N/A	0.250239E+03	N/A
1989	N/A	0.321305E+03	N/A
1990	N/A	0.124111E+04	N/A
1991	N/A	0.424202E+03	N/A
1992	N/A	0.689847E+03	N/A
1993	N/A	0.617535E+03	N/A
1994	N/A	0.833036E+03	N/A
1995	N/A	0.411503E+03	N/A
1996	N/A	0.812630E+03	N/A
1997	N/A	0.685996E+03	N/A
1998	N/A	0.758562E+03	N/A
1999	N/A	0.109165E+04	N/A
2000	N/A	0.118672E+04	N/A
2001	N/A	0.123765E+04	N/A
2002	N/A	0.101658E+04	N/A
2003	N/A	0.106040E+04	N/A
2004	N/A	0.645245E+03	N/A
2005	N/A	0.639538E+03	N/A
2006	N/A	0.535028E+03	N/A
2007	N/A	0.808832E+03	N/A
2008	N/A	0.303112E+04	N/A

Survey Index: 4 Tag: USsearly AGE = 4
 Time = JAN-1 Type = NUMBER
 Catchability = 0.926548E-01 % Variance Contribution = 0.3649
 Residual = LN(Observed) - LN(Predicted)

Year	Observed	Predicted	Residual
1973	0.103672E+04	0.160292E+04	-0.435763E+00
1974	0.122503E+04	0.111663E+04	0.926513E-01
1975	0.262554E+03	0.464244E+03	-0.569954E+00
1976	0.302447E+03	0.224730E+03	0.297008E+00
1977	0.363693E+03	0.293840E+03	0.213276E+00
1978	0.213926E+03	0.314119E+03	-0.384143E+00
1979	0.328265E+03	0.228641E+03	0.361669E+00
1980	0.460562E+03	0.302781E+03	0.419437E+00
1981	0.698850E+03	0.694795E+03	0.581989E-02
1982	N/A	0.512874E+03	N/A
1983	N/A	0.511190E+03	N/A
1984	N/A	0.599622E+03	N/A
1985	N/A	0.127736E+03	N/A
1986	N/A	0.710874E+02	N/A
1987	N/A	0.133385E+03	N/A
1988	N/A	0.106814E+03	N/A
1989	N/A	0.714474E+02	N/A
1990	N/A	0.161850E+03	N/A
1991	N/A	0.407623E+03	N/A
1992	N/A	0.212716E+03	N/A
1993	N/A	0.301090E+03	N/A
1994	N/A	0.215258E+03	N/A
1995	N/A	0.146018E+03	N/A
1996	N/A	0.207275E+03	N/A
1997	N/A	0.472888E+03	N/A
1998	N/A	0.391768E+03	N/A
1999	N/A	0.321248E+03	N/A
2000	N/A	0.518025E+03	N/A
2001	N/A	0.468817E+03	N/A
2002	N/A	0.408081E+03	N/A
2003	N/A	0.520241E+03	N/A
2004	N/A	0.451183E+03	N/A
2005	N/A	0.249695E+03	N/A
2006	N/A	0.171412E+03	N/A
2007	N/A	0.283371E+03	N/A
2008	N/A	0.494684E+03	N/A

Survey Index: 5 Tag: USsearly AGE = 5
Time = JAN-1 Type = NUMBER
Catchability = 0.760134E-01 % Variance Contribution = 0.9712
Residual = LN(Observed) - LN(Predicted)

Year	Observed	Predicted	Residual
1973	0.399412E+03	0.529538E+03	-0.282011E+00
1974	0.336904E+03	0.435744E+03	-0.257257E+00
1975	0.201502E+03	0.234013E+03	-0.149578E+00
1976	0.191213E+03	0.742537E+02	0.945901E+00
1977	0.819210E+02	0.546579E+02	0.404661E+00
1978	0.257220E+02	0.726461E+02	-0.103825E+01
1979	0.587230E+02	0.816001E+02	-0.328999E+00
1980	0.550340E+02	0.568200E+02	-0.319373E-01
1981	0.206937E+03	0.989822E+02	0.737474E+00
1982	N/A	0.135514E+03	N/A
1983	N/A	0.115113E+03	N/A
1984	N/A	0.175223E+03	N/A
1985	N/A	0.661493E+02	N/A
1986	N/A	0.305398E+02	N/A
1987	N/A	0.214004E+02	N/A
1988	N/A	0.235102E+02	N/A
1989	N/A	0.150713E+02	N/A
1990	N/A	0.190288E+02	N/A
1991	N/A	0.425580E+02	N/A
1992	N/A	0.714511E+02	N/A
1993	N/A	0.436560E+02	N/A
1994	N/A	0.462725E+02	N/A
1995	N/A	0.231922E+02	N/A
1996	N/A	0.386593E+02	N/A
1997	N/A	0.790200E+02	N/A
1998	N/A	0.191199E+03	N/A
1999	N/A	0.135130E+03	N/A
2000	N/A	0.110673E+03	N/A
2001	N/A	0.133456E+03	N/A
2002	N/A	0.119355E+03	N/A
2003	N/A	0.143942E+03	N/A
2004	N/A	0.191710E+03	N/A
2005	N/A	0.491995E+02	N/A
2006	N/A	0.523244E+02	N/A
2007	N/A	0.472596E+02	N/A
2008	N/A	0.142534E+03	N/A

Survey Index: 6 Tag: USsearly AGE = 6
 Time = JAN-1 Type = NUMBER
 Catchability = 0.720239E-01 % Variance Contribution = 2.3385
 Residual = LN(Observed) - LN(Predicted)

Year	Observed	Predicted	Residual
1973	0.210237E+03	0.216990E+03	-0.316145E-01
1974	0.273813E+03	0.172241E+03	0.463553E+00
1975	0.862890E+02	0.123057E+03	-0.354946E+00
1976	0.108419E+03	0.112494E+03	-0.369004E-01
1977	0.128120E+02	0.612415E+02	-0.156444E+01
1978	0.766800E+01	0.268954E+02	-0.125490E+01
1979	0.887150E+02	0.402845E+02	0.789463E+00
1980	0.353310E+02	0.172269E+02	0.718290E+00
1981	0.568790E+02	0.159495E+02	0.127150E+01
1982	N/A	0.112316E+02	N/A
1983	N/A	0.248123E+02	N/A
1984	N/A	0.350759E+02	N/A
1985	N/A	0.979108E+01	N/A
1986	N/A	0.161171E+02	N/A
1987	N/A	0.144777E+02	N/A
1988	N/A	0.523051E+01	N/A
1989	N/A	0.394296E+01	N/A
1990	N/A	0.335652E+01	N/A
1991	N/A	0.749242E+01	N/A
1992	N/A	0.471472E+01	N/A
1993	N/A	0.910829E+01	N/A
1994	N/A	0.132350E+02	N/A
1995	N/A	0.476705E+01	N/A
1996	N/A	0.502483E+01	N/A
1997	N/A	0.177382E+02	N/A
1998	N/A	0.236209E+02	N/A
1999	N/A	0.486333E+02	N/A
2000	N/A	0.670709E+02	N/A
2001	N/A	0.661418E+02	N/A
2002	N/A	0.803555E+02	N/A
2003	N/A	0.120890E+03	N/A
2004	N/A	0.133758E+03	N/A
2005	N/A	0.201861E+02	N/A
2006	N/A	0.284291E+02	N/A
2007	N/A	0.181384E+02	N/A
2008	N/A	0.385756E+02	N/A

Survey Index: 7 Tag: USspr AGE = 1
 Time = JAN-1 Type = NUMBER
 Catchability = 0.423531E-02 % Variance Contribution = 1.1088
 Residual = LN(Observed) - LN(Predicted)

Year	Observed	Predicted	Residual
1973	N/A	0.124450E+03	N/A
1974	N/A	0.221015E+03	N/A
1975	N/A	0.299148E+03	N/A
1976	N/A	0.104742E+03	N/A
1977	N/A	0.731996E+02	N/A
1978	N/A	0.230557E+03	N/A
1979	N/A	0.108036E+03	N/A
1980	N/A	0.101790E+03	N/A
1981	N/A	0.266810E+03	N/A
1982	0.440660E+02	0.967593E+02	-0.786538E+00
1983	N/A	0.278731E+02	N/A
1984	N/A	0.459256E+02	N/A
1985	0.106381E+03	0.709365E+02	0.405242E+00
1986	0.265950E+02	0.358873E+02	-0.299660E+00
1987	0.265950E+02	0.389366E+02	-0.381212E+00
1988	0.755150E+02	0.967385E+02	-0.247680E+00
1989	0.452310E+02	0.409175E+02	0.100224E+00
1990	N/A	0.475071E+02	N/A
1991	0.422513E+03	0.955348E+02	0.148673E+01
1992	N/A	0.741935E+02	N/A
1993	0.447460E+02	0.590336E+02	-0.277106E+00
1994	N/A	0.558203E+02	N/A
1995	N/A	0.494351E+02	N/A
1996	N/A	0.570503E+02	N/A
1997	N/A	0.838638E+02	N/A
1998	N/A	0.948782E+02	N/A
1999	N/A	0.104037E+03	N/A
2000	N/A	0.841959E+02	N/A
2001	N/A	0.945791E+02	N/A
2002	N/A	0.658454E+02	N/A
2003	N/A	0.498502E+02	N/A
2004	N/A	0.443506E+02	N/A
2005	N/A	0.611376E+02	N/A
2006	N/A	0.209383E+03	N/A
2007	N/A	0.778143E+02	N/A
2008	N/A	0.000000E+00	N/A

Survey Index: 8 Tag: USspr AGE = 2
 Time = JAN-1 Type = NUMBER
 Catchability = 0.455643E-01 % Variance Contribution = 4.3332
 Residual = LN(Observed) - LN(Predicted)

Year	Observed	Predicted	Residual
1973	N/A	0.110138E+04	N/A
1974	N/A	0.108137E+04	N/A
1975	N/A	0.184935E+04	N/A
1976	N/A	0.244433E+04	N/A
1977	N/A	0.896445E+03	N/A
1978	N/A	0.629198E+03	N/A
1979	N/A	0.162226E+04	N/A
1980	N/A	0.938393E+03	N/A
1981	N/A	0.883491E+03	N/A
1982	0.365654E+04	0.234566E+04	0.443952E+00
1983	0.181002E+04	0.763376E+03	0.863344E+00
1984	0.902680E+02	0.216641E+03	-0.875457E+00
1985	0.213421E+04	0.383365E+03	0.171686E+01
1986	0.175305E+04	0.584919E+03	0.109764E+01
1987	0.732820E+02	0.308741E+03	-0.143819E+01
1988	0.266922E+03	0.336521E+03	-0.231703E+00
1989	0.391259E+03	0.831547E+03	-0.753919E+00
1990	0.636730E+02	0.352595E+03	-0.171156E+01
1991	N/A	0.408957E+03	N/A
1992	0.198774E+04	0.814190E+03	0.892562E+00
1993	0.281093E+03	0.554417E+03	-0.679231E+00
1994	0.602273E+03	0.306438E+03	0.675696E+00
1995	N/A	0.488738E+03	N/A
1996	N/A	0.433497E+03	N/A
1997	N/A	0.498362E+03	N/A
1998	N/A	0.735311E+03	N/A
1999	N/A	0.828757E+03	N/A
2000	N/A	0.913885E+03	N/A
2001	N/A	0.736178E+03	N/A
2002	N/A	0.825819E+03	N/A
2003	N/A	0.571251E+03	N/A
2004	N/A	0.432512E+03	N/A
2005	N/A	0.388012E+03	N/A
2006	N/A	0.536038E+03	N/A
2007	N/A	0.183792E+04	N/A
2008	N/A	0.683211E+03	N/A

Survey Index: 9 Tag: USspr AGE = 3
Time = JAN-1 Type = NUMBER
Catchability = 0.954470E-01 % Variance Contribution = 1.3029
Residual = LN(Observed) - LN(Predicted)

Year	Observed	Predicted	Residual
1973	N/A	0.281723E+04	N/A
1974	N/A	0.144473E+04	N/A
1975	N/A	0.104327E+04	N/A
1976	N/A	0.940343E+03	N/A
1977	N/A	0.148461E+04	N/A
1978	N/A	0.762355E+03	N/A
1979	N/A	0.775383E+03	N/A
1980	N/A	0.188139E+04	N/A
1981	N/A	0.126637E+04	N/A
1982	0.109652E+04	0.142075E+04	-0.259047E+00
1983	0.264777E+04	0.247559E+04	0.672392E-01
1984	0.806007E+03	0.627920E+03	0.249679E+00
1985	0.254401E+03	0.199363E+03	0.243786E+00
1986	0.282646E+03	0.285524E+03	-0.101319E-01
1987	0.132976E+03	0.458238E+03	-0.123722E+01
1988	0.355249E+03	0.249819E+03	0.352081E+00
1989	0.737675E+03	0.320767E+03	0.832789E+00
1990	0.107468E+04	0.123903E+04	-0.142308E+00
1991	0.246927E+03	0.423491E+03	-0.539439E+00
1992	0.184069E+04	0.688690E+03	0.983106E+00
1993	0.485798E+03	0.616500E+03	-0.238265E+00
1994	0.614697E+03	0.831640E+03	-0.302270E+00
1995	N/A	0.410814E+03	N/A
1996	N/A	0.811268E+03	N/A
1997	N/A	0.684846E+03	N/A
1998	N/A	0.757290E+03	N/A
1999	N/A	0.108982E+04	N/A
2000	N/A	0.118473E+04	N/A
2001	N/A	0.123557E+04	N/A
2002	N/A	0.101487E+04	N/A
2003	N/A	0.105862E+04	N/A
2004	N/A	0.644163E+03	N/A
2005	N/A	0.638466E+03	N/A
2006	N/A	0.534131E+03	N/A
2007	N/A	0.807476E+03	N/A
2008	N/A	0.302604E+04	N/A

Survey Index: 10 Tag: USspr AGE = 4
 Time = JAN-1 Type = NUMBER
 Catchability = 0.152428E+00 % Variance Contribution = 0.8905
 Residual = LN(Observed) - LN(Predicted)

Year	Observed	Predicted	Residual
1973	N/A	0.263699E+04	N/A
1974	N/A	0.183697E+04	N/A
1975	N/A	0.763734E+03	N/A
1976	N/A	0.369706E+03	N/A
1977	N/A	0.483399E+03	N/A
1978	N/A	0.516762E+03	N/A
1979	N/A	0.376140E+03	N/A
1980	N/A	0.498109E+03	N/A
1981	N/A	0.114302E+04	N/A
1982	0.992464E+03	0.843737E+03	0.162350E+00
1983	0.514431E+03	0.840965E+03	-0.491489E+00
1984	0.837941E+03	0.986447E+03	-0.163161E+00
1985	0.273425E+03	0.210140E+03	0.263251E+00
1986	0.546460E+02	0.116947E+03	-0.760843E+00
1987	0.129287E+03	0.219433E+03	-0.529013E+00
1988	0.234697E+03	0.175722E+03	0.289393E+00
1989	0.280996E+03	0.117539E+03	0.871569E+00
1990	0.358355E+03	0.266261E+03	0.297046E+00
1991	0.665072E+03	0.670586E+03	-0.825684E-02
1992	0.621782E+03	0.349942E+03	0.574822E+00
1993	0.307882E+03	0.495327E+03	-0.475501E+00
1994	0.343601E+03	0.354124E+03	-0.301674E-01
1995	N/A	0.240216E+03	N/A
1996	N/A	0.340991E+03	N/A
1997	N/A	0.777954E+03	N/A
1998	N/A	0.644502E+03	N/A
1999	N/A	0.528489E+03	N/A
2000	N/A	0.852210E+03	N/A
2001	N/A	0.771257E+03	N/A
2002	N/A	0.671340E+03	N/A
2003	N/A	0.855855E+03	N/A
2004	N/A	0.742247E+03	N/A
2005	N/A	0.410777E+03	N/A
2006	N/A	0.281992E+03	N/A
2007	N/A	0.466178E+03	N/A
2008	N/A	0.813811E+03	N/A

Survey Index: 11 Tag: USspr AGE = 5
Time = JAN-1 Type = NUMBER
Catchability = 0.228532E+00 % Variance Contribution = 2.0826
Residual = LN(Observed) - LN(Predicted)

Year	Observed	Predicted	Residual
1973	N/A	0.159204E+04	N/A
1974	N/A	0.131005E+04	N/A
1975	N/A	0.703553E+03	N/A
1976	N/A	0.223241E+03	N/A
1977	N/A	0.164327E+03	N/A
1978	N/A	0.218408E+03	N/A
1979	N/A	0.245328E+03	N/A
1980	N/A	0.170828E+03	N/A
1981	N/A	0.297587E+03	N/A
1982	0.444546E+03	0.407418E+03	0.872126E-01
1983	0.119581E+03	0.346084E+03	-0.106269E+01
1984	0.810375E+03	0.526801E+03	0.430674E+00
1985	0.143361E+03	0.198876E+03	-0.327314E+00
1986	0.132879E+03	0.918170E+02	0.369642E+00
1987	0.509580E+02	0.643396E+02	-0.233174E+00
1988	0.193154E+03	0.706827E+02	0.100529E+01
1989	0.593050E+02	0.453113E+02	0.269138E+00
1990	0.112204E+03	0.572094E+02	0.673600E+00
1991	0.255469E+03	0.127949E+03	0.691466E+00
1992	0.159959E+03	0.214816E+03	-0.294863E+00
1993	0.260130E+02	0.131250E+03	-0.161851E+01
1994	0.140449E+03	0.139117E+03	0.952951E-02
1995	N/A	0.697265E+02	N/A
1996	N/A	0.116228E+03	N/A
1997	N/A	0.237571E+03	N/A
1998	N/A	0.574832E+03	N/A
1999	N/A	0.406263E+03	N/A
2000	N/A	0.332734E+03	N/A
2001	N/A	0.401231E+03	N/A
2002	N/A	0.358836E+03	N/A
2003	N/A	0.432756E+03	N/A
2004	N/A	0.576371E+03	N/A
2005	N/A	0.147917E+03	N/A
2006	N/A	0.157312E+03	N/A
2007	N/A	0.142085E+03	N/A
2008	N/A	0.428524E+03	N/A

Survey Index: 12 Tag: USspr AGE = 6
 Time = JAN-1 Type = NUMBER
 Catchability = 0.422932E+00 % Variance Contribution = 1.7526
 Residual = LN(Observed) - LN(Predicted)

Year	Observed	Predicted	Residual
1973	N/A	0.127419E+04	N/A
1974	N/A	0.101142E+04	N/A
1975	N/A	0.722605E+03	N/A
1976	N/A	0.660580E+03	N/A
1977	N/A	0.359617E+03	N/A
1978	N/A	0.157933E+03	N/A
1979	N/A	0.236555E+03	N/A
1980	N/A	0.101158E+03	N/A
1981	N/A	0.936574E+02	N/A
1982	0.883270E+02	0.659533E+02	0.292099E+00
1983	0.237318E+03	0.145701E+03	0.487846E+00
1984	0.236541E+03	0.205970E+03	0.138392E+00
1985	N/A	0.574943E+02	N/A
1986	0.531900E+02	0.946416E+02	-0.576227E+00
1987	0.531900E+02	0.850147E+02	-0.468953E+00
1988	0.265950E+02	0.307142E+02	-0.144000E+00
1989	0.434840E+02	0.231535E+02	0.630248E+00
1990	0.100751E+03	0.197099E+02	0.163153E+01
1991	0.199950E+02	0.439963E+02	-0.788624E+00
1992	0.166950E+02	0.276853E+02	-0.505793E+00
1993	N/A	0.534849E+02	N/A
1994	0.387280E+02	0.777176E+02	-0.696519E+00
1995	N/A	0.279926E+02	N/A
1996	N/A	0.295064E+02	N/A
1997	N/A	0.104161E+03	N/A
1998	N/A	0.138705E+03	N/A
1999	N/A	0.285580E+03	N/A
2000	N/A	0.393848E+03	N/A
2001	N/A	0.388392E+03	N/A
2002	N/A	0.471856E+03	N/A
2003	N/A	0.709879E+03	N/A
2004	N/A	0.785444E+03	N/A
2005	N/A	0.118535E+03	N/A
2006	N/A	0.166939E+03	N/A
2007	N/A	0.106511E+03	N/A
2008	N/A	0.226520E+03	N/A

Survey Index: 13 Tag: USspr95 AGE = 1
 Time = JAN-1 Type = NUMBER
 Catchability = 0.458156E-02 % Variance Contribution = 2.5795
 Residual = LN(Observed) - LN(Predicted)

Year	Observed	Predicted	Residual
1973	N/A	0.134624E+03	N/A
1974	N/A	0.239084E+03	N/A
1975	N/A	0.323604E+03	N/A
1976	N/A	0.113305E+03	N/A
1977	N/A	0.791839E+02	N/A
1978	N/A	0.249406E+03	N/A
1979	N/A	0.116868E+03	N/A
1980	N/A	0.110111E+03	N/A
1981	N/A	0.288623E+03	N/A
1982	N/A	0.104670E+03	N/A
1983	N/A	0.301518E+02	N/A
1984	N/A	0.496801E+02	N/A
1985	N/A	0.767358E+02	N/A
1986	N/A	0.388212E+02	N/A
1987	N/A	0.421198E+02	N/A
1988	N/A	0.104647E+03	N/A
1989	N/A	0.442627E+02	N/A
1990	N/A	0.513910E+02	N/A
1991	N/A	0.103345E+03	N/A
1992	N/A	0.802591E+02	N/A
1993	N/A	0.638598E+02	N/A
1994	N/A	0.603837E+02	N/A
1995	0.390190E+02	0.534766E+02	-0.315195E+00
1996	0.243630E+02	0.617144E+02	-0.929451E+00
1997	0.181510E+02	0.907200E+02	-0.160905E+01
1998	N/A	0.102635E+03	N/A
1999	0.487250E+02	0.112542E+03	-0.837133E+00
2000	0.177333E+03	0.910792E+02	0.666300E+00
2001	N/A	0.102311E+03	N/A
2002	0.182380E+03	0.712285E+02	0.940199E+00
2003	0.196066E+03	0.539257E+02	0.129084E+01
2004	0.470750E+02	0.479764E+02	-0.189662E-01
2005	N/A	0.661358E+02	N/A
2006	0.493466E+03	0.226500E+03	0.778708E+00
2007	0.870650E+02	0.841759E+02	0.337463E-01
2008	N/A	0.000000E+00	N/A

Survey Index: 14 Tag: USspr95 AGE = 2
 Time = JAN-1 Type = NUMBER
 Catchability = 0.143683E+00 % Variance Contribution = 0.7884
 Residual = LN(Observed) - LN(Predicted)

Year	Observed	Predicted	Residual
1973	N/A	0.347311E+04	N/A
1974	N/A	0.341001E+04	N/A
1975	N/A	0.583176E+04	N/A
1976	N/A	0.770796E+04	N/A
1977	N/A	0.282686E+04	N/A
1978	N/A	0.198412E+04	N/A
1979	N/A	0.511564E+04	N/A
1980	N/A	0.295914E+04	N/A
1981	N/A	0.278601E+04	N/A
1982	N/A	0.739681E+04	N/A
1983	N/A	0.240723E+04	N/A
1984	N/A	0.683156E+03	N/A
1985	N/A	0.120891E+04	N/A
1986	N/A	0.184449E+04	N/A
1987	N/A	0.973585E+03	N/A
1988	N/A	0.106119E+04	N/A
1989	N/A	0.262221E+04	N/A
1990	N/A	0.111187E+04	N/A
1991	N/A	0.128961E+04	N/A
1992	N/A	0.256747E+04	N/A
1993	N/A	0.174830E+04	N/A
1994	N/A	0.966323E+03	N/A
1995	0.114456E+04	0.154119E+04	-0.297533E+00
1996	0.958104E+03	0.136699E+04	-0.355412E+00
1997	0.113447E+04	0.157154E+04	-0.325893E+00
1998	0.202007E+04	0.231873E+04	-0.137892E+00
1999	0.460630E+04	0.261341E+04	0.566768E+00
2000	0.467764E+04	0.288185E+04	0.484359E+00
2001	0.224671E+04	0.232147E+04	-0.327356E-01
2002	0.234154E+04	0.260414E+04	-0.106297E+00
2003	0.424144E+04	0.180139E+04	0.856345E+00
2004	0.957327E+03	0.136389E+04	-0.353949E+00
2005	0.195348E+04	0.122356E+04	0.467847E+00
2006	0.907826E+03	0.169035E+04	-0.621637E+00
2007	0.489972E+04	0.579571E+04	-0.167941E+00
2008	0.220671E+04	0.215444E+04	0.239702E-01

Survey Index: 15 Tag: USspr95 AGE = 3
 Time = JAN-1 Type = NUMBER
 Catchability = 0.499530E+00 % Variance Contribution = 1.8724
 Residual = LN(Observed) - LN(Predicted)

Year	Observed	Predicted	Residual
1973	N/A	0.147442E+05	N/A
1974	N/A	0.756112E+04	N/A
1975	N/A	0.546005E+04	N/A
1976	N/A	0.492136E+04	N/A
1977	N/A	0.776980E+04	N/A
1978	N/A	0.398984E+04	N/A
1979	N/A	0.405803E+04	N/A
1980	N/A	0.984639E+04	N/A
1981	N/A	0.662765E+04	N/A
1982	N/A	0.743560E+04	N/A
1983	N/A	0.129562E+05	N/A
1984	N/A	0.328627E+04	N/A
1985	N/A	0.104338E+04	N/A
1986	N/A	0.149431E+04	N/A
1987	N/A	0.239822E+04	N/A
1988	N/A	0.130745E+04	N/A
1989	N/A	0.167876E+04	N/A
1990	N/A	0.648455E+04	N/A
1991	N/A	0.221637E+04	N/A
1992	N/A	0.360431E+04	N/A
1993	N/A	0.322650E+04	N/A
1994	N/A	0.435245E+04	N/A
1995	0.467036E+04	0.215002E+04	0.775756E+00
1996	0.254857E+04	0.424583E+04	-0.510405E+00
1997	0.362305E+04	0.358419E+04	0.107832E-01
1998	0.102216E+04	0.396334E+04	-0.135516E+01
1999	0.105017E+05	0.570365E+04	0.610428E+00
2000	0.744052E+04	0.620038E+04	0.182330E+00
2001	0.637050E+04	0.646645E+04	-0.149494E-01
2002	0.119711E+05	0.531142E+04	0.812636E+00
2003	0.656492E+04	0.554036E+04	0.169680E+00
2004	0.211441E+04	0.337128E+04	-0.466516E+00
2005	0.493097E+04	0.334146E+04	0.389128E+00
2006	0.341922E+04	0.279542E+04	0.201431E+00
2007	0.607912E+04	0.422599E+04	0.363607E+00
2008	0.492146E+04	0.158370E+05	-0.116875E+01

Survey Index: 16 Tag: USspr95 AGE = 4
 Time = JAN-1 Type = NUMBER
 Catchability = 0.593361E+00 % Variance Contribution = 1.6588
 Residual = LN(Observed) - LN(Predicted)

Year	Observed	Predicted	Residual
1973	N/A	0.102651E+05	N/A
1974	N/A	0.715087E+04	N/A
1975	N/A	0.297302E+04	N/A
1976	N/A	0.143917E+04	N/A
1977	N/A	0.188175E+04	N/A
1978	N/A	0.201162E+04	N/A
1979	N/A	0.146422E+04	N/A
1980	N/A	0.193901E+04	N/A
1981	N/A	0.444947E+04	N/A
1982	N/A	0.328445E+04	N/A
1983	N/A	0.327366E+04	N/A
1984	N/A	0.383998E+04	N/A
1985	N/A	0.818023E+03	N/A
1986	N/A	0.455244E+03	N/A
1987	N/A	0.854197E+03	N/A
1988	N/A	0.684040E+03	N/A
1989	N/A	0.457549E+03	N/A
1990	N/A	0.103649E+04	N/A
1991	N/A	0.261042E+04	N/A
1992	N/A	0.136223E+04	N/A
1993	N/A	0.192818E+04	N/A
1994	N/A	0.137852E+04	N/A
1995	0.144167E+04	0.935099E+03	0.432905E+00
1996	0.262176E+04	0.132739E+04	0.680630E+00
1997	0.396073E+04	0.302838E+04	0.268403E+00
1998	0.112340E+04	0.250888E+04	-0.803476E+00
1999	0.264049E+04	0.205727E+04	0.249583E+00
2000	0.282850E+04	0.331743E+04	-0.159446E+00
2001	0.233998E+04	0.300231E+04	-0.249237E+00
2002	0.395840E+04	0.261335E+04	0.415206E+00
2003	0.279191E+04	0.333162E+04	-0.176735E+00
2004	0.659928E+03	0.288937E+04	-0.147666E+01
2005	0.233270E+04	0.159905E+04	0.377619E+00
2006	0.211266E+04	0.109772E+04	0.654710E+00
2007	0.276230E+04	0.181471E+04	0.420138E+00
2008	0.168110E+04	0.316796E+04	-0.633636E+00

Survey Index: 17 Tag: USspr95 AGE = 5
 Time = JAN-1 Type = NUMBER
 Catchability = 0.480729E+00 % Variance Contribution = 3.0452
 Residual = LN(Observed) - LN(Predicted)

Year	Observed	Predicted	Residual
1973	N/A	0.334894E+04	N/A
1974	N/A	0.275576E+04	N/A
1975	N/A	0.147996E+04	N/A
1976	N/A	0.469600E+03	N/A
1977	N/A	0.345672E+03	N/A
1978	N/A	0.459433E+03	N/A
1979	N/A	0.516061E+03	N/A
1980	N/A	0.359345E+03	N/A
1981	N/A	0.625990E+03	N/A
1982	N/A	0.857027E+03	N/A
1983	N/A	0.728007E+03	N/A
1984	N/A	0.110815E+04	N/A
1985	N/A	0.418346E+03	N/A
1986	N/A	0.193142E+03	N/A
1987	N/A	0.135342E+03	N/A
1988	N/A	0.148685E+03	N/A
1989	N/A	0.953147E+02	N/A
1990	N/A	0.120343E+03	N/A
1991	N/A	0.269148E+03	N/A
1992	N/A	0.451876E+03	N/A
1993	N/A	0.276092E+03	N/A
1994	N/A	0.292640E+03	N/A
1995	0.621491E+03	0.146674E+03	0.144391E+01
1996	0.591596E+03	0.244492E+03	0.883642E+00
1997	0.682349E+03	0.499744E+03	0.311446E+00
1998	0.737093E+03	0.120919E+04	-0.494993E+00
1999	0.157523E+04	0.854597E+03	0.611525E+00
2000	0.789215E+03	0.699924E+03	0.120066E+00
2001	0.469200E+03	0.844011E+03	-0.587137E+00
2002	0.169034E+04	0.754831E+03	0.806192E+00
2003	0.428628E+03	0.910325E+03	-0.753212E+00
2004	0.247704E+03	0.121243E+04	-0.158815E+01
2005	0.261778E+03	0.311151E+03	-0.172781E+00
2006	0.307688E+03	0.330914E+03	-0.727716E-01
2007	0.539959E+03	0.298882E+03	0.591443E+00
2008	0.300302E+03	0.901424E+03	-0.109919E+01

Survey Index: 18 Tag: USspr95 AGE = 6
 Time = JAN-1 Type = NUMBER
 Catchability = 0.391240E+00 % Variance Contribution = 3.3145
 Residual = LN(Observed) - LN(Predicted)

Year	Observed	Predicted	Residual
1973	N/A	0.117871E+04	N/A
1974	N/A	0.935626E+03	N/A
1975	N/A	0.668457E+03	N/A
1976	N/A	0.611079E+03	N/A
1977	N/A	0.332669E+03	N/A
1978	N/A	0.146098E+03	N/A
1979	N/A	0.218829E+03	N/A
1980	N/A	0.935779E+02	N/A
1981	N/A	0.866392E+02	N/A
1982	N/A	0.610111E+02	N/A
1983	N/A	0.134783E+03	N/A
1984	N/A	0.190535E+03	N/A
1985	N/A	0.531860E+02	N/A
1986	N/A	0.875497E+02	N/A
1987	N/A	0.786441E+02	N/A
1988	N/A	0.284126E+02	N/A
1989	N/A	0.214185E+02	N/A
1990	N/A	0.182329E+02	N/A
1991	N/A	0.406995E+02	N/A
1992	N/A	0.256107E+02	N/A
1993	N/A	0.494770E+02	N/A
1994	N/A	0.718939E+02	N/A
1995	0.951200E+01	0.258950E+02	-0.100150E+01
1996	0.561990E+02	0.272953E+02	0.722184E+00
1997	0.129676E+03	0.963555E+02	0.296995E+00
1998	0.339622E+03	0.128311E+03	0.973378E+00
1999	0.756311E+03	0.264180E+03	0.105182E+01
2000	0.508413E+03	0.364335E+03	0.333220E+00
2001	0.439693E+03	0.359288E+03	0.201953E+00
2002	0.845414E+03	0.436498E+03	0.661043E+00
2003	0.836873E+03	0.656684E+03	0.242469E+00
2004	0.263816E+03	0.726587E+03	-0.101311E+01
2005	0.111428E+03	0.109653E+03	0.160620E-01
2006	0.797850E+02	0.154429E+03	-0.660400E+00
2007	0.125211E+03	0.985294E+02	0.239645E+00
2008	0.266070E+02	0.209546E+03	-0.206377E+01

Survey Index: 19 Tag: USfall AGE = 1
Time = MEAN Type = NUMBER
Catchability = 0.396438E-01 % Variance Contribution = 8.8749
Residual = LN(Observed) - LN(Predicted)

Year	Observed	Predicted	Residual
1973	0.242045E+04	0.104889E+04	0.836221E+00
1974	0.448671E+04	0.182929E+04	0.897192E+00
1975	0.454864E+04	0.244800E+04	0.619557E+00
1976	0.333507E+03	0.876372E+03	-0.966127E+00
1977	0.906661E+03	0.613733E+03	0.390209E+00
1978	0.462056E+04	0.175844E+04	0.966091E+00
1979	0.128200E+04	0.910384E+03	0.342312E+00
1980	0.743596E+03	0.857446E+03	-0.142460E+00
1981	0.154824E+04	0.226147E+04	-0.378893E+00
1982	0.235328E+04	0.778708E+03	0.110593E+01
1983	0.105701E+03	0.222737E+03	-0.745379E+00
1984	0.641583E+03	0.379680E+03	0.524609E+00
1985	0.131025E+04	0.583018E+03	0.809752E+00
1986	0.273425E+03	0.301017E+03	-0.961395E-01
1987	0.987130E+02	0.327320E+03	-0.119872E+01
1988	0.181510E+02	0.811099E+03	-0.379966E+01
1989	0.241006E+03	0.343481E+03	-0.354311E+00
1990	N/A	0.398600E+03	N/A
1991	0.203880E+04	0.797711E+03	0.938370E+00
1992	0.146759E+03	0.581998E+03	-0.137768E+01
1993	0.814646E+03	0.392382E+03	0.730517E+00
1994	0.115980E+04	0.472195E+03	0.898611E+00
1995	N/A	0.418492E+03	N/A
1996	N/A	0.482066E+03	N/A
1997	N/A	0.709904E+03	N/A
1998	N/A	0.801682E+03	N/A
1999	N/A	0.881459E+03	N/A
2000	N/A	0.711762E+03	N/A
2001	N/A	0.799003E+03	N/A
2002	N/A	0.554541E+03	N/A
2003	N/A	0.419846E+03	N/A
2004	N/A	0.375030E+03	N/A
2005	N/A	0.517523E+03	N/A
2006	N/A	0.177338E+04	N/A
2007	N/A	0.659135E+03	N/A
2008	N/A	0.000000E+00	N/A

Survey Index: 20 Tag: USfall AGE = 2
Time = MEAN Type = NUMBER
Catchability = 0.875114E-01 % Variance Contribution = 4.0246
Residual = LN(Observed) - LN(Predicted)

Year	Observed	Predicted	Residual
1973	0.533601E+04	0.168924E+04	0.115020E+01
1974	0.277948E+04	0.144504E+04	0.654125E+00
1975	0.243734E+04	0.189980E+04	0.249156E+00
1976	0.186389E+04	0.269245E+04	-0.367785E+00
1977	0.214712E+04	0.113454E+04	0.637903E+00
1978	0.124327E+04	0.937787E+03	0.281980E+00
1979	0.200851E+04	0.235222E+04	-0.157964E+00
1980	0.496999E+04	0.145827E+04	0.122617E+01
1981	0.227942E+04	0.149106E+04	0.424433E+00
1982	0.212033E+04	0.326072E+04	-0.430376E+00
1983	0.221642E+04	0.952557E+03	0.844499E+00
1984	0.388056E+03	0.283621E+03	0.313511E+00
1985	0.527535E+03	0.458860E+03	0.139469E+00
1986	0.107506E+04	0.715039E+03	0.407798E+00
1987	0.388832E+03	0.382589E+03	0.161869E-01
1988	0.206743E+03	0.447335E+03	-0.771832E+00
1989	0.193407E+04	0.135348E+04	0.356943E+00
1990	0.359228E+03	0.519416E+03	-0.368747E+00
1991	0.267019E+03	0.705641E+03	-0.971786E+00
1992	0.383882E+03	0.981248E+03	-0.938490E+00
1993	0.135208E+03	0.905260E+03	-0.190141E+01
1994	0.214605E+03	0.474748E+03	-0.793985E+00
1995	N/A	0.837472E+03	N/A
1996	N/A	0.725437E+03	N/A
1997	N/A	0.818725E+03	N/A
1998	N/A	0.119384E+04	N/A
1999	N/A	0.132292E+04	N/A
2000	N/A	0.142139E+04	N/A
2001	N/A	0.115540E+04	N/A
2002	N/A	0.125325E+04	N/A
2003	N/A	0.817901E+03	N/A
2004	N/A	0.700895E+03	N/A
2005	N/A	0.608559E+03	N/A
2006	N/A	0.876999E+03	N/A
2007	N/A	0.313704E+04	N/A
2008	N/A	0.000000E+00	N/A

Survey Index: 21 Tag: USfall AGE = 3
Time = MEAN Type = NUMBER
Catchability = 0.150362E+00 % Variance Contribution = 1.6776
Residual = LN(Observed) - LN(Predicted)

Year	Observed	Predicted	Residual
1973	0.495446E+04	0.293164E+04	0.524725E+00
1974	0.147157E+04	0.137717E+04	0.662987E-01
1975	0.851723E+03	0.849413E+03	0.271566E-02
1976	0.460270E+03	0.886190E+03	-0.655118E+00
1977	0.157280E+04	0.120057E+04	0.270058E+00
1978	0.757185E+03	0.706581E+03	0.691704E-01
1979	0.253721E+03	0.801768E+03	-0.115058E+01
1980	0.591198E+04	0.190004E+04	0.113511E+01
1981	0.159280E+04	0.132999E+04	0.180316E+00
1982	0.154339E+04	0.141923E+04	0.838664E-01
1983	0.185846E+04	0.210829E+04	-0.126132E+00
1984	0.296720E+03	0.500332E+03	-0.522483E+00
1985	0.165880E+03	0.198400E+03	-0.179021E+00
1986	0.338651E+03	0.319032E+03	0.596788E-01
1987	0.384562E+03	0.384508E+03	0.139552E-03
1988	0.103954E+03	0.227157E+03	-0.781691E+00
1989	0.750390E+03	0.370846E+03	0.704806E+00
1990	0.142992E+04	0.119255E+04	0.181530E+00
1991	0.426201E+03	0.488621E+03	-0.136675E+00
1992	0.690988E+03	0.747543E+03	-0.786689E-01
1993	0.568786E+03	0.608172E+03	-0.669538E-01
1994	0.954124E+03	0.627584E+03	0.418915E+00
1995	N/A	0.474941E+03	N/A
1996	N/A	0.100111E+04	N/A
1997	N/A	0.837880E+03	N/A
1998	N/A	0.811343E+03	N/A
1999	N/A	0.122705E+04	N/A
2000	N/A	0.123199E+04	N/A
2001	N/A	0.119114E+04	N/A
2002	N/A	0.118164E+04	N/A
2003	N/A	0.113648E+04	N/A
2004	N/A	0.664002E+03	N/A
2005	N/A	0.566115E+03	N/A
2006	N/A	0.631553E+03	N/A
2007	N/A	0.101948E+04	N/A
2008	N/A	0.000000E+00	N/A

Survey Index: 22 Tag: USfall AGE = 4
Time = MEAN Type = NUMBER
Catchability = 0.156082E+00 % Variance Contribution = 2.9035
Residual = LN(Observed) - LN(Predicted)

Year	Observed	Predicted	Residual
1973	0.285742E+04	0.163457E+04	0.558540E+00
1974	0.102906E+04	0.102622E+04	0.275752E-02
1975	0.555198E+03	0.385073E+03	0.365892E+00
1976	0.113563E+03	0.219058E+03	-0.656978E+00
1977	0.615376E+03	0.288313E+03	0.758186E+00
1978	0.399218E+03	0.314441E+03	0.238712E+00
1979	0.116669E+03	0.224808E+03	-0.655906E+00
1980	0.661966E+03	0.333449E+03	0.685723E+00
1981	0.570533E+03	0.621036E+03	-0.848179E-01
1982	0.410380E+03	0.484203E+03	-0.165421E+00
1983	0.495698E+03	0.574455E+03	-0.147454E+00
1984	0.235959E+03	0.435737E+03	-0.613380E+00
1985	0.491140E+02	0.123661E+03	-0.923400E+00
1986	0.719230E+02	0.756168E+02	-0.500827E-01
1987	0.514430E+02	0.114719E+03	-0.802016E+00
1988	0.265950E+02	0.846364E+02	-0.115764E+01
1989	0.765820E+02	0.722503E+02	0.582258E-01
1990	0.285849E+03	0.162817E+03	0.562834E+00
1991	0.347193E+03	0.349853E+03	-0.763365E-02
1992	0.157144E+03	0.193910E+03	-0.210232E+00
1993	0.520352E+03	0.246099E+03	0.748772E+00
1994	0.692153E+03	0.155165E+03	0.149532E+01
1995	N/A	0.147302E+03	N/A
1996	N/A	0.243889E+03	N/A
1997	N/A	0.570976E+03	N/A
1998	N/A	0.441433E+03	N/A
1999	N/A	0.361787E+03	N/A
2000	N/A	0.516809E+03	N/A
2001	N/A	0.465475E+03	N/A
2002	N/A	0.464256E+03	N/A
2003	N/A	0.603154E+03	N/A
2004	N/A	0.326567E+03	N/A
2005	N/A	0.229472E+03	N/A
2006	N/A	0.175812E+03	N/A
2007	N/A	0.377514E+03	N/A
2008	N/A	0.000000E+00	N/A

Survey Index: 23 Tag: USfall AGE = 5
Time = MEAN Type = NUMBER
Catchability = 0.204982E+00 % Variance Contribution = 3.5899
Residual = LN(Observed) - LN(Predicted)

Year	Observed	Predicted	Residual
1973	0.118115E+04	0.864424E+03	0.312184E+00
1974	0.444255E+03	0.641070E+03	-0.366740E+00
1975	0.324383E+03	0.310725E+03	0.430163E-01
1976	0.118513E+03	0.115866E+03	0.225893E-01
1977	0.102304E+03	0.858513E+02	0.175332E+00
1978	0.131617E+03	0.116411E+03	0.122766E+00
1979	0.134335E+03	0.128436E+03	0.449021E-01
1980	0.212276E+03	0.100171E+03	0.751009E+00
1981	0.763880E+02	0.141631E+03	-0.617397E+00
1982	0.865800E+02	0.204805E+03	-0.860989E+00
1983	0.298950E+02	0.207080E+03	-0.193541E+01
1984	0.727000E+02	0.203834E+03	-0.103096E+01
1985	0.783290E+02	0.102514E+03	-0.269082E+00
1986	N/A	0.520034E+02	N/A
1987	0.770680E+02	0.294640E+02	0.961518E+00
1988	N/A	0.298211E+02	N/A
1989	0.539670E+02	0.243973E+02	0.793899E+00
1990	N/A	0.306435E+02	N/A
1991	N/A	0.584721E+02	N/A
1992	0.139382E+03	0.104267E+03	0.290259E+00
1993	N/A	0.571212E+02	N/A
1994	0.254886E+03	0.533944E+02	0.156311E+01
1995	N/A	0.374527E+02	N/A
1996	N/A	0.728180E+02	N/A
1997	N/A	0.152734E+03	N/A
1998	N/A	0.344874E+03	N/A
1999	N/A	0.243615E+03	N/A
2000	N/A	0.176750E+03	N/A
2001	N/A	0.212114E+03	N/A
2002	N/A	0.217365E+03	N/A
2003	N/A	0.267147E+03	N/A
2004	N/A	0.222129E+03	N/A
2005	N/A	0.723802E+02	N/A
2006	N/A	0.859112E+02	N/A
2007	N/A	0.100788E+03	N/A
2008	N/A	0.000000E+00	N/A

Survey Index: 24 Tag: USfall AGE = 6
 Time = MEAN Type = NUMBER
 Catchability = 0.306257E+00 % Variance Contribution = 2.7247
 Residual = LN(Observed) - LN(Predicted)

Year	Observed	Predicted	Residual
1973	0.599943E+03	0.558540E+03	0.715090E-01
1974	0.368061E+03	0.399572E+03	-0.821441E-01
1975	0.611490E+02	0.257648E+03	-0.143828E+01
1976	0.972570E+02	0.276792E+03	-0.104591E+01
1977	0.105701E+03	0.151678E+03	-0.361149E+00
1978	0.349430E+02	0.679588E+02	-0.665184E+00
1979	0.108613E+03	0.999816E+02	0.828049E-01
1980	0.250907E+03	0.478886E+02	0.165621E+01
1981	0.528020E+02	0.359859E+02	0.383421E+00
1982	N/A	0.267660E+02	N/A
1983	0.476580E+02	0.703826E+02	-0.389896E+00
1984	0.606640E+02	0.643399E+02	-0.588291E-01
1985	N/A	0.239262E+02	N/A
1986	N/A	0.432751E+02	N/A
1987	N/A	0.314308E+02	N/A
1988	N/A	0.104615E+02	N/A
1989	N/A	0.100647E+02	N/A
1990	N/A	0.852319E+01	N/A
1991	N/A	0.162321E+02	N/A
1992	0.265950E+02	0.108488E+02	0.896673E+00
1993	0.213540E+02	0.187921E+02	0.127803E+00
1994	0.548400E+02	0.240815E+02	0.822977E+00
1995	N/A	0.121388E+02	N/A
1996	N/A	0.149242E+02	N/A
1997	N/A	0.540622E+02	N/A
1998	N/A	0.671827E+02	N/A
1999	N/A	0.138252E+03	N/A
2000	N/A	0.168903E+03	N/A
2001	N/A	0.165765E+03	N/A
2002	N/A	0.230755E+03	N/A
2003	N/A	0.353784E+03	N/A
2004	N/A	0.244380E+03	N/A
2005	N/A	0.468270E+02	N/A
2006	N/A	0.736026E+02	N/A
2007	N/A	0.609960E+02	N/A
2008	N/A	0.000000E+00	N/A

Survey Index: 25 Tag: USfall95 AGE = 1
 Time = MEAN Type = NUMBER
 Catchability = 0.654075E-01 % Variance Contribution = 2.7233
 Residual = LN(Observed) - LN(Predicted)

Year	Observed	Predicted	Residual
1973	N/A	0.173054E+04	N/A
1974	N/A	0.301811E+04	N/A
1975	N/A	0.403890E+04	N/A
1976	N/A	0.144591E+04	N/A
1977	N/A	0.101258E+04	N/A
1978	N/A	0.290121E+04	N/A
1979	N/A	0.150202E+04	N/A
1980	N/A	0.141468E+04	N/A
1981	N/A	0.373115E+04	N/A
1982	N/A	0.128477E+04	N/A
1983	N/A	0.367490E+03	N/A
1984	N/A	0.626426E+03	N/A
1985	N/A	0.961910E+03	N/A
1986	N/A	0.496642E+03	N/A
1987	N/A	0.540038E+03	N/A
1988	N/A	0.133822E+04	N/A
1989	N/A	0.566703E+03	N/A
1990	N/A	0.657642E+03	N/A
1991	N/A	0.131613E+04	N/A
1992	N/A	0.960227E+03	N/A
1993	N/A	0.647383E+03	N/A
1994	N/A	0.779065E+03	N/A
1995	0.267698E+03	0.690461E+03	-0.947500E+00
1996	0.144332E+03	0.795351E+03	-0.170667E+01
1997	0.135179E+04	0.117126E+04	0.143352E+00
1998	0.184438E+04	0.132268E+04	0.332485E+00
1999	0.299875E+04	0.145430E+04	0.723669E+00
2000	0.610814E+03	0.117432E+04	-0.653653E+00
2001	0.341417E+04	0.131826E+04	0.951624E+00
2002	0.203142E+04	0.914926E+03	0.797648E+00
2003	0.104527E+04	0.692695E+03	0.411438E+00
2004	0.850268E+03	0.618754E+03	0.317844E+00
2005	0.304000E+03	0.853850E+03	-0.103273E+01
2006	0.601205E+04	0.292587E+04	0.720176E+00
2007	0.102653E+04	0.108749E+04	-0.576878E-01
2008	N/A	0.000000E+00	N/A

Survey Index: 26 Tag: USfall95 AGE = 2
 Time = MEAN Type = NUMBER
 Catchability = 0.212258E+00 % Variance Contribution = 6.1770
 Residual = LN(Observed) - LN(Predicted)

Year	Observed	Predicted	Residual
1973	N/A	0.409724E+04	N/A
1974	N/A	0.350494E+04	N/A
1975	N/A	0.460796E+04	N/A
1976	N/A	0.653051E+04	N/A
1977	N/A	0.275181E+04	N/A
1978	N/A	0.227460E+04	N/A
1979	N/A	0.570529E+04	N/A
1980	N/A	0.353702E+04	N/A
1981	N/A	0.361655E+04	N/A
1982	N/A	0.790885E+04	N/A
1983	N/A	0.231042E+04	N/A
1984	N/A	0.687921E+03	N/A
1985	N/A	0.111296E+04	N/A
1986	N/A	0.173432E+04	N/A
1987	N/A	0.927966E+03	N/A
1988	N/A	0.108501E+04	N/A
1989	N/A	0.328286E+04	N/A
1990	N/A	0.125984E+04	N/A
1991	N/A	0.171153E+04	N/A
1992	N/A	0.238001E+04	N/A
1993	N/A	0.219570E+04	N/A
1994	N/A	0.115150E+04	N/A
1995	0.115407E+03	0.203128E+04	-0.286796E+01
1996	0.341272E+03	0.175954E+04	-0.164013E+01
1997	0.517731E+03	0.198581E+04	-0.134433E+01
1998	0.467531E+04	0.289566E+04	0.479082E+00
1999	0.817587E+04	0.320873E+04	0.935311E+00
2000	0.164754E+04	0.344758E+04	-0.738390E+00
2001	0.608359E+04	0.280241E+04	0.775114E+00
2002	0.558177E+04	0.303976E+04	0.607729E+00
2003	0.488283E+04	0.198381E+04	0.900703E+00
2004	0.534610E+04	0.170002E+04	0.114573E+01
2005	0.203356E+04	0.147606E+04	0.320412E+00
2006	0.606718E+04	0.212716E+04	0.104811E+01
2007	0.111109E+05	0.760888E+04	0.378614E+00
2008	N/A	0.000000E+00	N/A

Survey Index: 27 Tag: USfall95 AGE = 3
 Time = MEAN Type = NUMBER
 Catchability = 0.556137E+00 % Variance Contribution = 1.9472
 Residual = LN(Observed) - LN(Predicted)

Year	Observed	Predicted	Residual
1973	N/A	0.108431E+05	N/A
1974	N/A	0.509367E+04	N/A
1975	N/A	0.314169E+04	N/A
1976	N/A	0.327771E+04	N/A
1977	N/A	0.444051E+04	N/A
1978	N/A	0.261340E+04	N/A
1979	N/A	0.296547E+04	N/A
1980	N/A	0.702759E+04	N/A
1981	N/A	0.491920E+04	N/A
1982	N/A	0.524925E+04	N/A
1983	N/A	0.779785E+04	N/A
1984	N/A	0.185056E+04	N/A
1985	N/A	0.733814E+03	N/A
1986	N/A	0.117999E+04	N/A
1987	N/A	0.142217E+04	N/A
1988	N/A	0.840175E+03	N/A
1989	N/A	0.137163E+04	N/A
1990	N/A	0.441083E+04	N/A
1991	N/A	0.180724E+04	N/A
1992	N/A	0.276491E+04	N/A
1993	N/A	0.224942E+04	N/A
1994	N/A	0.232122E+04	N/A
1995	0.335157E+03	0.175664E+04	-0.165656E+01
1996	0.181381E+04	0.370275E+04	-0.713649E+00
1997	0.334099E+04	0.309903E+04	0.751767E-01
1998	0.407886E+04	0.300088E+04	0.306910E+00
1999	0.555887E+04	0.453844E+04	0.202811E+00
2000	0.467249E+04	0.455673E+04	0.250876E-01
2001	0.785372E+04	0.440562E+04	0.578106E+00
2002	0.206452E+04	0.437047E+04	-0.749972E+00
2003	0.272590E+04	0.420344E+04	-0.433104E+00
2004	0.486244E+04	0.245592E+04	0.683040E+00
2005	0.365207E+04	0.209387E+04	0.556283E+00
2006	0.355666E+04	0.233590E+04	0.420425E+00
2007	0.763474E+04	0.377070E+04	0.705448E+00
2008	N/A	0.000000E+00	N/A

Survey Index: 28 Tag: USfall95 AGE = 4
Time = MEAN Type = NUMBER
Catchability = 0.471055E+00 % Variance Contribution = 1.5766
Residual = LN(Observed) - LN(Predicted)

Year	Observed	Predicted	Residual
1973	N/A	0.493313E+04	N/A
1974	N/A	0.309714E+04	N/A
1975	N/A	0.116215E+04	N/A
1976	N/A	0.661116E+03	N/A
1977	N/A	0.870128E+03	N/A
1978	N/A	0.948981E+03	N/A
1979	N/A	0.678470E+03	N/A
1980	N/A	0.100635E+04	N/A
1981	N/A	0.187428E+04	N/A
1982	N/A	0.146132E+04	N/A
1983	N/A	0.173370E+04	N/A
1984	N/A	0.131505E+04	N/A
1985	N/A	0.373208E+03	N/A
1986	N/A	0.228211E+03	N/A
1987	N/A	0.346223E+03	N/A
1988	N/A	0.255432E+03	N/A
1989	N/A	0.218051E+03	N/A
1990	N/A	0.491382E+03	N/A
1991	N/A	0.105586E+04	N/A
1992	N/A	0.585220E+03	N/A
1993	N/A	0.742726E+03	N/A
1994	N/A	0.468287E+03	N/A
1995	0.267213E+03	0.444556E+03	-0.509031E+00
1996	0.433481E+03	0.736056E+03	-0.529459E+00
1997	0.202851E+04	0.172320E+04	0.163117E+00
1998	0.115456E+04	0.133224E+04	-0.143147E+00
1999	0.139032E+04	0.109187E+04	0.241642E+00
2000	0.235027E+04	0.155973E+04	0.410020E+00
2001	0.252479E+04	0.140480E+04	0.586263E+00
2002	0.576066E+03	0.140112E+04	-0.888807E+00
2003	0.548015E+03	0.182032E+04	-0.120046E+01
2004	0.204443E+04	0.985578E+03	0.729644E+00
2005	0.595867E+03	0.692546E+03	-0.150357E+00
2006	0.113291E+04	0.530599E+03	0.758543E+00
2007	0.193960E+04	0.113934E+04	0.532036E+00
2008	N/A	0.000000E+00	N/A

Survey Index: 29 Tag: USfall95 AGE = 5
 Time = MEAN Type = NUMBER
 Catchability = 0.490130E+00 % Variance Contribution = 3.4779
 Residual = LN(Observed) - LN(Predicted)

Year	Observed	Predicted	Residual
1973	N/A	0.206692E+04	N/A
1974	N/A	0.153286E+04	N/A
1975	N/A	0.742972E+03	N/A
1976	N/A	0.277046E+03	N/A
1977	N/A	0.205278E+03	N/A
1978	N/A	0.278350E+03	N/A
1979	N/A	0.307104E+03	N/A
1980	N/A	0.239518E+03	N/A
1981	N/A	0.338652E+03	N/A
1982	N/A	0.489707E+03	N/A
1983	N/A	0.495147E+03	N/A
1984	N/A	0.487385E+03	N/A
1985	N/A	0.245121E+03	N/A
1986	N/A	0.124345E+03	N/A
1987	N/A	0.704512E+02	N/A
1988	N/A	0.713049E+02	N/A
1989	N/A	0.583362E+02	N/A
1990	N/A	0.732715E+02	N/A
1991	N/A	0.139812E+03	N/A
1992	N/A	0.249313E+03	N/A
1993	N/A	0.136582E+03	N/A
1994	N/A	0.127671E+03	N/A
1995	0.446490E+02	0.895528E+02	-0.695997E+00
1996	0.727000E+02	0.174115E+03	-0.873373E+00
1997	0.103983E+04	0.365201E+03	0.104636E+01
1998	0.289537E+03	0.824626E+03	-0.104665E+01
1999	0.139421E+04	0.582505E+03	0.872742E+00
2000	0.919667E+03	0.422626E+03	0.777525E+00
2001	0.166783E+04	0.507185E+03	0.119040E+01
2002	0.295555E+03	0.519740E+03	-0.564474E+00
2003	0.969650E+02	0.638772E+03	-0.188520E+01
2004	0.897052E+03	0.531130E+03	0.524106E+00
2005	0.179274E+03	0.173068E+03	0.352326E-01
2006	0.247704E+03	0.205422E+03	0.187170E+00
2007	0.371264E+03	0.240992E+03	0.432148E+00
2008	N/A	0.000000E+00	N/A

Survey Index: 30 Tag: USfall95 AGE = 6
 Time = MEAN Type = NUMBER
 Catchability = 0.361645E+00 % Variance Contribution = 4.7434
 Residual = LN(Observed) - LN(Predicted)

Year	Observed	Predicted	Residual
1973	N/A	0.659554E+03	N/A
1974	N/A	0.471835E+03	N/A
1975	N/A	0.304245E+03	N/A
1976	N/A	0.326851E+03	N/A
1977	N/A	0.179110E+03	N/A
1978	N/A	0.802494E+02	N/A
1979	N/A	0.118064E+03	N/A
1980	N/A	0.565494E+02	N/A
1981	N/A	0.424941E+02	N/A
1982	N/A	0.316067E+02	N/A
1983	N/A	0.831115E+02	N/A
1984	N/A	0.759760E+02	N/A
1985	N/A	0.282533E+02	N/A
1986	N/A	0.511016E+02	N/A
1987	N/A	0.371151E+02	N/A
1988	N/A	0.123536E+02	N/A
1989	N/A	0.118849E+02	N/A
1990	N/A	0.100646E+02	N/A
1991	N/A	0.191677E+02	N/A
1992	N/A	0.128108E+02	N/A
1993	N/A	0.221907E+02	N/A
1994	N/A	0.284367E+02	N/A
1995	0.121330E+02	0.143342E+02	-0.166717E+00
1996	N/A	0.176233E+02	N/A
1997	0.797850E+02	0.638395E+02	0.222963E+00
1998	0.717290E+02	0.793329E+02	-0.100758E+00
1999	0.252751E+03	0.163255E+03	0.437090E+00
2000	0.802610E+03	0.199450E+03	0.139231E+01
2001	0.198823E+04	0.195744E+03	0.231819E+01
2002	0.265950E+02	0.272488E+03	-0.232687E+01
2003	0.185681E+03	0.417768E+03	-0.810895E+00
2004	0.170733E+03	0.288577E+03	-0.524860E+00
2005	N/A	0.552958E+02	N/A
2006	0.443580E+02	0.869139E+02	-0.672625E+00
2007	0.908510E+02	0.720273E+02	0.232175E+00
2008	N/A	0.000000E+00	N/A

Survey Index: 32 Tag: Canada AGE = 2
 Time = JAN-1 Type = NUMBER
 Catchability = 0.229939E-03 % Variance Contribution = 1.8950
 Residual = LN(Observed) - LN(Predicted)

Year	Observed	Predicted	Residual
1973	N/A	0.555811E+01	N/A
1974	N/A	0.545712E+01	N/A
1975	N/A	0.933271E+01	N/A
1976	N/A	0.123352E+02	N/A
1977	N/A	0.452389E+01	N/A
1978	N/A	0.317524E+01	N/A
1979	N/A	0.818669E+01	N/A
1980	N/A	0.473558E+01	N/A
1981	N/A	0.445852E+01	N/A
1982	N/A	0.118373E+02	N/A
1983	N/A	0.385236E+01	N/A
1984	N/A	0.109327E+01	N/A
1985	N/A	0.193465E+01	N/A
1986	N/A	0.295178E+01	N/A
1987	0.119400E+01	0.155805E+01	-0.266128E+00
1988	0.177600E+01	0.169824E+01	0.447687E-01
1989	0.102700E+01	0.419639E+01	-0.140758E+01
1990	0.238700E+01	0.177936E+01	0.293783E+00
1991	0.858000E+00	0.206379E+01	-0.877698E+00
1992	0.110390E+02	0.410879E+01	0.988306E+00
1993	0.243100E+01	0.279785E+01	-0.140549E+00
1994	0.605600E+01	0.154643E+01	0.136510E+01
1995	N/A	0.246640E+01	N/A
1996	N/A	0.218763E+01	N/A
1997	N/A	0.251497E+01	N/A
1998	N/A	0.371073E+01	N/A
1999	N/A	0.418231E+01	N/A
2000	N/A	0.461190E+01	N/A
2001	N/A	0.371511E+01	N/A
2002	N/A	0.416748E+01	N/A
2003	N/A	0.288280E+01	N/A
2004	N/A	0.218266E+01	N/A
2005	N/A	0.195810E+01	N/A
2006	N/A	0.270511E+01	N/A
2007	N/A	0.927502E+01	N/A
2008	N/A	0.344781E+01	N/A

Survey Index: 33 Tag: Canada AGE = 3
Time = JAN-1 Type = NUMBER
Catchability = 0.369401E-03 % Variance Contribution = 0.3860
Residual = LN(Observed) - LN(Predicted)

Year	Observed	Predicted	Residual
1973	N/A	0.109033E+02	N/A
1974	N/A	0.559143E+01	N/A
1975	N/A	0.403769E+01	N/A
1976	N/A	0.363933E+01	N/A
1977	N/A	0.574575E+01	N/A
1978	N/A	0.295048E+01	N/A
1979	N/A	0.300090E+01	N/A
1980	N/A	0.728139E+01	N/A
1981	N/A	0.490114E+01	N/A
1982	N/A	0.549861E+01	N/A
1983	N/A	0.958107E+01	N/A
1984	N/A	0.243019E+01	N/A
1985	N/A	0.771577E+00	N/A
1986	N/A	0.110504E+01	N/A
1987	0.197000E+01	0.177348E+01	0.105088E+00
1988	0.127500E+01	0.966856E+00	0.276652E+00
1989	0.609000E+00	0.124144E+01	-0.712207E+00
1990	0.362800E+01	0.479531E+01	-0.278957E+00
1991	0.118600E+01	0.163900E+01	-0.323502E+00
1992	0.367700E+01	0.266538E+01	0.321750E+00
1993	0.408500E+01	0.238599E+01	0.537708E+00
1994	0.346400E+01	0.321863E+01	0.734685E-01
1995	N/A	0.158994E+01	N/A
1996	N/A	0.313978E+01	N/A
1997	N/A	0.265050E+01	N/A
1998	N/A	0.293088E+01	N/A
1999	N/A	0.421784E+01	N/A
2000	N/A	0.458517E+01	N/A
2001	N/A	0.478193E+01	N/A
2002	N/A	0.392779E+01	N/A
2003	N/A	0.409709E+01	N/A
2004	N/A	0.249305E+01	N/A
2005	N/A	0.247100E+01	N/A
2006	N/A	0.206721E+01	N/A
2007	N/A	0.312511E+01	N/A
2008	N/A	0.117115E+02	N/A

Survey Index: 34 Tag: Canada AGE = 4
 Time = JAN-1 Type = NUMBER
 Catchability = 0.619069E-03 % Variance Contribution = 0.6297
 Residual = LN(Observed) - LN(Predicted)

Year	Observed	Predicted	Residual
1973	N/A	0.107099E+02	N/A
1974	N/A	0.746068E+01	N/A
1975	N/A	0.310183E+01	N/A
1976	N/A	0.150152E+01	N/A
1977	N/A	0.196328E+01	N/A
1978	N/A	0.209878E+01	N/A
1979	N/A	0.152765E+01	N/A
1980	N/A	0.202302E+01	N/A
1981	N/A	0.464224E+01	N/A
1982	N/A	0.342675E+01	N/A
1983	N/A	0.341549E+01	N/A
1984	N/A	0.400635E+01	N/A
1985	N/A	0.853464E+00	N/A
1986	N/A	0.474967E+00	N/A
1987	0.492000E+00	0.891205E+00	-0.594095E+00
1988	0.610000E+00	0.713676E+00	-0.156970E+00
1989	0.294000E+00	0.477373E+00	-0.484718E+00
1990	0.914000E+00	0.108139E+01	-0.168175E+00
1991	0.375900E+01	0.272352E+01	0.322229E+00
1992	0.990000E+00	0.142125E+01	-0.361589E+00
1993	0.407600E+01	0.201172E+01	0.706127E+00
1994	0.300600E+01	0.143824E+01	0.737190E+00
1995	N/A	0.975612E+00	N/A
1996	N/A	0.138490E+01	N/A
1997	N/A	0.315958E+01	N/A
1998	N/A	0.261758E+01	N/A
1999	N/A	0.214640E+01	N/A
2000	N/A	0.346116E+01	N/A
2001	N/A	0.313238E+01	N/A
2002	N/A	0.272658E+01	N/A
2003	N/A	0.347596E+01	N/A
2004	N/A	0.301456E+01	N/A
2005	N/A	0.166833E+01	N/A
2006	N/A	0.114528E+01	N/A
2007	N/A	0.189333E+01	N/A
2008	N/A	0.330521E+01	N/A

Survey Index: 35 Tag: Canada AGE = 5
 Time = JAN-1 Type = NUMBER
 Catchability = 0.693342E-03 % Variance Contribution = 0.9166
 Residual = LN(Observed) - LN(Predicted)

Year	Observed	Predicted	Residual
1973	N/A	0.483008E+01	N/A
1974	N/A	0.397456E+01	N/A
1975	N/A	0.213451E+01	N/A
1976	N/A	0.677291E+00	N/A
1977	N/A	0.498552E+00	N/A
1978	N/A	0.662628E+00	N/A
1979	N/A	0.744300E+00	N/A
1980	N/A	0.518273E+00	N/A
1981	N/A	0.902848E+00	N/A
1982	N/A	0.123607E+01	N/A
1983	N/A	0.104998E+01	N/A
1984	N/A	0.159826E+01	N/A
1985	N/A	0.603368E+00	N/A
1986	N/A	0.278563E+00	N/A
1987	0.870000E-01	0.195200E+00	-0.808116E+00
1988	0.278000E+00	0.214444E+00	0.259572E+00
1989	0.660000E-01	0.137470E+00	-0.733749E+00
1990	0.209000E+00	0.173567E+00	0.185768E+00
1991	0.525000E+00	0.388185E+00	0.301916E+00
1992	0.350000E+00	0.651728E+00	-0.621695E+00
1993	0.887000E+00	0.398200E+00	0.800890E+00
1994	0.781000E+00	0.422066E+00	0.615412E+00
1995	N/A	0.211543E+00	N/A
1996	N/A	0.352624E+00	N/A
1997	N/A	0.720766E+00	N/A
1998	N/A	0.174398E+01	N/A
1999	N/A	0.123256E+01	N/A
2000	N/A	0.100948E+01	N/A
2001	N/A	0.121729E+01	N/A
2002	N/A	0.108867E+01	N/A
2003	N/A	0.131294E+01	N/A
2004	N/A	0.174865E+01	N/A
2005	N/A	0.448764E+00	N/A
2006	N/A	0.477268E+00	N/A
2007	N/A	0.431070E+00	N/A
2008	N/A	0.130010E+01	N/A

Survey Index: 36 Tag: Canada AGE = 6
 Time = JAN-1 Type = NUMBER
 Catchability = 0.402918E-03 % Variance Contribution = 1.1596
 Residual = LN(Observed) - LN(Predicted)

Year	Observed	Predicted	Residual
1973	N/A	0.121389E+01	N/A
1974	N/A	0.963555E+00	N/A
1975	N/A	0.688410E+00	N/A
1976	N/A	0.629320E+00	N/A
1977	N/A	0.342599E+00	N/A
1978	N/A	0.150459E+00	N/A
1979	N/A	0.225361E+00	N/A
1980	N/A	0.963712E-01	N/A
1981	N/A	0.892254E-01	N/A
1982	N/A	0.628323E-01	N/A
1983	N/A	0.138806E+00	N/A
1984	N/A	0.196223E+00	N/A
1985	N/A	0.547736E-01	N/A
1986	N/A	0.901630E-01	N/A
1987	0.490000E-01	0.809917E-01	-0.502526E+00
1988	0.240000E-01	0.292607E-01	-0.198192E+00
1989	0.220000E-01	0.220578E-01	-0.262525E-02
1990	0.140000E-01	0.187772E-01	-0.293585E+00
1991	0.140000E-01	0.419144E-01	-0.109657E+01
1992	0.300000E-01	0.263752E-01	0.128772E+00
1993	0.130000E+00	0.509539E-01	0.936613E+00
1994	0.207000E+00	0.740399E-01	0.102811E+01
1995	N/A	0.266680E-01	N/A
1996	N/A	0.281101E-01	N/A
1997	N/A	0.992317E-01	N/A
1998	N/A	0.132141E+00	N/A
1999	N/A	0.272066E+00	N/A
2000	N/A	0.375211E+00	N/A
2001	N/A	0.370013E+00	N/A
2002	N/A	0.449527E+00	N/A
2003	N/A	0.676287E+00	N/A
2004	N/A	0.748276E+00	N/A
2005	N/A	0.112926E+00	N/A
2006	N/A	0.159039E+00	N/A
2007	N/A	0.101471E+00	N/A
2008	N/A	0.215801E+00	N/A

Survey Index: 38 Tag: Can95 AGE = 2
 Time = JAN-1 Type = NUMBER
 Catchability = 0.496646E-03 % Variance Contribution = 2.3507
 Residual = LN(Observed) - LN(Predicted)

Year	Observed	Predicted	Residual
1973	N/A	0.120050E+02	N/A
1974	N/A	0.117869E+02	N/A
1975	N/A	0.201577E+02	N/A
1976	N/A	0.266429E+02	N/A
1977	N/A	0.977116E+01	N/A
1978	N/A	0.685820E+01	N/A
1979	N/A	0.176825E+02	N/A
1980	N/A	0.102284E+02	N/A
1981	N/A	0.962996E+01	N/A
1982	N/A	0.255674E+02	N/A
1983	N/A	0.832072E+01	N/A
1984	N/A	0.236136E+01	N/A
1985	N/A	0.417864E+01	N/A
1986	N/A	0.637556E+01	N/A
1987	N/A	0.336524E+01	N/A
1988	N/A	0.366804E+01	N/A
1989	N/A	0.906378E+01	N/A
1990	N/A	0.384324E+01	N/A
1991	N/A	0.445759E+01	N/A
1992	N/A	0.887458E+01	N/A
1993	N/A	0.604309E+01	N/A
1994	N/A	0.334014E+01	N/A
1995	0.125100E+01	0.532719E+01	-0.144888E+01
1996	0.714200E+01	0.472507E+01	0.413110E+00
1997	0.124820E+02	0.543210E+01	0.831962E+00
1998	0.333000E+01	0.801481E+01	-0.878319E+00
1999	0.208610E+02	0.903337E+01	0.836956E+00
2000	0.137650E+02	0.996126E+01	0.323426E+00
2001	0.198960E+02	0.802427E+01	0.908048E+00
2002	0.119620E+02	0.900134E+01	0.284361E+00
2003	0.118890E+02	0.622657E+01	0.646787E+00
2004	0.359900E+01	0.471434E+01	-0.269952E+00
2005	0.160200E+01	0.422929E+01	-0.970782E+00
2006	0.489300E+01	0.584276E+01	-0.177398E+00
2007	0.121590E+02	0.200331E+02	-0.499318E+00
2008	N/A	0.744694E+01	N/A

Survey Index: 39 Tag: Can95 AGE = 3
 Time = JAN-1 Type = NUMBER
 Catchability = 0.206205E-02 % Variance Contribution = 1.2149
 Residual = LN(Observed) - LN(Predicted)

Year	Observed	Predicted	Residual
1973	N/A	0.608639E+02	N/A
1974	N/A	0.312122E+02	N/A
1975	N/A	0.225390E+02	N/A
1976	N/A	0.203153E+02	N/A
1977	N/A	0.320736E+02	N/A
1978	N/A	0.164700E+02	N/A
1979	N/A	0.167515E+02	N/A
1980	N/A	0.406457E+02	N/A
1981	N/A	0.273588E+02	N/A
1982	N/A	0.306940E+02	N/A
1983	N/A	0.534829E+02	N/A
1984	N/A	0.135657E+02	N/A
1985	N/A	0.430706E+01	N/A
1986	N/A	0.616850E+01	N/A
1987	N/A	0.989983E+01	N/A
1988	N/A	0.539713E+01	N/A
1989	N/A	0.692988E+01	N/A
1990	N/A	0.267681E+02	N/A
1991	N/A	0.914915E+01	N/A
1992	N/A	0.148785E+02	N/A
1993	N/A	0.133189E+02	N/A
1994	N/A	0.179668E+02	N/A
1995	0.435300E+01	0.887527E+01	-0.712403E+00
1996	0.917400E+01	0.175267E+02	-0.647353E+00
1997	0.139020E+02	0.147955E+02	-0.622898E-01
1998	0.490700E+01	0.163606E+02	-0.120421E+01
1999	0.208340E+02	0.235446E+02	-0.122309E+00
2000	0.274420E+02	0.255951E+02	0.696753E-01
2001	0.421240E+02	0.266934E+02	0.456201E+00
2002	0.310150E+02	0.219255E+02	0.346822E+00
2003	0.246180E+02	0.228705E+02	0.736289E-01
2004	0.162600E+02	0.139166E+02	0.155627E+00
2005	0.279590E+02	0.137935E+02	0.706543E+00
2006	0.186000E+02	0.115394E+02	0.477391E+00
2007	0.277080E+02	0.174448E+02	0.462680E+00
2008	N/A	0.653750E+02	N/A

Survey Index: 40 Tag: Can95 AGE = 4
Time = JAN-1 Type = NUMBER
Catchability = 0.263975E-02 % Variance Contribution = 0.9553
Residual = LN(Observed) - LN(Predicted)

Year	Observed	Predicted	Residual
1973	N/A	0.456676E+02	N/A
1974	N/A	0.318129E+02	N/A
1975	N/A	0.132264E+02	N/A
1976	N/A	0.640259E+01	N/A
1977	N/A	0.837155E+01	N/A
1978	N/A	0.894932E+01	N/A
1979	N/A	0.651402E+01	N/A
1980	N/A	0.862629E+01	N/A
1981	N/A	0.197948E+02	N/A
1982	N/A	0.146119E+02	N/A
1983	N/A	0.145639E+02	N/A
1984	N/A	0.170834E+02	N/A
1985	N/A	0.363923E+01	N/A
1986	N/A	0.202529E+01	N/A
1987	N/A	0.380016E+01	N/A
1988	N/A	0.304317E+01	N/A
1989	N/A	0.203555E+01	N/A
1990	N/A	0.461113E+01	N/A
1991	N/A	0.116133E+02	N/A
1992	N/A	0.606032E+01	N/A
1993	N/A	0.857811E+01	N/A
1994	N/A	0.613275E+01	N/A
1995	0.254600E+01	0.416008E+01	-0.491010E+00
1996	0.540600E+01	0.590530E+01	-0.883415E-01
1997	0.163690E+02	0.134727E+02	0.194726E+00
1998	0.433400E+01	0.111615E+02	-0.945983E+00
1999	0.766900E+01	0.915242E+01	-0.176832E+00
2000	0.192430E+02	0.147586E+02	0.265319E+00
2001	0.133070E+02	0.133567E+02	-0.372748E-02
2002	0.122340E+02	0.116263E+02	0.509478E-01
2003	0.110860E+02	0.148218E+02	-0.290413E+00
2004	0.920500E+01	0.128543E+02	-0.333930E+00
2005	0.205640E+02	0.711386E+01	0.106150E+01
2006	0.657200E+01	0.488356E+01	0.296943E+00
2007	0.127990E+02	0.807330E+01	0.460804E+00
2008	N/A	0.140936E+02	N/A

Survey Index: 41 Tag: Can95 AGE = 5
 Time = JAN-1 Type = NUMBER
 Catchability = 0.240473E-02 % Variance Contribution = 1.7187
 Residual = LN(Observed) - LN(Predicted)

Year	Observed	Predicted	Residual
1973	N/A	0.167523E+02	N/A
1974	N/A	0.137850E+02	N/A
1975	N/A	0.740316E+01	N/A
1976	N/A	0.234906E+01	N/A
1977	N/A	0.172914E+01	N/A
1978	N/A	0.229821E+01	N/A
1979	N/A	0.258147E+01	N/A
1980	N/A	0.179754E+01	N/A
1981	N/A	0.313137E+01	N/A
1982	N/A	0.428707E+01	N/A
1983	N/A	0.364168E+01	N/A
1984	N/A	0.554328E+01	N/A
1985	N/A	0.209268E+01	N/A
1986	N/A	0.966147E+00	N/A
1987	N/A	0.677016E+00	N/A
1988	N/A	0.743761E+00	N/A
1989	N/A	0.476789E+00	N/A
1990	N/A	0.601987E+00	N/A
1991	N/A	0.134635E+01	N/A
1992	N/A	0.226040E+01	N/A
1993	N/A	0.138109E+01	N/A
1994	N/A	0.146386E+01	N/A
1995	0.647000E+00	0.733699E+00	-0.125753E+00
1996	0.115500E+01	0.122301E+01	-0.572161E-01
1997	0.404400E+01	0.249985E+01	0.481004E+00
1998	0.198800E+01	0.604869E+01	-0.111271E+01
1999	0.535000E+01	0.427492E+01	0.224332E+00
2000	0.506900E+01	0.350121E+01	0.370036E+00
2001	0.458100E+01	0.422197E+01	0.816166E-01
2002	0.555300E+01	0.377586E+01	0.385709E+00
2003	0.342100E+01	0.455368E+01	-0.286003E+00
2004	0.227300E+01	0.606488E+01	-0.981414E+00
2005	0.569600E+01	0.155646E+01	0.129735E+01
2006	0.820000E+00	0.165532E+01	-0.702444E+00
2007	0.228800E+01	0.149509E+01	0.425493E+00
2008	N/A	0.450916E+01	N/A

Survey Index: 42 Tag: Can95 AGE = 6
 Time = JAN-1 Type = NUMBER
 Catchability = 0.186002E-02 % Variance Contribution = 1.6987
 Residual = LN(Observed) - LN(Predicted)

Year	Observed	Predicted	Residual
1973	N/A	0.560378E+01	N/A
1974	N/A	0.444813E+01	N/A
1975	N/A	0.317796E+01	N/A
1976	N/A	0.290518E+01	N/A
1977	N/A	0.158157E+01	N/A
1978	N/A	0.694575E+00	N/A
1979	N/A	0.104035E+01	N/A
1980	N/A	0.444886E+00	N/A
1981	N/A	0.411898E+00	N/A
1982	N/A	0.290058E+00	N/A
1983	N/A	0.640780E+00	N/A
1984	N/A	0.905839E+00	N/A
1985	N/A	0.252855E+00	N/A
1986	N/A	0.416226E+00	N/A
1987	N/A	0.373888E+00	N/A
1988	N/A	0.135078E+00	N/A
1989	N/A	0.101827E+00	N/A
1990	N/A	0.866825E-01	N/A
1991	N/A	0.193492E+00	N/A
1992	N/A	0.121758E+00	N/A
1993	N/A	0.235222E+00	N/A
1994	N/A	0.341796E+00	N/A
1995	0.101000E+00	0.123109E+00	-0.197953E+00
1996	0.123000E+00	0.129767E+00	-0.535533E-01
1997	0.670000E+00	0.458091E+00	0.380211E+00
1998	0.558000E+00	0.610012E+00	-0.891191E-01
1999	0.220000E+01	0.125596E+01	0.560558E+00
2000	0.368900E+01	0.173211E+01	0.756014E+00
2001	0.239700E+01	0.170812E+01	0.338827E+00
2002	0.283300E+01	0.207519E+01	0.311285E+00
2003	0.198800E+01	0.312199E+01	-0.451342E+00
2004	0.141600E+01	0.345432E+01	-0.891790E+00
2005	0.156500E+01	0.521307E+00	0.109930E+01
2006	0.238000E+00	0.734184E+00	-0.112649E+01
2007	0.248000E+00	0.468426E+00	-0.635949E+00
2008	N/A	0.996218E+00	N/A

Survey Index: 43 Tag: Scall AGE = 1
Time = MEAN Type = NUMBER
Catchability = 0.233364E-04 % Variance Contribution = 4.4457
Residual = LN(Observed) - LN(Predicted)

Year	Observed	Predicted	Residual
1973	N/A	0.617432E+00	N/A
1974	N/A	0.107682E+01	N/A
1975	N/A	0.144102E+01	N/A
1976	N/A	0.515879E+00	N/A
1977	N/A	0.361276E+00	N/A
1978	N/A	0.103511E+01	N/A
1979	N/A	0.535901E+00	N/A
1980	N/A	0.504738E+00	N/A
1981	N/A	0.133122E+01	N/A
1982	0.313000E+00	0.458389E+00	-0.381516E+00
1983	0.140000E+00	0.131115E+00	0.655667E-01
1984	0.233000E+00	0.223500E+00	0.416271E-01
1985	0.549000E+00	0.343196E+00	0.469798E+00
1986	0.103000E+00	0.177195E+00	-0.542520E+00
1987	0.470000E-01	0.192678E+00	-0.141087E+01
1988	0.116000E+00	0.477456E+00	-0.141488E+01
1989	0.195000E+00	0.202191E+00	-0.362157E-01
1990	0.100000E+00	0.234637E+00	-0.852871E+00
1991	0.211700E+01	0.469575E+00	0.150593E+01
1992	0.167000E+00	0.342595E+00	-0.718556E+00
1993	0.112900E+01	0.230977E+00	0.158677E+01
1994	0.150300E+01	0.277959E+00	0.168774E+01
1995	N/A	0.246347E+00	N/A
1996	N/A	0.283770E+00	N/A
1997	N/A	0.417888E+00	N/A
1998	N/A	0.471913E+00	N/A
1999	N/A	0.518874E+00	N/A
2000	N/A	0.418981E+00	N/A
2001	N/A	0.470336E+00	N/A
2002	N/A	0.326432E+00	N/A
2003	N/A	0.247143E+00	N/A
2004	N/A	0.220762E+00	N/A
2005	N/A	0.304641E+00	N/A
2006	N/A	0.104391E+01	N/A
2007	N/A	0.388002E+00	N/A
2008	N/A	0.000000E+00	N/A

Survey Index: 44 Tag: Scall95 AGE = 1
Time = MEAN Type = NUMBER
Catchability = 0.539497E-04 % Variance Contribution = 0.3281
Residual = LN(Observed) - LN(Predicted)

Year	Observed	Predicted	Residual
1973	N/A	0.142739E+01	N/A
1974	N/A	0.248941E+01	N/A
1975	N/A	0.333139E+01	N/A
1976	N/A	0.119262E+01	N/A
1977	N/A	0.835206E+00	N/A
1978	N/A	0.239299E+01	N/A
1979	N/A	0.123891E+01	N/A
1980	N/A	0.116687E+01	N/A
1981	N/A	0.307755E+01	N/A
1982	N/A	0.105972E+01	N/A
1983	N/A	0.303115E+00	N/A
1984	N/A	0.516693E+00	N/A
1985	N/A	0.793408E+00	N/A
1986	N/A	0.409643E+00	N/A
1987	N/A	0.445437E+00	N/A
1988	N/A	0.110379E+01	N/A
1989	N/A	0.467431E+00	N/A
1990	N/A	0.542440E+00	N/A
1991	N/A	0.108557E+01	N/A
1992	N/A	0.792020E+00	N/A
1993	N/A	0.533978E+00	N/A
1994	N/A	0.642592E+00	N/A
1995	0.609000E+00	0.569510E+00	0.670423E-01
1996	0.508000E+00	0.656025E+00	-0.255718E+00
1997	0.106200E+01	0.966082E+00	0.946601E-01
1998	0.187200E+01	0.109098E+01	0.539932E+00
1999	0.103800E+01	0.119954E+01	-0.144646E+00
2000	0.912000E+00	0.968610E+00	-0.602223E-01
2001	0.789000E+00	0.108733E+01	-0.320717E+00
2002	0.100500E+01	0.754654E+00	0.286483E+00
2003	0.880000E+00	0.571352E+00	0.431916E+00
2004	0.330000E+00	0.510364E+00	-0.436031E+00
2005	0.573000E+00	0.704277E+00	-0.206286E+00
2006	0.242200E+01	0.241333E+01	0.358668E-02
2007	N/A	0.896992E+00	N/A
2008	N/A	0.000000E+00	N/A

Retrospective Summary

Average Fishing Mortality
Ages = 4 - 5

	1973	1974	1975	1976	1977
2000	0.9046	1.1647	1.4350	1.0158	0.9995
2001	0.9046	1.1647	1.4350	1.0158	0.9995
2002	0.9046	1.1647	1.4350	1.0158	0.9995
2003	0.9046	1.1647	1.4350	1.0158	0.9995
2004	0.9046	1.1647	1.4350	1.0158	0.9995
2005	0.9046	1.1647	1.4350	1.0158	0.9995
2006	0.9046	1.1647	1.4350	1.0158	0.9995
2007	0.9046	1.1647	1.4350	1.0158	0.9995
	1978	1979	1980	1981	1982
2000	0.9500	0.9943	0.7201	1.2366	1.0961
2001	0.9500	0.9943	0.7201	1.2366	1.0961
2002	0.9500	0.9943	0.7201	1.2366	1.0961
2003	0.9500	0.9943	0.7201	1.2366	1.0961
2004	0.9500	0.9943	0.7201	1.2366	1.0961
2005	0.9500	0.9943	0.7201	1.2366	1.0961
2006	0.9500	0.9943	0.7201	1.2366	1.0961
2007	0.9500	0.9943	0.7201	1.2366	1.0961
	1983	1984	1985	1986	1987
2000	0.6727	1.8064	1.0330	0.8025	1.3378
2001	0.6727	1.8064	1.0330	0.8025	1.3378
2002	0.6727	1.8064	1.0330	0.8025	1.3378
2003	0.6727	1.8064	1.0330	0.8025	1.3378
2004	0.6727	1.8064	1.0330	0.8025	1.3378
2005	0.6727	1.8064	1.0330	0.8025	1.3378
2006	0.6727	1.8064	1.0330	0.8025	1.3378
2007	0.6727	1.8064	1.0330	0.8025	1.3378
	1988	1989	1990	1991	1992
2000	1.5603	0.9250	0.9378	1.3432	1.1853
2001	1.5603	0.9250	0.9378	1.3432	1.1853
2002	1.5603	0.9250	0.9378	1.3434	1.1857
2003	1.5603	0.9250	0.9378	1.3434	1.1857
2004	1.5603	0.9250	0.9378	1.3434	1.1856
2005	1.5603	0.9250	0.9378	1.3434	1.1856
2006	1.5603	0.9250	0.9378	1.3434	1.1856
2007	1.5603	0.9250	0.9378	1.3434	1.1856
	1993	1994	1995	1996	1997
2000	1.4731	1.8188	0.9109	0.5418	0.4712
2001	1.4733	1.8201	0.9132	0.5445	0.4751
2002	1.4749	1.8304	0.9317	0.5673	0.5089
2003	1.4750	1.8311	0.9328	0.5687	0.5111
2004	1.4749	1.8301	0.9310	0.5664	0.5076
2005	1.4749	1.8301	0.9310	0.5664	0.5076
2006	1.4749	1.8301	0.9310	0.5664	0.5076
2007	1.4749	1.8301	0.9310	0.5664	0.5076

	1998	1999	2000	2001	2002
2000	0.5854	0.5269	0.6011		
2001	0.5938	0.5401	0.6280	0.4138	
2002	0.6696	0.6738	0.9785	1.0250	0.7292
2003	0.6748	0.6840	1.0130	1.1286	0.9286
2004	0.6666	0.6680	0.9592	0.9727	0.6477
2005	0.6665	0.6678	0.9586	0.9710	0.6453
2006	0.6664	0.6676	0.9581	0.9698	0.6436
2007	0.6665	0.6677	0.9583	0.9701	0.6441

	2003	2004	2005	2006	2007
2000					
2001					
2002					
2003	1.4185				
2004	0.6067	1.8883			
2005	0.6025	1.8412	1.2270		
2006	0.5994	1.8085	1.1407	0.8425	
2007	0.6003	1.8180	1.1648	0.8904	0.2892

Spawning Stock Biomass

	1973	1974	1975	1976	1977
2000	22161.	14780.	9014.	10024.	8351.
2001	22161.	14780.	9014.	10024.	8351.
2002	22161.	14780.	9014.	10024.	8351.
2003	22161.	14780.	9014.	10024.	8351.
2004	22161.	14780.	9014.	10024.	8351.
2005	22161.	14780.	9014.	10024.	8351.
2006	22161.	14780.	9014.	10024.	8351.
2007	22161.	14780.	9014.	10024.	8351.

	1978	1979	1980	1981	1982
2000	6169.	8501.	10884.	10144.	12975.
2001	6169.	8501.	10884.	10144.	12975.
2002	6169.	8501.	10884.	10144.	12975.
2003	6169.	8501.	10884.	10144.	12975.
2004	6169.	8501.	10884.	10144.	12975.
2005	6169.	8501.	10884.	10144.	12975.
2006	6169.	8501.	10884.	10144.	12975.
2007	6169.	8501.	10884.	10144.	12975.

	1983	1984	1985	1986	1987
2000	11103.	3847.	2558.	3210.	2750.
2001	11103.	3847.	2558.	3210.	2750.
2002	11103.	3847.	2558.	3210.	2750.
2003	11103.	3847.	2558.	3210.	2750.
2004	11103.	3847.	2558.	3210.	2750.
2005	11103.	3847.	2558.	3210.	2750.
2006	11103.	3847.	2558.	3210.	2750.
2007	11103.	3847.	2558.	3210.	2750.

	1988	1989	1990	1991	1992
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2000	2198.	4170.	4750.	3486.	4474.
2001	2198.	4170.	4750.	3486.	4474.
2002	2198.	4170.	4750.	3485.	4472.
2003	2198.	4170.	4750.	3485.	4471.
2004	2198.	4170.	4750.	3485.	4472.
2005	2198.	4170.	4750.	3485.	4472.
2006	2198.	4170.	4750.	3485.	4472.
2007	2198.	4170.	4750.	3485.	4472.

1993	1994	1995	1996	1997
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2000	3973.	2852.	3038.	5258.	6909.
2001	3972.	2849.	3026.	5227.	6847.
2002	3965.	2822.	2938.	4984.	6362.
2003	3965.	2821.	2933.	4970.	6333.
2004	3966.	2823.	2941.	4993.	6379.
2005	3966.	2823.	2941.	4993.	6380.
2006	3966.	2823.	2941.	4993.	6380.
2007	3966.	2823.	2941.	4993.	6380.

1998	1999	2000	2001	2002
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2000	8398.	13633.	19462.		
2001	8266.	12307.	15883.	19972.	
2002	7223.	9496.	10026.	9529.	12523.
2003	7161.	9328.	9618.	7742.	7425.
2004	7260.	9595.	10267.	9272.	10140.
2005	7261.	9599.	10275.	9291.	10180.
2006	7262.	9601.	10281.	9305.	10210.
2007	7262.	9600.	10280.	9300.	10201.

2003	2004	2005	2006	2007
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2000					
2001					
2002					
2003	7709.				
2004	11316.	9201.			
2005	10171.	6307.	5645.		
2006	10239.	5915.	4452.	5001.	
2007	10219.	5869.	4157.	4427.	9526.

Total Population Numbers

1973	1974	1975	1976	1977
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2000	110351.	111229.	131948.	93193.	57252.
2001	110351.	111229.	131948.	93193.	57252.
2002	110351.	111229.	131948.	93193.	57252.
2003	110351.	111229.	131948.	93193.	57252.
2004	110351.	111229.	131948.	93193.	57252.
2005	110351.	111229.	131948.	93193.	57252.
2006	110351.	111229.	131948.	93193.	57252.
2007	110351.	111229.	131948.	93193.	57252.

1978	1979	1980	1981	1982
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2000	80953.	73336.	68594.	104677.	96685.
2001	80953.	73336.	68594.	104677.	96685.
2002	80953.	73336.	68594.	104677.	96685.

2003	80953.	73336.	68594.	104677.	96685.
2004	80953.	73336.	68594.	104677.	96685.
2005	80953.	73336.	68594.	104677.	96685.
2006	80953.	73336.	68594.	104677.	96685.
2007	80953.	73336.	68594.	104677.	96685.

1983	1984	1985	1986	1987
------	------	------	------	------

2000	56648.	31441.	29636.	25695.	22692.
2001	56648.	31441.	29636.	25695.	22692.
2002	56648.	31441.	29636.	25695.	22692.
2003	56648.	31441.	29636.	25695.	22692.
2004	56648.	31441.	29636.	25695.	22692.
2005	56648.	31441.	29636.	25695.	22692.
2006	56648.	31441.	29636.	25695.	22692.
2007	56648.	31441.	29636.	25695.	22692.

1988	1989	1990	1991	1992
------	------	------	------	------

2000	34379.	32297.	33985.	41046.	45955.
2001	34379.	32297.	33984.	41044.	45949.
2002	34379.	32296.	33980.	41032.	45902.
2003	34379.	32296.	33980.	41031.	45899.
2004	34379.	32296.	33980.	41032.	45903.
2005	34379.	32296.	33980.	41032.	45903.
2006	34379.	32296.	33980.	41032.	45904.
2007	34379.	32296.	33980.	41032.	45904.

1993	1994	1995	1996	1997
------	------	------	------	------

2000	36699.	32442.	29994.	36618.	50007.
2001	36677.	32360.	29838.	36348.	49343.
2002	36509.	31710.	28604.	34220.	44110.
2003	36499.	31671.	28531.	34094.	43799.
2004	36515.	31733.	28648.	34295.	44294.
2005	36516.	31734.	28649.	34298.	44300.
2006	36516.	31734.	28650.	34300.	44305.
2007	36516.	31734.	28650.	34299.	44303.

1998	1999	2000	2001	2002
------	------	------	------	------

2000	74662.	94898.	106568.	95461.	
2001	65513.	81056.	100947.	107644.	96358.
2002	53087.	59035.	64338.	72549.	84526.
2003	52350.	57340.	53839.	51205.	54271.
2004	53523.	60040.	60206.	58943.	60591.
2005	53538.	60074.	60286.	59091.	51195.
2006	53548.	60098.	60344.	59199.	51478.
2007	53545.	60091.	60327.	59167.	51394.

2003	2004	2005	2006	2007
------	------	------	------	------

2000					
2001					
2002	79767.				
2003	50873.	49695.			
2004	61118.	49021.	49140.		
2005	49419.	41036.	31650.	37349.	
2006	44779.	38032.	35214.	82324.	82517.
2007	44585.	35962.	33263.	69731.	71101.

2008

2000
2001
2002
2003
2004
2005
2006
2007

73568.

Age 1 Population

	1973	1974	1975	1976	1977
2000	29384.	52184.	70632.	24731.	17283.
2001	29384.	52184.	70632.	24731.	17283.
2002	29384.	52184.	70632.	24731.	17283.
2003	29384.	52184.	70632.	24731.	17283.
2004	29384.	52184.	70632.	24731.	17283.
2005	29384.	52184.	70632.	24731.	17283.
2006	29384.	52184.	70632.	24731.	17283.
2007	29384.	52184.	70632.	24731.	17283.
	1978	1979	1980	1981	1982
2000	54437.	25508.	24034.	62997.	22846.
2001	54437.	25508.	24034.	62997.	22846.
2002	54437.	25508.	24034.	62997.	22846.
2003	54437.	25508.	24034.	62997.	22846.
2004	54437.	25508.	24034.	62997.	22846.
2005	54437.	25508.	24034.	62997.	22846.
2006	54437.	25508.	24034.	62997.	22846.
2007	54437.	25508.	24034.	62997.	22846.
	1983	1984	1985	1986	1987
2000	6581.	10843.	16749.	8473.	9193.
2001	6581.	10843.	16749.	8473.	9193.
2002	6581.	10843.	16749.	8473.	9193.
2003	6581.	10843.	16749.	8473.	9193.
2004	6581.	10843.	16749.	8473.	9193.
2005	6581.	10843.	16749.	8473.	9193.
2006	6581.	10843.	16749.	8473.	9193.
2007	6581.	10843.	16749.	8473.	9193.
	1988	1989	1990	1991	1992
2000	22841.	9662.	11220.	22567.	17559.
2001	22841.	9662.	11220.	22566.	17554.
2002	22841.	9661.	11217.	22556.	17516.
2003	22841.	9661.	11217.	22556.	17514.
2004	22841.	9661.	11217.	22557.	17518.
2005	22841.	9661.	11217.	22557.	17518.
2006	22841.	9661.	11217.	22557.	17518.
2007	22841.	9661.	11217.	22557.	17518.
	1993	1994	1995	1996	1997
2000	14079.	13739.	12438.	14691.	23608.

2001	14063.	13674.	12349.	14549.	23165.
2002	13934.	13161.	11646.	13429.	19672.
2003	13926.	13130.	11604.	13362.	19464.
2004	13938.	13179.	11671.	13468.	19795.
2005	13938.	13179.	11672.	13469.	19799.
2006	13938.	13180.	11672.	13470.	19802.
2007	13938.	13180.	11672.	13470.	19801.

1998	1999	2000	2001	2002
------	------	------	------	------

2000	38882.	42191.	37675.	20997.	
2001	30272.	35826.	43381.	37456.	21188.
2002	22100.	23880.	24753.	32432.	37740.
2003	21617.	22782.	15639.	19687.	24978.
2004	22387.	24531.	19800.	22206.	24928.
2005	22397.	24553.	19853.	22289.	15410.
2006	22404.	24569.	19891.	22349.	15604.
2007	22402.	24564.	19880.	22331.	15547.

2003	2004	2005	2006	2007
------	------	------	------	------

2000					
2001					
2002	20357.				
2003	15892.	19265.			
2004	20776.	10009.	19332.		
2005	16768.	11590.	8658.	18561.	
2006	11895.	12383.	14697.	60429.	19370.
2007	11770.	10472.	14435.	49437.	18373.

2008

2000	
2001	
2002	
2003	
2004	
2005	
2006	
2007	19120.

In the Retrospective Analysis
The Following Survey Indices Have Predicted
Index Value Set to Zero in Terminal Year + 1

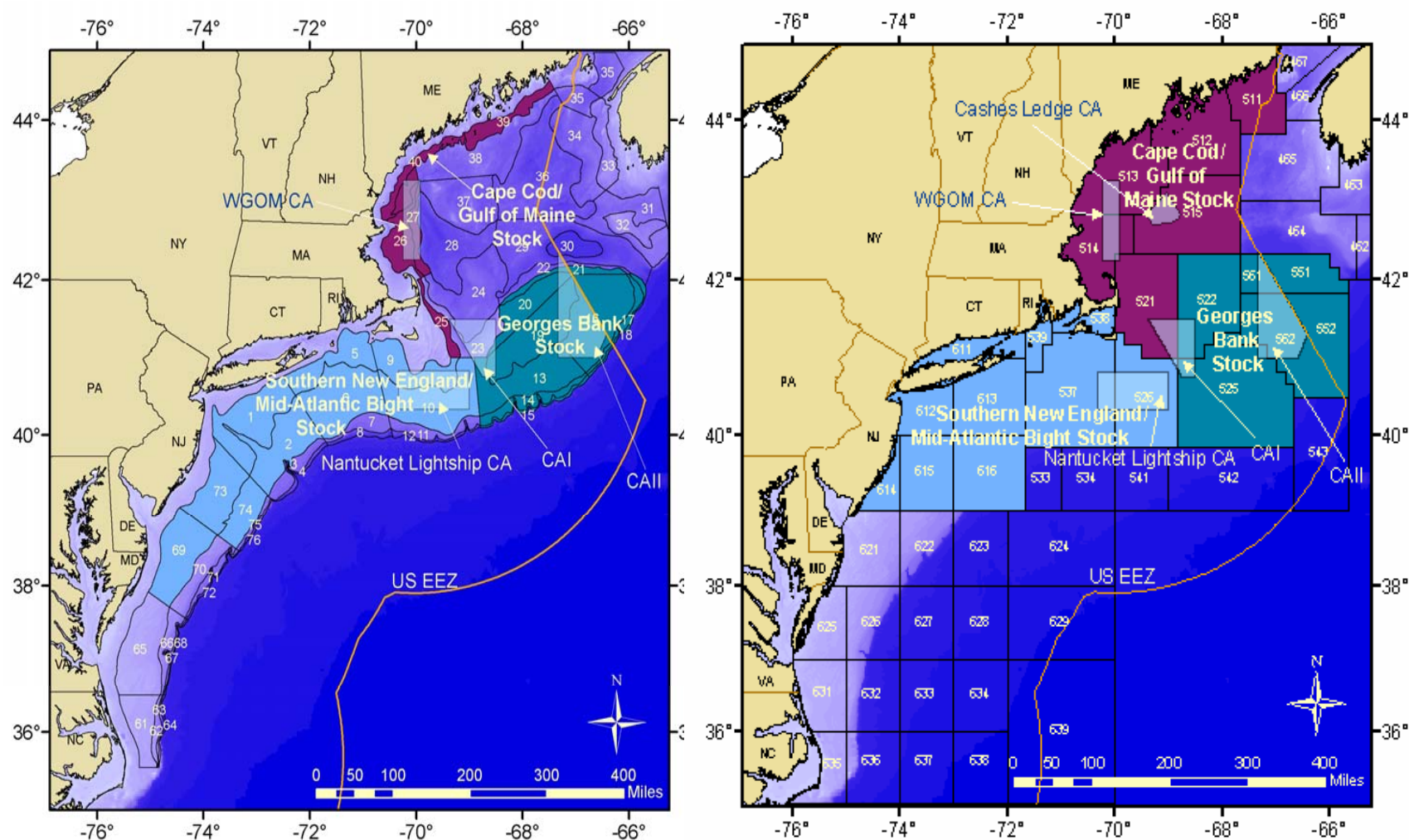
1	USsearly	1
2	USsearly	2
3	USsearly	3
4	USsearly	4
5	USsearly	5
6	USsearly	6
19	USfall	1
20	USfall	2
21	USfall	3
22	USfall	4
23	USfall	5
24	USfall	6
25	USfall95	1
26	USfall95	2
27	USfall95	3
28	USfall95	4
29	USfall95	5
30	USfall95	6
43	Scall	1
44	Scall95	1

Plus Group Diagnostic Report

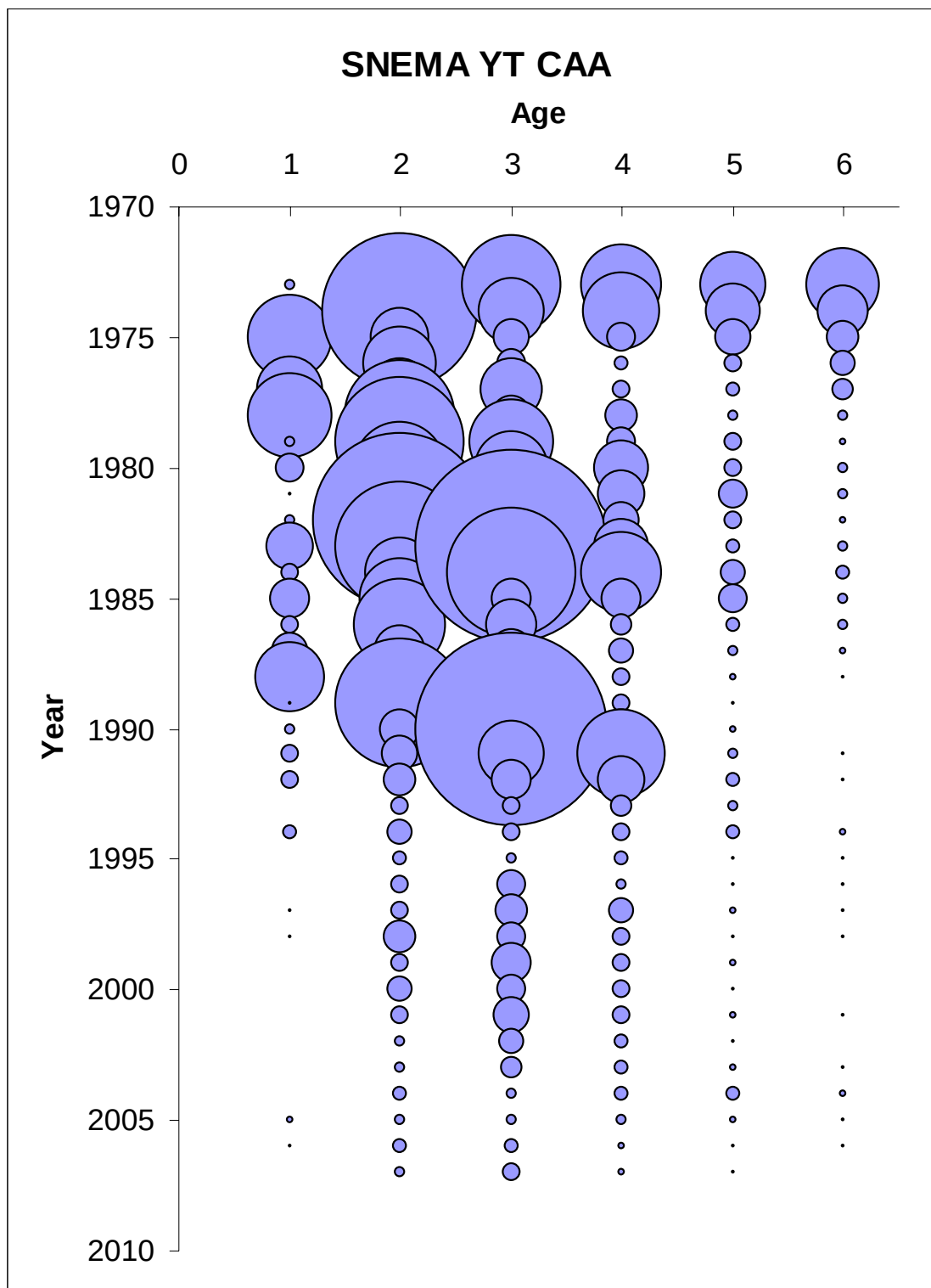
Calculation Method Selected = Backward

Year	Population Backward	Population Forward	F Forward	F Backward	Ratio
1973	3013.	3013.	0.904553	0.904559	1.000007
1974	2391.	3307.	0.695689	1.164718	1.674194
1975	1709.	2815.	0.631724	1.434953	2.271487
1976	1562.	1825.	0.793523	1.015833	1.280156
1977	850.	965.	0.816769	0.999464	1.223680
1978	373.	566.	0.523246	0.949972	1.815536
1979	559.	577.	0.944090	0.994293	1.053177
1980	239.	509.	0.278307	0.720099	2.587425
1981	221.	613.	0.301185	1.236571	4.105689
1982	156.	681.	0.168110	1.096145	6.520394
1983	345.	959.	0.195123	0.672714	3.447641
1984	487.	1279.	0.393483	1.806415	4.590832
1985	136.	1016.	0.091534	1.032965	11.284990
1986	224.	1013.	0.131529	0.802529	6.101535
1987	201.	875.	0.189551	1.337831	7.057877
1988	73.	653.	0.094237	1.560327	16.557517
1989	55.	540.	0.064098	0.925028	14.431503
1990	47.	479.	0.061967	0.937802	15.133953
1991	104.	449.	0.191804	1.343232	7.003139
1992	65.	423.	0.115829	1.185267	10.232886
1993	127.	544.	0.202189	1.473117	7.285851
1994	184.	471.	0.407228	1.818787	4.466256
1995	67.	338.	0.128092	0.910906	7.111332
1996	72.	345.	0.092195	0.541761	5.876269
1997	261.	508.	0.215425	0.471187	2.187239
1998	361.	899.	0.197115	0.585412	2.969895
1999	805.	1865.	0.195705	0.526857	2.692103
2000	1278.	2280.	0.293725	0.601070	2.046370
2001	1470.	2288.	N/A	N/A	

Appendix D. Southern New England/ Mid-Atlantic yellowtail flounder
Appendix Tables and Figures by Larry Alade, Chris Legault and Steven Cadrin

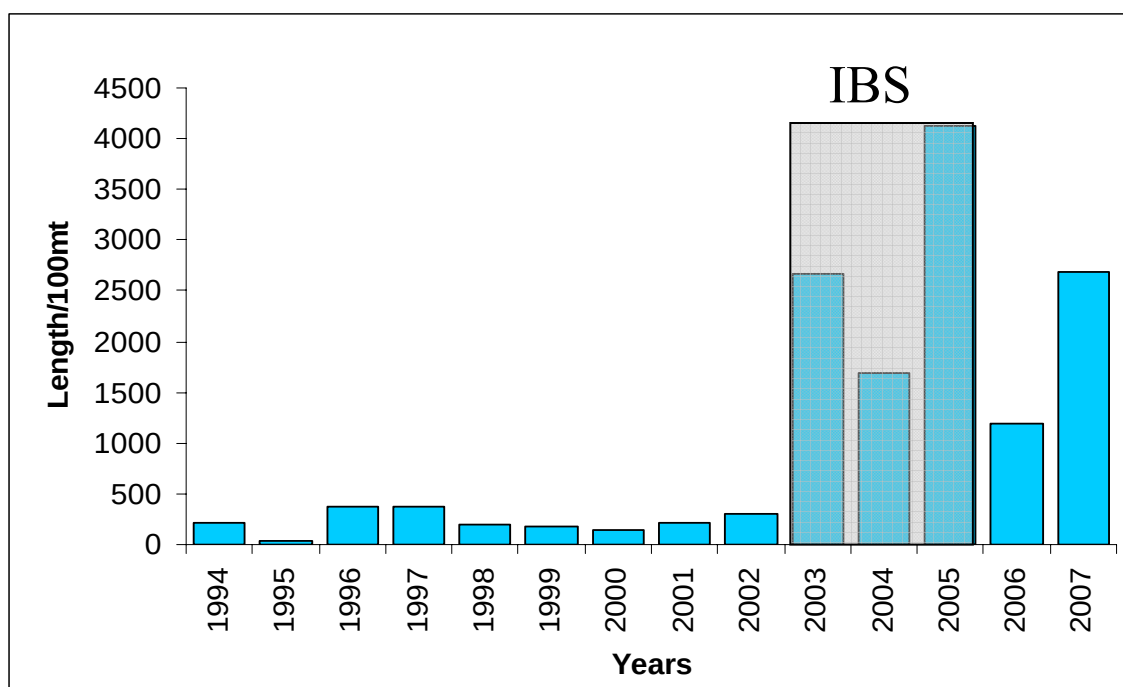


Appendix Figure D.1. Offshore Survey strata (1, 2, 5, 6, 9, 10, 69, 73, 74) used by NEFSC to estimate the autumn, spring and fall (Strata 69, 73 and 74 excluded from the fall series) survey indices [Left] and commercial statistical areas [Right] for all three yellowtail flounder stocks.

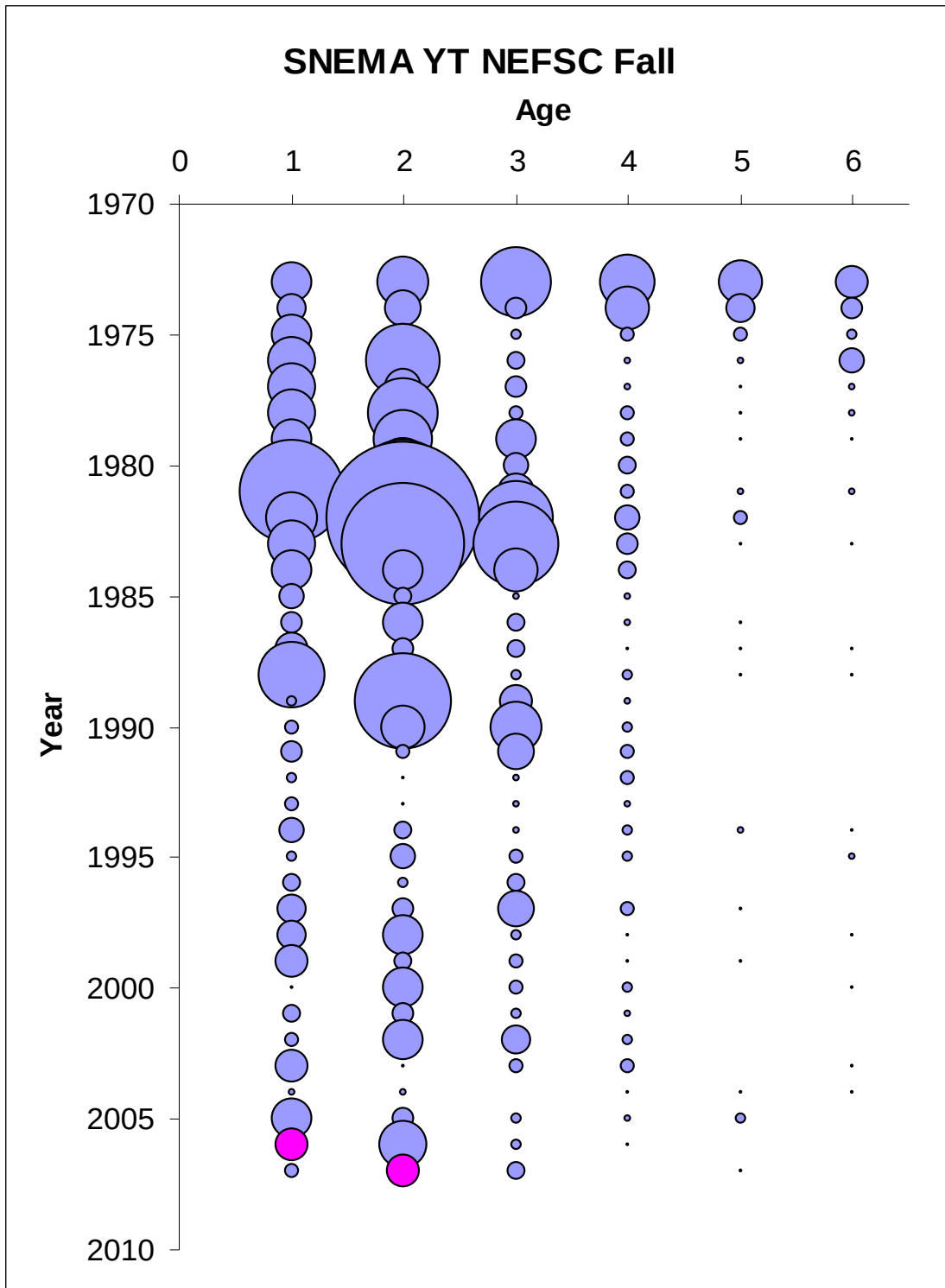


Appendix Figure D.2 Catch at age bubble plot for Southern New England-Mid Atlantic yellowtail flounder.

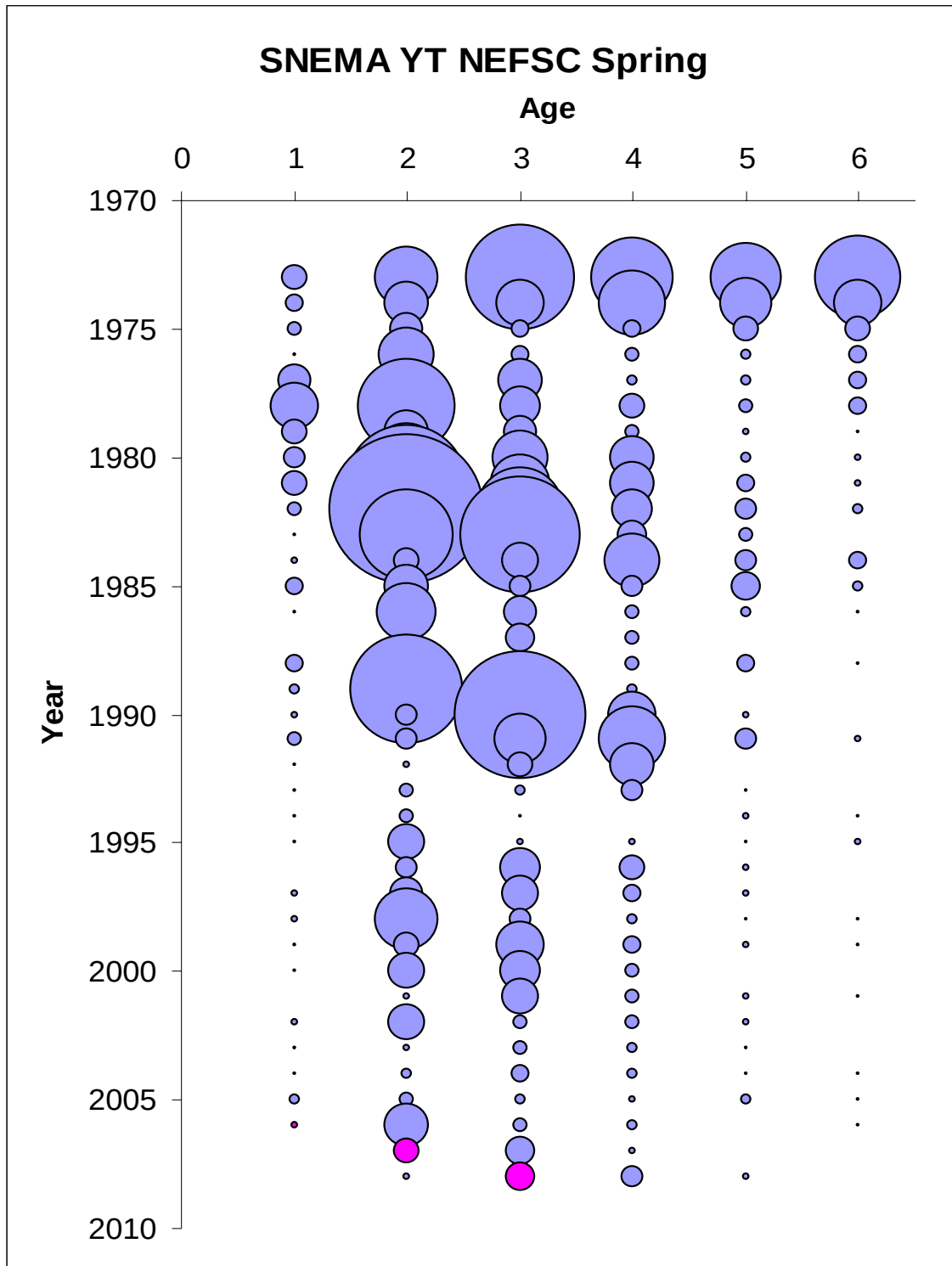
Southern New England-Mid Atlantic Yellowtail flounder Biological Sampling



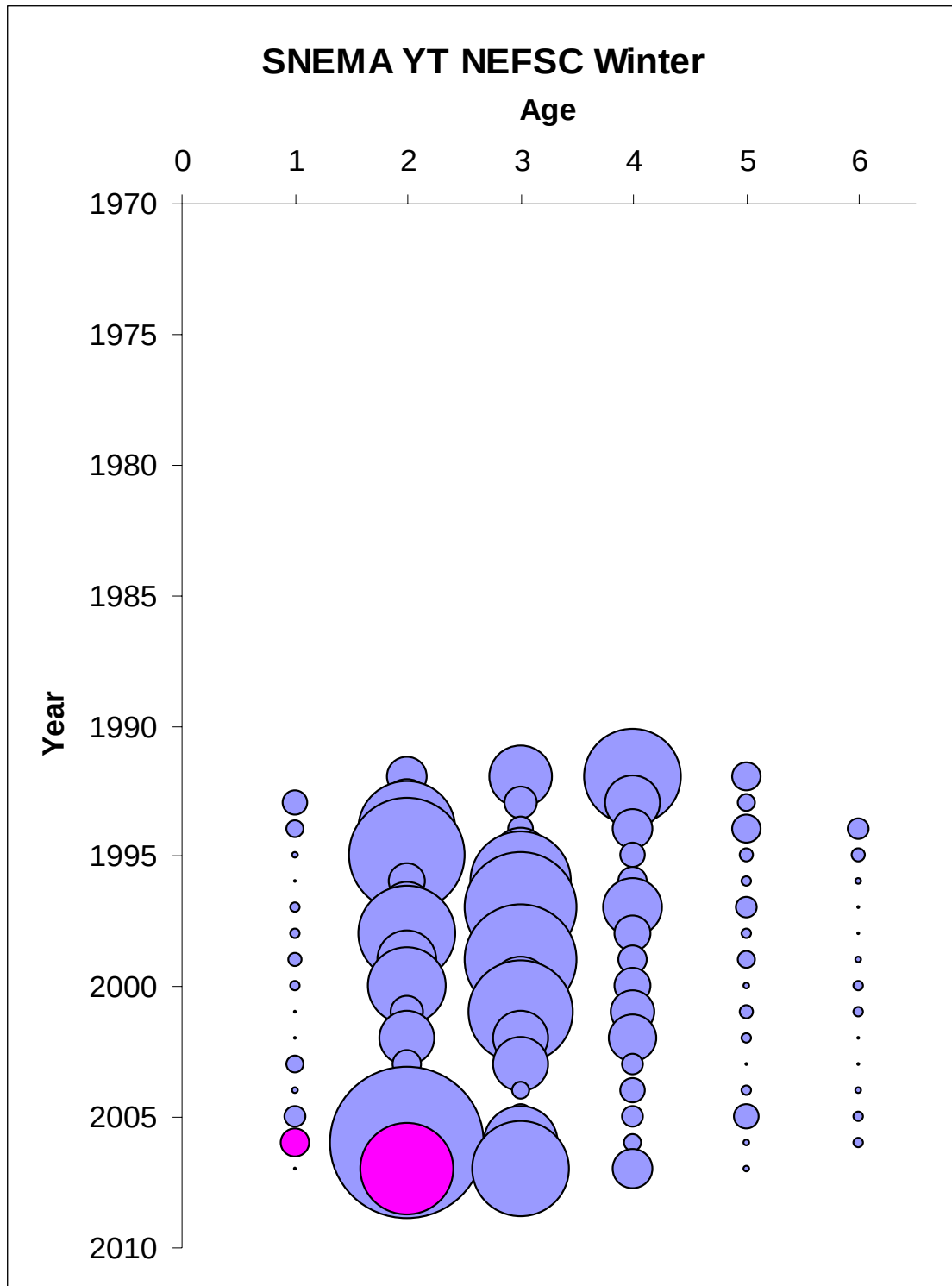
Appendix Figure D.3. Biological sampling for Southern New England-Mid Atlantic yellowtail flounder. Note: 2003 -2005 was heavily supplemented by the Industry based survey (IBS – shaded in Grey).



Appendix Figure D.4.a Survey bubble plot for SNEMA yellowtail NEFSC Fall survey. Note the 2005 year class is highlighted in pink.

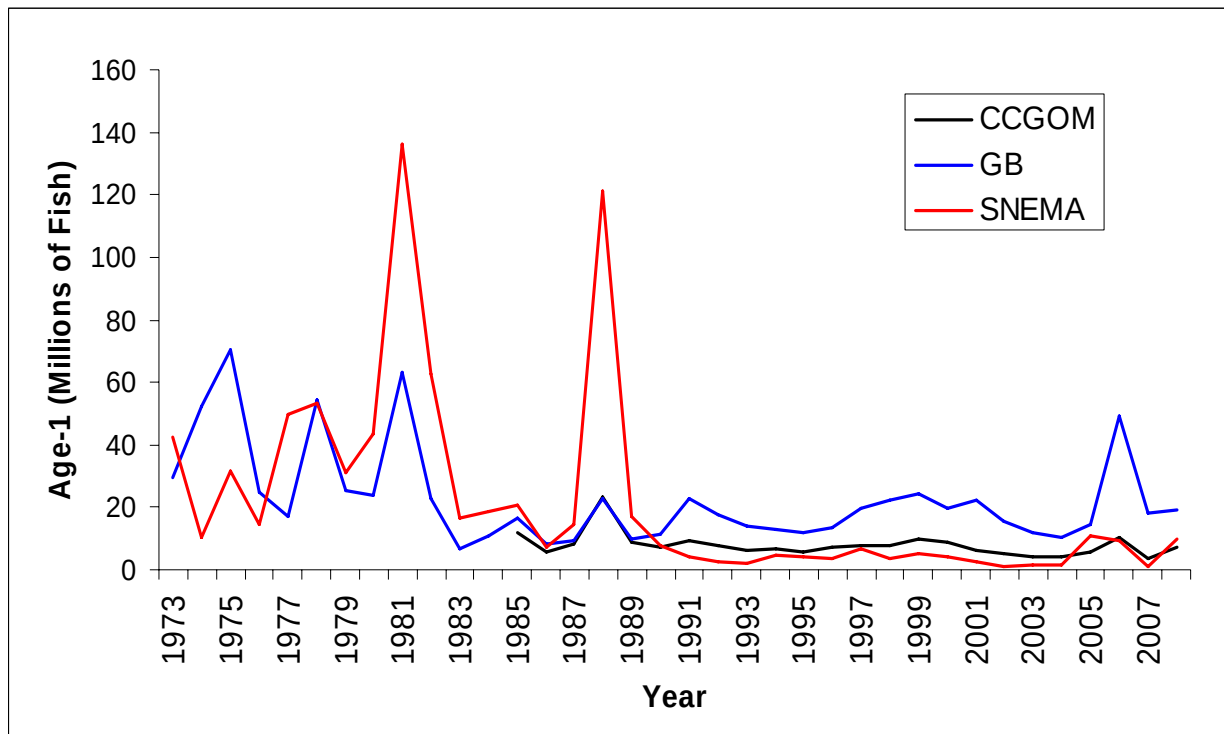


Appendix Figure D.4.b Survey bubble plot for SNEMA yellowtail NEFSC Spring survey. Note the 2005 year class is highlighted in pink.



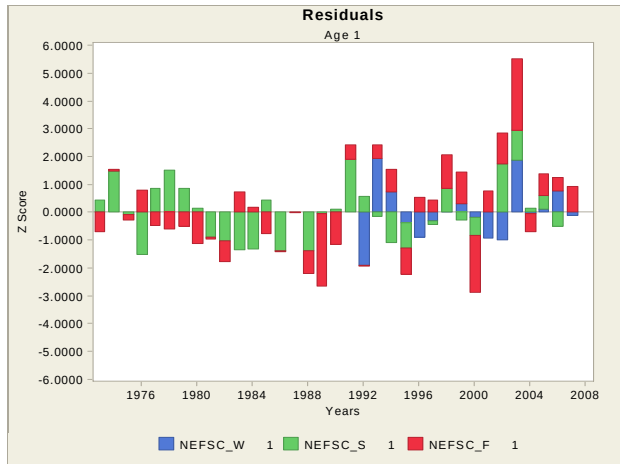
Appendix Figure D.4.c Survey bubble plot for SNEMA yellowtail NEFSC Winter survey. Note the 2005 year class is highlighted in pink.

Age-1 Recruitment

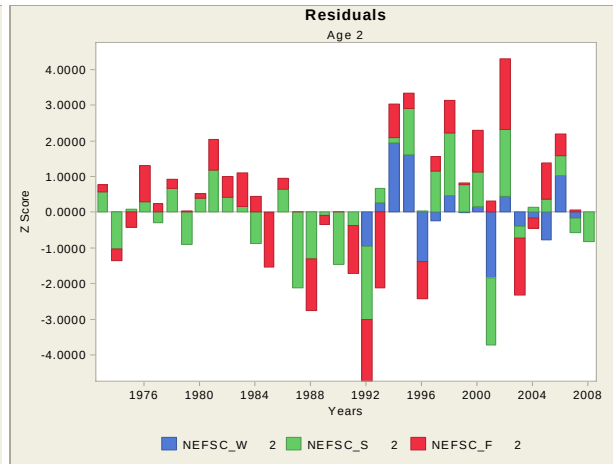


Appendix Figure D.5. Comparison of recruitment trends from the three yellowtail flounder stocks.

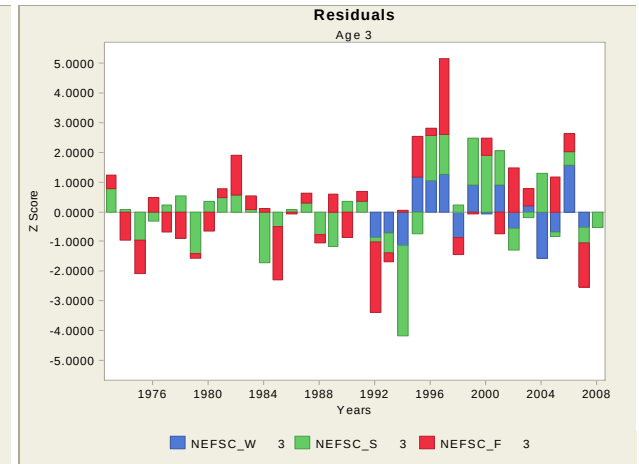
Age 1



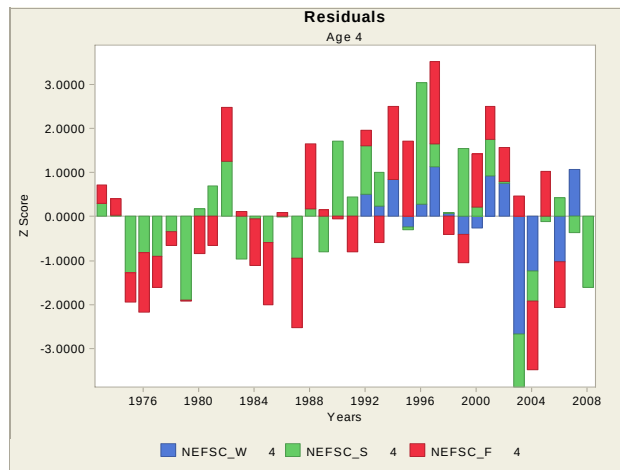
Age 2



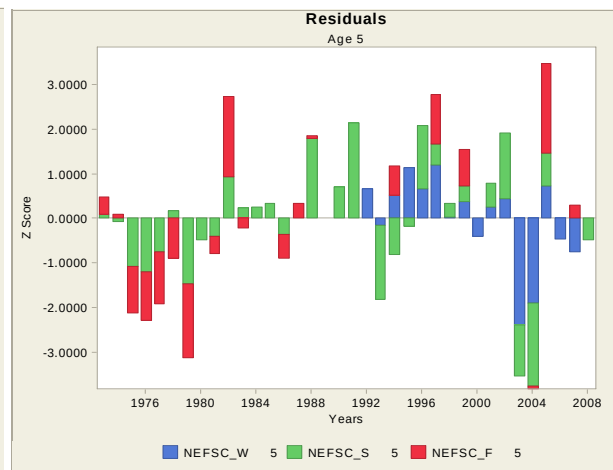
Age 3



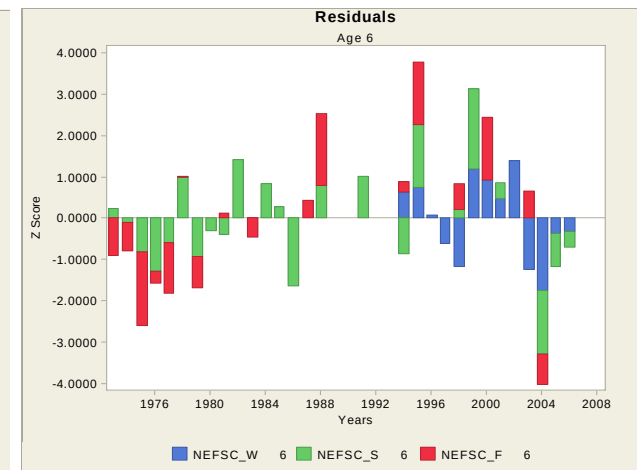
Age 4



Age 5



Age 6+



Appendix Figure D.6. Standardized residuals for all indices by age.

Appendix VPA Output Report

VPA Version 2.8.0

Model ID: snema 6 plus for GARM2008_Retro

Input File:

L:\YELLOWTAILFLOUNDER\ASSESSMENTS\SNEMA\VPA\SNEMA_VPA_6PLUS_JULY_2008_RETRO.DAT

Date of Run: 17-JUL-2008

Time of Run: 14:24

Levenburg-Marquardt Algorithm Completed 15 Iterations
Residual Sum of Squares = 337.729

Number of Residuals = 457
Number of Parameters = 4
Degrees of Freedom = 453
Mean Squared Residual = 0.745539
Standard Deviation = 0.863446

Number of Years = 35
Number of Ages = 6
First Year = 1973
Youngest Age = 1
Oldest True Age = 5

Number of Survey Indices Available = 18
Number of Survey Indices Used in Estimate = 18

VPA Classic Method - Auto Estimated Q's

Stock Numbers Predicted in Terminal Year Plus One (2008)

Age	Stock Predicted	Std. Error	CV
2	952.892	0.486501E+03	0.510552E+00
3	6071.373	0.208250E+04	0.343003E+00
4	5190.411	0.160161E+04	0.308571E+00
5	236.964	0.900044E+02	0.379823E+00

Catchability Values for Each Survey Used in Estimate

INDEX	Catchability	Std. Error	CV
-------	--------------	------------	----

1	0.453675E-01	0.125163E-01	0.275888E+00
2	0.142556E+01	0.258922E+00	0.181628E+00
3	0.229197E+01	0.418383E+00	0.182543E+00
4	0.254824E+01	0.320159E+00	0.125639E+00
5	0.189483E+01	0.439295E+00	0.231838E+00
6	0.234050E+01	0.826870E+00	0.353288E+00
7	0.141979E-01	0.237835E-02	0.167514E+00
8	0.182963E+00	0.273950E-01	0.149730E+00
9	0.283400E+00	0.369888E-01	0.130518E+00
10	0.419285E+00	0.435372E-01	0.103837E+00
11	0.550028E+00	0.953396E-01	0.173336E+00
12	0.568391E+00	0.113931E+00	0.200446E+00
13	0.100583E+00	0.159129E-01	0.158206E+00
14	0.175600E+00	0.286112E-01	0.162934E+00
15	0.199593E+00	0.246573E-01	0.123538E+00
16	0.217045E+00	0.281861E-01	0.129863E+00
17	0.221817E+00	0.420359E-01	0.189507E+00
18	0.449687E+00	0.132708E+00	0.295111E+00

-- Non-Linear Least Squares Fit --

Default Tolerances Used

Scaled Gradient Tolerance = 6.055454E-06
 Scaled Step Tolerance = 3.666853E-11
 Relative Function Tolerance = 3.666853E-11
 Absolute Function Tolerance = 4.930381E-32

VPA Method Options

- Catchability Values Estimated as an Analytic Function of N
- Catch Equation Used in Cohort Solution
- Plus Group Backward Calculation Method Used
- Rivard Weights Used for JAN-1 Biomass
- Rivard Weights Calculation Used 3 Years for Terminal Year Plus One
- Heincke Rule Used in F-Oldest Calculation
- F-Oldest Calculation in Years Prior to Terminal Year
 Uses Stock Sizes in Ages 4 to 5
- Calculation of Population of Age 1 In Year 2008
 = Geometric Mean of First Age Populations
 Year Range Applied = 1973 to 2007

Stock Estimates

Age 2
 Age 3
 Age 4
 Age 5

Full F in Terminal Year = 0.4129

F in Oldest True Age in Terminal Year = 0.4129

Full F Calculated Using Classic Method

Age	Input Partial Recruitment	Calc Partial Recruitment	Fishing Mortality	Used In Full F	Comments
1	0.010	0.014	0.0057	NO	Stock Estimate in T+1
2	0.120	0.087	0.0358	NO	Stock Estimate in T+1
3	0.580	0.226	0.0935	NO	Stock Estimate in T+1
4	1.000	1.000	0.4129	YES	Stock Estimate in T+1
5	1.000	1.000	0.4129		Input PR * Full F

Catch At Age - Input Data

AGE	1973	1974	1975	1976	1977
1	220.0	861.0	8910.0	214.0	5513.0
2	5632.0	28519.0	4129.0	6677.0	5027.0
3	11951.0	5556.0	1884.0	1181.0	4891.0
4	7978.0	7370.0	1130.0	327.0	507.0
5	5226.0	3687.0	1597.0	449.0	278.0
6	6286.0	3347.0	1452.0	896.0	649.0
AGE	1978	1979	1980	1981	1982
1	8698.0	205.0	1006.0	38.0	169.0
2	14191.0	19419.0	10215.0	7029.0	35696.0
3	2164.0	8667.0	6595.0	7578.0	14358.0
4	1470.0	1062.0	3829.0	2926.0	1858.0
5	247.0	438.0	512.0	1111.0	415.0
6	179.0	131.0	167.0	183.0	86.0
AGE	1983	1984	1985	1986	1987
1	2668.0	517.0	2239.0	463.0	1594.0
2	19288.0	6200.0	8074.0	9970.0	3437.0
3	42837.0	19990.0	2175.0	3326.0	2368.0
4	3601.0	8129.0	1968.0	635.0	926.0
5	385.0	878.0	1109.0	356.0	167.0
6	192.0	276.0	246.0	149.0	65.0
AGE	1988	1989	1990	1991	1992
1	5899.0	24.0	192.0	446.0	477.0
2	2109.0	19920.0	2056.0	1610.0	1453.0
3	536.0	3347.0	42644.0	5169.0	2097.0
4	506.0	462.0	2209.0	9703.0	2739.0
5	134.0	48.0	90.0	168.0	297.0
6	32.0	3.0	5.0	51.0	18.0
AGE	1993	1994	1995	1996	1997
1	13.0	362.0	1.0	3.0	22.0
2	457.0	851.0	373.0	519.0	485.0
3	447.0	399.0	198.0	1117.0	1512.0
4	711.0	404.0	288.0	232.0	789.0
5	145.0	297.0	51.0	32.0	110.0
6	4.0	86.0	36.0	30.0	42.0

Catch At Age - Input Data

AGE	1998	1999	2000	2001	2002
1	19.0	10.0	4.0	0.0	1.0
2	1463.0	475.0	905.0	405.0	250.0
3	1136.0	2217.0	1190.0	1683.0	966.0
4	396.0	407.0	514.0	477.0	388.0
5	52.0	125.0	55.0	126.0	25.0
6	31.0	8.0	13.0	39.0	1.0
AGE	2003	2004	2005	2006	2007
1	2.0	4.0	66.0	19.0	6.0
2	155.0	280.0	226.0	312.0	245.0
3	594.0	243.0	217.0	344.0	564.0
4	344.0	311.0	150.0	139.0	135.0
5	89.0	313.0	118.0	44.0	44.0
6	23.0	124.0	52.0	57.0	15.0

Weight At Age - Input Data

AGE	1973	1974	1975	1976	1977
1	0.2100	0.2030	0.2180	0.2280	0.2150
2	0.2960	0.3080	0.2890	0.3030	0.2830
3	0.3480	0.3520	0.3760	0.4080	0.3810
4	0.3750	0.3960	0.4320	0.4980	0.5040
5	0.3820	0.4390	0.4350	0.4990	0.5130
6	0.4280	0.4570	0.4810	0.5570	0.5420
AGE	1978	1979	1980	1981	1982
1	0.2340	0.1890	0.2060	0.1400	0.2260
2	0.2930	0.3010	0.2810	0.2620	0.2630
3	0.3830	0.3640	0.3840	0.3420	0.3530
4	0.5360	0.4750	0.5000	0.4740	0.4990
5	0.6620	0.5900	0.6820	0.5960	0.6600
6	0.6560	0.6620	0.9250	0.6500	0.8330
AGE	1983	1984	1985	1986	1987
1	0.1750	0.1820	0.1830	0.1860	0.2470
2	0.2610	0.2370	0.2600	0.2840	0.2680
3	0.3390	0.2950	0.3650	0.3310	0.3530
4	0.4960	0.3880	0.4080	0.4630	0.4040
5	0.6680	0.4870	0.5040	0.5870	0.5200
6	0.8190	0.6560	0.6080	0.6420	0.6310
AGE	1988	1989	1990	1991	1992
1	0.2700	0.3110	0.3010	0.2060	0.1670
2	0.2930	0.3380	0.3270	0.2620	0.3160
3	0.3960	0.3940	0.3780	0.3370	0.3680
4	0.4930	0.5530	0.4550	0.4140	0.4340
5	0.6110	0.7350	0.7630	0.6780	0.5990
6	0.8210	0.9570	0.8840	0.8000	0.9180

AGE	1993	1994	1995	1996	1997
1	0.1220	0.1230	0.0720	0.1050	0.1920
2	0.3540	0.1980	0.2270	0.3440	0.2540
3	0.4300	0.3530	0.3560	0.3810	0.4020
4	0.4510	0.4160	0.4460	0.4690	0.5120
5	0.6410	0.5040	0.5970	0.6130	0.6650
6	1.0400	0.6720	0.8490	0.7340	0.8410

Weight At Age - Input Data

AGE	1998	1999	2000	2001	2002
1	0.1680	0.2000	0.1440	0.1530	0.1650
2	0.2800	0.3610	0.3480	0.3780	0.3740
3	0.3840	0.4300	0.4790	0.4440	0.4730
4	0.5190	0.6090	0.6250	0.6140	0.6280
5	0.5870	0.7690	0.7480	0.7530	0.8380
6	0.6930	1.1140	0.8880	0.9170	0.7970
AGE	2003	2004	2005	2006	2007
1	0.1000	0.1580	0.0960	0.1180	0.1240
2	0.3470	0.3200	0.2980	0.2550	0.2730
3	0.4360	0.4030	0.4220	0.3910	0.3820
4	0.6200	0.4930	0.5280	0.5340	0.5010
5	0.6390	0.5760	0.6690	0.6750	0.7370
6	0.8460	0.7440	0.8410	0.8520	0.8690

JAN-1 Weights at Age - Input Data

AGE	1973	1974	1975	1976	1977
1	0.1734	0.1701	0.1849	0.2046	0.1842
2	0.2714	0.2543	0.2422	0.2570	0.2540
3	0.3262	0.3228	0.3403	0.3434	0.3398
4	0.3466	0.3712	0.3900	0.4327	0.4535
5	0.3785	0.4057	0.4150	0.4643	0.5054
6	0.4280	0.4570	0.4810	0.5570	0.5420
AGE	1978	1979	1980	1981	1982
1	0.2063	0.1550	0.1827	0.1021	0.2103
2	0.2510	0.2654	0.2305	0.2323	0.1919
3	0.3292	0.3266	0.3400	0.3100	0.3041
4	0.4519	0.4265	0.4266	0.4266	0.4131
5	0.5776	0.5624	0.5692	0.5459	0.5593
6	0.6560	0.6620	0.9250	0.6500	0.8330
AGE	1983	1984	1985	1986	1987
1	0.1504	0.1523	0.1469	0.1550	0.2268
2	0.2429	0.2037	0.2175	0.2280	0.2233
3	0.2986	0.2775	0.2941	0.2934	0.3166
4	0.4184	0.3627	0.3469	0.4111	0.3657
5	0.5773	0.4915	0.4422	0.4894	0.4907
6	0.8190	0.6560	0.6080	0.6420	0.6310

AGE	1988	1989	1990	1991	1992
1	0.2413	0.3033	0.3226	0.1663	0.1147
2	0.2690	0.3021	0.3189	0.2808	0.2551
3	0.3258	0.3398	0.3574	0.3320	0.3105
4	0.4172	0.4680	0.4234	0.3956	0.3824
5	0.4968	0.6020	0.6496	0.5554	0.4980
6	0.8210	0.9570	0.8840	0.8000	0.9180
AGE	1993	1994	1995	1996	1997
1	0.0958	0.0905	0.0329	0.0675	0.1590
2	0.2431	0.1554	0.1671	0.1574	0.1633
3	0.3686	0.3535	0.2655	0.2941	0.3719
4	0.4074	0.4229	0.3968	0.4086	0.4417
5	0.5274	0.4768	0.4983	0.5229	0.5585
6	1.0400	0.6720	0.8490	0.7340	0.8410

JAN-1 Weights at Age - Input Data

AGE	1998	1999	2000	2001	2002
1	0.1146	0.1516	0.0889	0.0979	0.1138
2	0.2319	0.2463	0.2638	0.2333	0.2392
3	0.3123	0.3470	0.4158	0.3931	0.4228
4	0.4568	0.4836	0.5184	0.5423	0.5280
5	0.5482	0.6318	0.6749	0.6860	0.7173
6	0.6930	1.1140	0.8880	0.9170	0.7970
AGE	2003	2004	2005	2006	2007
1	0.0559	0.1150	0.0589	0.0776	0.0857
2	0.2393	0.1789	0.2170	0.1565	0.1795
3	0.4038	0.3740	0.3675	0.3413	0.3121
4	0.5415	0.4636	0.4613	0.4747	0.4426
5	0.6335	0.5976	0.5743	0.5970	0.6273
6	0.8460	0.7440	0.8410	0.8520	0.8690
AGE	2008				
1	0.0740				
2	0.1843				
3	0.3403				
4	0.4595				
5	0.5995				
6	0.8540				

SSB Weight At Age - Input Data

AGE	1973	1974	1975	1976	1977
1	0.1240	0.2030	0.2180	0.2280	0.2150
2	0.2730	0.3080	0.2890	0.3030	0.2830
3	0.3820	0.3520	0.3760	0.4080	0.3810
4	0.5010	0.3960	0.4320	0.4980	0.5040
5	0.7370	0.4390	0.4350	0.4990	0.5130
6	0.8690	0.4570	0.4810	0.5570	0.5420
AGE	1978	1979	1980	1981	1982
1	0.2340	0.1890	0.2060	0.1400	0.2260
2	0.2930	0.3010	0.2810	0.2620	0.2630
3	0.3830	0.3640	0.3840	0.3420	0.3530
4	0.5360	0.4750	0.5000	0.4740	0.4990
5	0.6620	0.5900	0.6820	0.5960	0.6600
6	0.6560	0.6620	0.9250	0.6500	0.8330
AGE	1983	1984	1985	1986	1987
1	0.1750	0.1820	0.1830	0.1860	0.2470
2	0.2610	0.2370	0.2600	0.2840	0.2680
3	0.3390	0.2950	0.3650	0.3310	0.3530
4	0.4960	0.3880	0.4080	0.4630	0.4040
5	0.6680	0.4870	0.5040	0.5870	0.5200
6	0.8190	0.6560	0.6080	0.6420	0.6310
AGE	1988	1989	1990	1991	1992
1	0.2700	0.3110	0.3010	0.2060	0.1670
2	0.2930	0.3380	0.3270	0.2620	0.3160
3	0.3960	0.3940	0.3780	0.3370	0.3680
4	0.4930	0.5530	0.4550	0.4140	0.4340
5	0.6110	0.7350	0.7630	0.6780	0.5990
6	0.8210	0.9570	0.8840	0.8000	0.9180
AGE	1993	1994	1995	1996	1997
1	0.1220	0.1230	0.0720	0.1050	0.1920
2	0.3540	0.1980	0.2270	0.3440	0.2540
3	0.4300	0.3530	0.3560	0.3810	0.4020
4	0.4510	0.4160	0.4460	0.4690	0.5120
5	0.6410	0.5040	0.5970	0.6130	0.6650
6	1.0400	0.6720	0.8490	0.7340	0.8410

SSB Weight At Age - Input Data

AGE	1998	1999	2000	2001	2002
1	0.1680	0.2000	0.1440	0.1530	0.1650
2	0.2800	0.3610	0.3480	0.3780	0.3740
3	0.3840	0.4300	0.4790	0.4440	0.4730
4	0.5190	0.6090	0.6250	0.6140	0.6280
5	0.5870	0.7690	0.7480	0.7530	0.8380
6	0.6930	1.1140	0.8880	0.9170	0.7970
AGE	2003	2004	2005	2006	2007
1	0.1000	0.1580	0.0960	0.1180	0.1240
2	0.3470	0.3200	0.2980	0.2550	0.2730
3	0.4360	0.4030	0.4220	0.3910	0.3820
4	0.6200	0.4930	0.5280	0.5340	0.5010
5	0.6390	0.5760	0.6690	0.6750	0.7370
6	0.8460	0.7440	0.8410	0.8520	0.8690

Natural Mortality - Input Data

AGE	1973	1974	1975	1976	1977
1	0.2000	0.2000	0.2000	0.2000	0.2000
2	0.2000	0.2000	0.2000	0.2000	0.2000
3	0.2000	0.2000	0.2000	0.2000	0.2000
4	0.2000	0.2000	0.2000	0.2000	0.2000
5	0.2000	0.2000	0.2000	0.2000	0.2000
6	0.2000	0.2000	0.2000	0.2000	0.2000
AGE	1978	1979	1980	1981	1982
1	0.2000	0.2000	0.2000	0.2000	0.2000
2	0.2000	0.2000	0.2000	0.2000	0.2000
3	0.2000	0.2000	0.2000	0.2000	0.2000
4	0.2000	0.2000	0.2000	0.2000	0.2000
5	0.2000	0.2000	0.2000	0.2000	0.2000
6	0.2000	0.2000	0.2000	0.2000	0.2000
AGE	1983	1984	1985	1986	1987
1	0.2000	0.2000	0.2000	0.2000	0.2000
2	0.2000	0.2000	0.2000	0.2000	0.2000
3	0.2000	0.2000	0.2000	0.2000	0.2000
4	0.2000	0.2000	0.2000	0.2000	0.2000
5	0.2000	0.2000	0.2000	0.2000	0.2000
6	0.2000	0.2000	0.2000	0.2000	0.2000
AGE	1988	1989	1990	1991	1992
1	0.2000	0.2000	0.2000	0.2000	0.2000
2	0.2000	0.2000	0.2000	0.2000	0.2000
3	0.2000	0.2000	0.2000	0.2000	0.2000
4	0.2000	0.2000	0.2000	0.2000	0.2000
5	0.2000	0.2000	0.2000	0.2000	0.2000
6	0.2000	0.2000	0.2000	0.2000	0.2000

AGE	1993	1994	1995	1996	1997
1	0.2000	0.2000	0.2000	0.2000	0.2000
2	0.2000	0.2000	0.2000	0.2000	0.2000
3	0.2000	0.2000	0.2000	0.2000	0.2000
4	0.2000	0.2000	0.2000	0.2000	0.2000
5	0.2000	0.2000	0.2000	0.2000	0.2000
6	0.2000	0.2000	0.2000	0.2000	0.2000

Natural Mortality - Input Data

AGE	1998	1999	2000	2001	2002
1	0.2000	0.2000	0.2000	0.2000	0.2000
2	0.2000	0.2000	0.2000	0.2000	0.2000
3	0.2000	0.2000	0.2000	0.2000	0.2000
4	0.2000	0.2000	0.2000	0.2000	0.2000
5	0.2000	0.2000	0.2000	0.2000	0.2000
6	0.2000	0.2000	0.2000	0.2000	0.2000
AGE	2003	2004	2005	2006	2007
1	0.2000	0.2000	0.2000	0.2000	0.2000
2	0.2000	0.2000	0.2000	0.2000	0.2000
3	0.2000	0.2000	0.2000	0.2000	0.2000
4	0.2000	0.2000	0.2000	0.2000	0.2000
5	0.2000	0.2000	0.2000	0.2000	0.2000
6	0.2000	0.2000	0.2000	0.2000	0.2000

Proportion of Natural Mortality Before Spawning = 0.4167
Proportion of Fishing Mortality Before Spawning = 0.4167

Maturity - Input Data

AGE	1973	1974	1975	1976	1977
1	0.0000	0.0000	0.0000	0.0000	0.0000
2	0.4900	0.4900	0.4900	0.4900	0.4900
3	0.9740	0.9740	0.9740	0.9740	0.9740
4	1.0000	1.0000	1.0000	1.0000	1.0000
5	1.0000	1.0000	1.0000	1.0000	1.0000
6	1.0000	1.0000	1.0000	1.0000	1.0000
AGE	1978	1979	1980	1981	1982
1	0.0000	0.0000	0.0000	0.0000	0.0000
2	0.4900	0.4900	0.4900	0.4900	0.4900
3	0.9740	0.9740	0.9740	0.9740	0.9740
4	1.0000	1.0000	1.0000	1.0000	1.0000
5	1.0000	1.0000	1.0000	1.0000	1.0000
6	1.0000	1.0000	1.0000	1.0000	1.0000
AGE	1983	1984	1985	1986	1987
1	0.0000	0.0000	0.0000	0.0000	0.0000
2	0.4900	0.4900	0.4900	0.4900	0.4900
3	0.9740	0.9740	0.9740	0.9740	0.9740

4	1.0000	1.0000	1.0000	1.0000	1.0000
5	1.0000	1.0000	1.0000	1.0000	1.0000
6	1.0000	1.0000	1.0000	1.0000	1.0000
AGE	1988	1989	1990	1991	1992
1	0.0000	0.0000	0.0000	0.0000	0.0000
2	0.4900	0.4900	0.4900	0.4900	0.4900
3	0.9740	0.9740	0.9740	0.9740	0.9740
4	1.0000	1.0000	1.0000	1.0000	1.0000
5	1.0000	1.0000	1.0000	1.0000	1.0000
6	1.0000	1.0000	1.0000	1.0000	1.0000
AGE	1993	1994	1995	1996	1997
1	0.0000	0.0000	0.0000	0.0000	0.0000
2	0.4900	0.4900	0.4900	0.4900	0.4900
3	0.9740	0.9740	0.9740	0.9740	0.9740
4	1.0000	1.0000	1.0000	1.0000	1.0000
5	1.0000	1.0000	1.0000	1.0000	1.0000
6	1.0000	1.0000	1.0000	1.0000	1.0000
Maturity - Input Data					
AGE	1998	1999	2000	2001	2002
1	0.0000	0.0000	0.0000	0.0000	0.0000
2	0.4900	0.4900	0.4900	0.4900	0.4900
3	0.9740	0.9740	0.9740	0.9740	0.9740
4	1.0000	1.0000	1.0000	1.0000	1.0000
5	1.0000	1.0000	1.0000	1.0000	1.0000
6	1.0000	1.0000	1.0000	1.0000	1.0000
AGE	2003	2004	2005	2006	2007
1	0.0000	0.0000	0.0000	0.0000	0.0000
2	0.4900	0.4900	0.4900	0.4900	0.4900
3	0.9740	0.9740	0.9740	0.9740	0.9740
4	1.0000	1.0000	1.0000	1.0000	1.0000
5	1.0000	1.0000	1.0000	1.0000	1.0000
6	1.0000	1.0000	1.0000	1.0000	1.0000

Input Partial Recruitment

AGE

1	0.0100
2	0.1200
3	0.5800
4	1.0000
5	1.0000

Input F-Plus Ratio

YEAR

1973	1.0000
1974	1.0000
1975	1.0000
1976	1.0000
1977	1.0000
1978	1.0000
1979	1.0000
1980	1.0000
1981	1.0000
1982	1.0000
1983	1.0000
1984	1.0000
1985	1.0000
1986	1.0000
1987	1.0000
1988	1.0000
1989	1.0000
1990	1.0000
1991	1.0000
1992	1.0000
1993	1.0000
1994	1.0000
1995	1.0000
1996	1.0000
1997	1.0000
1998	1.0000
1999	1.0000
2000	1.0000
2001	1.0000
2002	1.0000
2003	1.0000
2004	1.0000
2005	1.0000
2006	1.0000
2007	1.0000

SURVEY - INPUT DATA

INDEX	1	2	3	4	5
SURVEY TAG	NEFSC_W	NEFSC_W	NEFSC_W	NEFSC_W	NEFSC_W
AGE	1	2	3	4	5
TIME	JAN-1	JAN-1	JAN-1	JAN-1	JAN-1
TYPE	NUMBERS	NUMBERS	NUMBERS	NUMBERS	NUMBERS
RETRO FLAG	1	1	1	1	1
1973	0.0000	0.0000	0.0000	0.0000	0.0000
1974	0.0000	0.0000	0.0000	0.0000	0.0000
1975	0.0000	0.0000	0.0000	0.0000	0.0000
1976	0.0000	0.0000	0.0000	0.0000	0.0000
1977	0.0000	0.0000	0.0000	0.0000	0.0000
1978	0.0000	0.0000	0.0000	0.0000	0.0000
1979	0.0000	0.0000	0.0000	0.0000	0.0000
1980	0.0000	0.0000	0.0000	0.0000	0.0000
1981	0.0000	0.0000	0.0000	0.0000	0.0000
1982	0.0000	0.0000	0.0000	0.0000	0.0000
1983	0.0000	0.0000	0.0000	0.0000	0.0000
1984	0.0000	0.0000	0.0000	0.0000	0.0000
1985	0.0000	0.0000	0.0000	0.0000	0.0000
1986	0.0000	0.0000	0.0000	0.0000	0.0000
1987	0.0000	0.0000	0.0000	0.0000	0.0000
1988	0.0000	0.0000	0.0000	0.0000	0.0000
1989	0.0000	0.0000	0.0000	0.0000	0.0000
1990	0.0000	0.0000	0.0000	0.0000	0.0000
1991	0.0000	0.0000	0.0000	0.0000	0.0000
1992	13.7170	2098.7020	4591.9110	10616.2490	1235.3880
1993	852.0260	2749.1170	1510.7280	3553.2770	417.3690
1994	444.8030	10510.8000	901.3220	2009.1130	1173.5190
1995	128.3110	15261.3140	3854.9080	853.1690	361.3570
1996	58.1540	1835.7930	11767.1920	1216.5270	200.4680
1997	222.7580	3400.9610	13981.6320	4226.8390	755.4360
1998	168.8910	11203.2230	2280.3100	1654.6140	160.4600
1999	347.0690	4155.9680	14540.0280	1109.9350	444.5170
2000	155.1740	7025.3940	4294.7090	1658.0430	103.8780
2001	40.1510	1278.6820	12204.8500	2307.4580	362.2150
2002	17.2890	3907.7750	3683.5880	2924.8660	143.0280
2003	473.8080	996.4830	3710.4510	756.1500	60.8690
2004	72.1570	1373.8440	455.9480	841.5960	204.6120
2005	559.3970	1112.7920	880.3180	741.8610	837.8810
2006	993.9120	26771.0270	6512.5780	493.6690	127.3110
2007	46.1520	9756.6500	10771.2800	1909.3790	135.1700
2008	0.0000	0.0000	0.0000	0.0000	0.0000

SURVEY - INPUT DATA

INDEX	6	7	8	9	10
SURVEY TAG	NEFSC_W	NEFSC_S	NEFSC_S	NEFSC_S	NEFSC_S
AGE	6	1	2	3	4
TIME	JAN-1	JAN-1	JAN-1	JAN-1	JAN-1
TYPE	NUMBERS	NUMBERS	NUMBERS	NUMBERS	NUMBERS
RETRO FLAG	1	1	1	1	1
1973	0.0000	912.6700	5523.6480	15096.9030	8491.1200
1974	0.0000	592.2910	2507.7110	2956.9430	5712.1650
1975	0.0000	414.4700	1512.9830	454.9140	588.2800
1976	0.0000	49.8030	4269.7100	580.0910	278.4300
1977	0.0000	1572.9810	1642.1700	2881.7360	263.2220
1978	0.0000	3105.5170	11899.1330	2109.7860	900.9710
1979	0.0000	986.7060	2921.8460	1548.4130	278.2630
1980	0.0000	708.6100	6520.0480	4418.4510	2786.1410
1981	0.0000	849.1620	18261.4150	4743.5090	2497.5160
1982	0.0000	340.0990	29950.6380	9722.8310	2437.8520
1983	0.0000	66.3490	10831.8730	17948.5570	1220.1800
1984	0.0000	78.3820	924.0340	1838.2080	4301.2960
1985	0.0000	446.0570	2695.8930	677.8590	802.8690
1986	0.0000	27.2410	4834.4250	1530.0290	395.2510
1987	0.0000	0.0000	144.3960	1170.7110	278.4300
1988	0.0000	476.4730	595.8010	208.0710	290.1290
1989	0.0000	229.7970	15925.5080	761.9230	160.6070
1990	0.0000	127.0150	689.5580	21804.6320	3115.7110
1991	0.0000	346.4500	844.4830	3564.6090	5903.6910
1992	0.0000	60.1650	84.7320	954.6180	2669.4880
1993	0.0000	27.2410	423.3280	187.1800	827.1020
1994	571.9710	22.3950	382.0480	23.2300	0.0000
1995	286.7710	26.4060	1952.8560	114.1460	154.0890
1996	136.7410	0.0000	664.3220	2178.1400	946.5960
1997	53.5820	87.9080	1479.2230	1911.5760	546.1650
1998	26.0050	113.4780	5040.4900	644.6010	269.2380
1999	112.8800	59.3290	1087.1480	3225.5130	583.2660
2000	142.4570	32.0880	1935.8090	2478.2970	355.1410
2001	202.4690	0.0000	115.6510	1934.6390	400.5990
2002	28.0060	81.5570	1990.2920	393.0780	333.9160
2003	37.0070	51.6420	125.6780	339.4310	179.4920
2004	62.1550	27.2410	227.1230	488.1720	169.4650
2005	148.0290	245.5070	343.2750	161.4430	112.4750
2006	205.0410	83.8970	2646.9260	374.3600	176.8180
2007	0.0000	0.0000	962.9740	1320.6220	145.9000
2008	0.0000	0.0000	83.0610	1144.8060	802.3670

SURVEY - INPUT DATA

INDEX	11	12	13	14	15
SURVEY TAG	NEFSC_S	NEFSC_S	NEFSC_F	NEFSC_F	NEFSC_F
AGE	5	6	1	2	3
TIME	JAN-1	JAN-1	MEAN	MEAN	MEAN
TYPE	NUMBERS	NUMBERS	NUMBERS	NUMBERS	NUMBERS
RETRO FLAG	1	1	0	0	0
1973	6586.5630	9407.4660	2006.1030	2935.3990	5725.9300
1974	3454.9750	3114.5420	949.6310	1735.0920	582.0020
1975	866.0420	1020.2980	1994.1550	553.2810	180.0230
1976	264.5590	499.8710	2752.2740	5892.5120	490.4390
1977	164.7850	457.9230	2726.5400	1714.0680	618.0760
1978	292.6360	483.1580	2477.5870	5684.2270	352.5790
1979	121.1660	61.0010	1778.2880	3910.8790	1880.5350
1980	274.4190	109.3000	1373.6670	3464.0950	901.6090
1981	554.3540	94.7600	11330.7720	11315.2630	1490.7340
1982	799.0250	273.5840	2858.5420	24940.2670	6155.2510
1983	389.2340	0.0000	2691.1560	15806.6500	7839.9090
1984	800.0270	456.0840	2023.7950	1786.5600	2142.9300
1985	1192.9380	258.5420	848.7620	365.7900	106.0380
1986	207.4020	26.4060	604.5190	1832.2840	511.1190
1987	0.0000	0.0000	1226.3860	518.8160	411.9740
1988	491.3480	48.1320	5019.8530	373.9470	153.2550
1989	0.0000	0.0000	134.9890	10303.7100	1337.3640
1990	112.4750	0.0000	240.7970	2089.2790	3043.2750
1991	765.4330	85.2340	574.0750	237.2350	1480.2790
1992	0.0000	0.0000	192.4310	27.4570	82.2570
1993	28.5780	0.0000	324.4320	27.2270	126.9470
1994	97.2670	27.2410	841.0650	514.4500	122.8110
1995	31.2520	115.3160	159.6890	741.0010	295.4810
1996	119.8290	0.0000	514.9100	184.7330	367.0540
1997	112.1410	0.0000	944.6910	596.2480	1676.5010
1998	60.6660	34.2610	1022.4670	1861.4640	141.8820
1999	124.3410	38.2720	1422.1480	450.0000	320.5260
2000	0.0000	0.0000	56.7530	1917.4130	348.0980
2001	137.3770	38.2720	448.5070	701.7110	181.9760
2002	111.8070	0.0000	291.2310	1977.9570	982.3720
2003	54.1490	0.0000	1344.1420	28.4910	289.5080
2004	58.4940	32.0880	80.6490	112.4710	0.0000
2005	254.5310	26.4060	2031.1480	532.8320	212.8800
2006	0.0000	52.8120	1369.9910	2472.0720	196.2220
2007	0.0000	0.0000	257.4550	1286.3550	409.3310
2008	82.3930	0.0000	0.0000	0.0000	0.0000

SURVEY - INPUT DATA

INDEX	16	17	18		
SURVEY TAG	NEFSC_F	NEFSC_F	NEFSC_F		
AGE	4	5	6	NUMBERS	NUMBERS
TIME	MEAN	MEAN	MEAN	NUMBERS	NUMBERS
TYPE	NUMBERS	NUMBERS	NUMBERS	NUMBERS	NUMBERS
RETRO FLAG	0	0	0		
1973	3248.4580	2191.6410	1302.4390		
1974	2273.7830	962.8420	698.9540		
1975	290.3120	289.8520	146.4770		
1976	64.7950	102.2470	714.3480		
1977	93.7450	33.4310	92.8260		
1978	280.7760	28.6060	88.6900		
1979	286.5210	31.2480	30.3290		
1980	372.4540	0.0000	0.0000		
1981	235.3970	108.3360	57.7870		
1982	749.6180	301.8000	0.0000		
1983	642.3160	53.6510	37.1080		
1984	468.1520	0.0000	0.0000		
1985	103.1660	0.0000	0.0000		
1986	114.7690	39.7500	0.0000		
1987	34.5800	27.4570	27.4570		
1988	161.7570	15.1650	56.7530		
1989	70.7690	0.0000	0.0000		
1990	189.2140	0.0000	0.0000		
1991	358.0930	0.0000	0.0000		
1992	326.8450	0.0000	0.0000		
1993	101.2130	0.0000	0.0000		
1994	163.7100	60.6590	28.6060		
1995	132.5760	0.0000	60.5440		
1996	0.0000	0.0000	0.0000		
1997	311.4500	27.2270	0.0000		
1998	55.8340	0.0000	26.3080		
1999	32.0530	32.0530	0.0000		
2000	196.5660	0.0000	26.3080		
2001	81.5680	0.0000	0.0000		
2002	191.7410	0.0000	0.0000		
2003	263.1990	0.0000	56.9820		
2004	26.4230	55.0290	28.4910		
2005	84.3250	164.7440	0.0000		
2006	22.0580	0.0000	0.0000		
2007	0.0000	30.3290	0.0000		
2008	0.0000	0.0000	0.0000		

Additional Output Files

Population File L:\YELLOWTAILFLOUNDER\ASSESSMENTS\SNEMA\VPA\SNEMA_VPA_6PLUS_JULY
 Auxilliary File L:\YELLOWTAILFLOUNDER\ASSESSMENTS\SNEMA\VPA\SNEMA_VPA_6PLUS_JULY
 Covariance File L:\YELLOWTAILFLOUNDER\ASSESSMENTS\SNEMA\VPA\SNEMA_VPA_6PLUS_JULY
 Residuals File L:\YELLOWTAILFLOUNDER\ASSESSMENTS\SNEMA\VPA\SNEMA_VPA_6PLUS_JULY
 Log File L:\YELLOWTAILFLOUNDER\ASSESSMENTS\SNEMA\VPA\SNEMA_VPA_6PLUS_JULY

Estimation Results

JAN-1 Population Numbers

AGE	1973	1974	1975	1976	1977
1	42491.	10362.	31479.	14339.	49917.
2	18128.	34590.	7707.	17773.	11547.
3	29322.	9789.	3386.	2633.	8572.
4	16834.	13316.	3074.	1096.	1101.
5	11027.	6662.	4344.	1504.	604.
6	13264.	6047.	3950.	3002.	1409.
Total	131067.	80766.	53939.	40348.	73150.
AGE	1978	1979	1980	1981	1982
1	53116.	30998.	43355.	136011.	62906.
2	35899.	35657.	25194.	34588.	111322.
3	4961.	16692.	11907.	11488.	21995.
4	2670.	2127.	5943.	3880.	2697.
5	449.	877.	795.	1473.	602.
6	325.	262.	259.	243.	125.
Total	97420.	86614.	87453.	187683.	199647.
AGE	1983	1984	1985	1986	1987
1	16407.	18836.	20560.	7067.	14717.
2	51350.	11031.	14955.	14815.	5369.
3	59128.	24770.	3516.	5055.	3309.
4	5292.	10637.	2772.	949.	1194.
5	566.	1149.	1562.	532.	215.
6	282.	361.	346.	223.	84.
Total	133026.	66784.	43711.	28641.	24888.
AGE	1988	1989	1990	1991	1992
1	121166.	17049.	8019.	4092.	2476.
2	10612.	93879.	13937.	6392.	2948.
3	1349.	6791.	58946.	9559.	3787.
4	620.	625.	2575.	10656.	3224.
5	164.	65.	105.	184.	350.
6	39.	4.	6.	56.	21.
Total	133952.	118413.	83587.	30939.	12806.
AGE	1993	1994	1995	1996	1997
1	2223.	4434.	4288.	3465.	6904.
2	1598.	1809.	3304.	3510.	2834.
3	1118.	898.	721.	2369.	2406.
4	1234.	515.	379.	413.	942.
5	252.	379.	67.	57.	131.
6	7.	110.	47.	53.	50.
Total	6432.	8144.	8806.	9866.	13268.

JAN-1 Population Numbers

AGE	1998	1999	2000	2001	2002
1	3624.	5372.	4192.	2428.	1133.
2	5633.	2950.	4389.	3429.	1987.
3	1884.	3298.	1987.	2779.	2442.
4	629.	534.	739.	570.	781.
5	83.	164.	79.	151.	50.
6	49.	10.	19.	47.	2.
Total	11901.	12327.	11404.	9403.	6396.
AGE	2003	2004	2005	2006	2007
1	1326.	1666.	10877.	9408.	1170.
2	926.	1084.	1360.	8846.	7686.
3	1402.	619.	636.	910.	6961.
4	1135.	617.	289.	326.	437.
5	294.	621.	228.	103.	143.
6	76.	246.	100.	134.	49.
Total	5158.	4852.	13491.	19728.	16446.
AGE	2008				
1	9744.				
2	953.				
3	6071.				
4	5190.				
5	237.				
6	104.				
Total	22299.				

Fishing Mortality Calculated

AGE	1973	1974	1975	1976	1977
1	0.0057	0.0960	0.3716	0.0166	0.1296
2	0.4162	2.1240	0.8739	0.5291	0.6449
3	0.5894	0.9584	0.9282	0.6721	0.9667
4	0.7271	0.9201	0.5145	0.3962	0.6978
5	0.7271	0.9201	0.5145	0.3962	0.6978
6	0.7271	0.9201	0.5145	0.3962	0.6978
AGE	1978	1979	1980	1981	1982
1	0.1985	0.0073	0.0259	0.0003	0.0030
2	0.5658	0.8968	0.5853	0.2527	0.4327
3	0.6466	0.8327	0.9212	1.2492	1.2246
4	0.9127	0.7847	1.1947	1.6628	1.3615
5	0.9127	0.7847	1.1947	1.6628	1.3615
6	0.9127	0.7847	1.1947	1.6628	1.3615
AGE	1983	1984	1985	1986	1987
1	0.1970	0.0307	0.1277	0.0749	0.1270
2	0.5290	0.9433	0.8846	1.2989	1.1809
3	1.5154	1.9902	1.1095	1.2431	1.4745
4	1.3275	1.7185	1.4502	1.2835	1.7838
5	1.3275	1.7185	1.4502	1.2835	1.7838
6	1.3275	1.7185	1.4502	1.2835	1.7838
AGE	1988	1989	1990	1991	1992
1	0.0552	0.0016	0.0268	0.1278	0.2379
2	0.2464	0.2654	0.1771	0.3235	0.7699
3	0.5694	0.7699	1.5105	0.8869	0.9209
4	2.0563	1.5850	2.4359	3.2171	2.3499
5	2.0563	1.5850	2.4359	3.2171	2.3499
6	2.0563	1.5850	2.4359	3.2171	2.3499
AGE	1993	1994	1995	1996	1997
1	0.0065	0.0942	0.0003	0.0010	0.0035
2	0.3762	0.7196	0.1327	0.1775	0.2085
3	0.5747	0.6632	0.3584	0.7219	1.1415
4	0.9818	1.8382	1.6959	0.9443	2.2342
5	0.9818	1.8382	1.6959	0.9443	2.2342
6	0.9818	1.8382	1.6959	0.9443	2.2342

Fishing Mortality Calculated

AGE	1998	1999	2000	2001	2002
1	0.0058	0.0021	0.0011	0.0001	0.0010
2	0.3354	0.1949	0.2569	0.1393	0.1490
3	1.0613	1.2962	1.0485	1.0689	0.5663
4	1.1450	1.7099	1.3900	2.2271	0.7786
5	1.1450	1.7099	1.3900	2.2271	0.7786
6	1.1450	1.7099	1.3900	2.2271	0.7786

AGE	2003	2004	2005	2006	2007
1	0.0017	0.0027	0.0067	0.0022	0.0057
2	0.2033	0.3334	0.2017	0.0397	0.0358
3	0.6213	0.5607	0.4680	0.5331	0.0935
4	0.4037	0.7969	0.8310	0.6269	0.4129
5	0.4037	0.7969	0.8310	0.6269	0.4129
6	0.4037	0.7969	0.8310	0.6269	0.4129

Average Fishing Mortality For Ages 4- 5

Year	Average F	N Weighted	Biomass Wtd	Catch Wtd
1973	0.7271	0.7271	0.7271	0.7271
1974	0.9201	0.9201	0.9201	0.9201
1975	0.5145	0.5145	0.5145	0.5145
1976	0.3962	0.3962	0.3962	0.3962
1977	0.6978	0.6978	0.6978	0.6978
1978	0.9127	0.9127	0.9127	0.9127
1979	0.7847	0.7847	0.7847	0.7847
1980	1.1947	1.1947	1.1947	1.1947
1981	1.6628	1.6628	1.6628	1.6628
1982	1.3615	1.3615	1.3615	1.3615
1983	1.3275	1.3275	1.3275	1.3275
1984	1.7185	1.7185	1.7185	1.7185
1985	1.4502	1.4502	1.4502	1.4502
1986	1.2835	1.2835	1.2835	1.2835
1987	1.7838	1.7838	1.7838	1.7838
1988	2.0563	2.0563	2.0563	2.0563
1989	1.5850	1.5850	1.5850	1.5850
1990	2.4359	2.4359	2.4359	2.4359
1991	3.2171	3.2171	3.2171	3.2171
1992	2.3499	2.3499	2.3499	2.3499
1993	0.9818	0.9818	0.9818	0.9818
1994	1.8382	1.8382	1.8382	1.8382
1995	1.6959	1.6959	1.6959	1.6959
1996	0.9443	0.9443	0.9443	0.9443
1997	2.2342	2.2342	2.2342	2.2342
1998	1.1450	1.1450	1.1450	1.1450
1999	1.7099	1.7099	1.7099	1.7099
2000	1.3900	1.3900	1.3900	1.3900
2001	2.2271	2.2271	2.2271	2.2271
2002	0.7786	0.7786	0.7786	0.7786
2003	0.4037	0.4037	0.4037	0.4037
2004	0.7969	0.7969	0.7969	0.7969
2005	0.8310	0.8310	0.8310	0.8310
2006	0.6269	0.6269	0.6269	0.6269
2007	0.4129	0.4129	0.4129	0.4129

Back Calculated Partial Recruitment

AGE	1973	1974	1975	1976	1977
1	0.0079	0.0452	0.4004	0.0247	0.1341
2	0.5724	1.0000	0.9416	0.7872	0.6671
3	0.8107	0.4512	1.0000	1.0000	1.0000
4	1.0000	0.4332	0.5543	0.5894	0.7219
5	1.0000	0.4332	0.5543	0.5894	0.7219
6	1.0000	0.4332	0.5543	0.5894	0.7219
AGE	1978	1979	1980	1981	1982
1	0.2175	0.0082	0.0217	0.0002	0.0022
2	0.6199	1.0000	0.4899	0.1520	0.3178
3	0.7085	0.9285	0.7711	0.7513	0.8994
4	1.0000	0.8750	1.0000	1.0000	1.0000
5	1.0000	0.8750	1.0000	1.0000	1.0000
6	1.0000	0.8750	1.0000	1.0000	1.0000
AGE	1983	1984	1985	1986	1987
1	0.1300	0.0154	0.0881	0.0577	0.0712
2	0.3491	0.4740	0.6100	1.0000	0.6620
3	1.0000	1.0000	0.7651	0.9570	0.8266
4	0.8760	0.8635	1.0000	0.9882	1.0000
5	0.8760	0.8635	1.0000	0.9882	1.0000
6	0.8760	0.8635	1.0000	0.9882	1.0000
AGE	1988	1989	1990	1991	1992
1	0.0268	0.0010	0.0110	0.0397	0.1012
2	0.1198	0.1674	0.0727	0.1006	0.3277
3	0.2769	0.4857	0.6201	0.2757	0.3919
4	1.0000	1.0000	1.0000	1.0000	1.0000
5	1.0000	1.0000	1.0000	1.0000	1.0000
6	1.0000	1.0000	1.0000	1.0000	1.0000
AGE	1993	1994	1995	1996	1997
1	0.0066	0.0513	0.0002	0.0010	0.0016
2	0.3832	0.3915	0.0783	0.1880	0.0933
3	0.5853	0.3608	0.2113	0.7645	0.5109
4	1.0000	1.0000	1.0000	1.0000	1.0000
5	1.0000	1.0000	1.0000	1.0000	1.0000
6	1.0000	1.0000	1.0000	1.0000	1.0000

Back Calculated Partial Recruitment

AGE	1998	1999	2000	2001	2002
1	0.0051	0.0012	0.0008	0.0000	0.0013
2	0.2929	0.1140	0.1848	0.0625	0.1914
3	0.9269	0.7581	0.7543	0.4800	0.7273
4	1.0000	1.0000	1.0000	1.0000	1.0000
5	1.0000	1.0000	1.0000	1.0000	1.0000
6	1.0000	1.0000	1.0000	1.0000	1.0000
AGE	2003	2004	2005	2006	2007
1	0.0027	0.0033	0.0081	0.0036	0.0137
2	0.3272	0.4184	0.2427	0.0633	0.0867
3	1.0000	0.7036	0.5632	0.8504	0.2265
4	0.6498	1.0000	1.0000	1.0000	1.0000
5	0.6498	1.0000	1.0000	1.0000	1.0000
6	0.6498	1.0000	1.0000	1.0000	1.0000

JAN-1 Biomass

AGE	1973	1974	1975	1976	1977
1	7368.	1763.	5820.	2934.	9195.
2	4920.	8796.	1867.	4568.	2933.
3	9565.	3160.	1152.	904.	2913.
4	5835.	4943.	1199.	474.	499.
5	4174.	2703.	1803.	699.	305.
6	5677.	2764.	1900.	1672.	764.
=====					
Total	37538.	24128.	13741.	11251.	16609.
AGE	1978	1979	1980	1981	1982
1	10958.	4805.	7921.	13887.	13229.
2	9011.	9463.	5807.	8035.	21363.
3	1633.	5452.	4048.	3561.	6689.
4	1206.	907.	2535.	1655.	1114.
5	259.	493.	452.	804.	337.
6	213.	174.	240.	158.	104.
=====					
Total	23280.	21294.	21004.	28100.	42835.
AGE	1983	1984	1985	1986	1987
1	2468.	2869.	3020.	1095.	3338.
2	12473.	2247.	3253.	3378.	1199.
3	17656.	6874.	1034.	1483.	1048.
4	2214.	3858.	961.	390.	437.
5	327.	565.	691.	260.	106.
6	231.	237.	211.	143.	53.
=====					
Total	35368.	16649.	9170.	6750.	6180.
AGE	1988	1989	1990	1991	1992
1	29237.	5171.	2587.	680.	284.

2	2855.	28361.	4444.	1795.	752.
3	440.	2308.	21067.	3173.	1176.
4	259.	293.	1090.	4215.	1233.
5	82.	39.	68.	102.	174.
6	32.	4.	5.	45.	19.

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Total	32904.	36175.	29262.	10012.	3638.
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AGE	1993	1994	1995	1996	1997
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1	213.	401.	141.	234.	1098.
2	389.	281.	552.	552.	463.
3	412.	318.	191.	697.	895.
4	503.	218.	150.	169.	416.
5	133.	181.	33.	30.	73.
6	7.	74.	40.	39.	42.

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Total	1656.	1472.	1109.	1720.	2987.
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JAN-1 Biomass

AGE	1998	1999	2000	2001	2002
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1	415.	814.	373.	238.	129.
2	1306.	726.	1158.	800.	475.
3	588.	1144.	826.	1093.	1033.
4	287.	258.	383.	309.	413.
5	45.	104.	53.	103.	36.
6	34.	12.	17.	43.	2.

=====

Total	2677.	3058.	2810.	2585.	2087.
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AGE	2003	2004	2005	2006	2007
------------	-------------	-------------	-------------	-------------	-------------

1	74.	192.	641.	730.	100.
2	222.	194.	295.	1384.	1380.
3	566.	231.	234.	311.	2172.
4	615.	286.	133.	155.	194.
5	186.	371.	131.	62.	89.
6	64.	183.	84.	114.	42.

=====

Total	1727.	1457.	1518.	2755.	3978.
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AGE	2008
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1	721.
2	176.
3	2066.
4	2385.
5	142.
6	88.

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Total	5578.
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Mean Biomass

AGE	1973	1974	1975	1976	1977
1	8065.	1821.	5227.	2940.	9143.
2	4006.	4135.	1365.	3823.	2206.
3	7056.	2041.	763.	717.	1928.
4	4115.	3172.	949.	411.	366.
5	2746.	1759.	1350.	566.	204.
6	3700.	1662.	1358.	1260.	504.
Total	29688.	14590.	11012.	9716.	14351.
AGE	1978	1979	1980	1981	1982
1	10251.	5291.	7994.	17256.	12867.
2	7349.	6518.	4904.	7288.	21695.
3	1282.	3789.	2749.	2075.	4139.
4	863.	643.	1602.	834.	681.
5	179.	329.	292.	398.	201.
6	129.	111.	129.	72.	53.
Total	20053.	16680.	17672.	27922.	39636.
AGE	1983	1984	1985	1986	1987
1	2370.	3061.	3208.	1149.	3101.
2	9516.	1558.	2373.	2180.	780.
3	9583.	2963.	716.	886.	567.
4	1345.	1835.	554.	229.	210.
5	194.	249.	385.	163.	49.
6	118.	105.	103.	75.	23.
Total	23126.	9772.	7339.	4681.	4729.
AGE	1988	1989	1990	1991	1992
1	28875.	4802.	2160.	719.	335.
2	2508.	25371.	3797.	1304.	596.
3	373.	1713.	10671.	1964.	838.
4	121.	161.	413.	1249.	506.
5	40.	22.	28.	35.	76.
6	13.	2.	2.	13.	7.
Total	31929.	32071.	17070.	5283.	2358.
AGE	1993	1994	1995	1996	1997
1	245.	472.	280.	330.	1199.
2	430.	234.	638.	1006.	591.
3	334.	212.	197.	590.	532.
4	327.	91.	76.	115.	181.
5	95.	81.	18.	21.	33.
6	4.	31.	18.	23.	16.
Total	1435.	1123.	1226.	2084.	2552.

Mean Biomass

AGE	1998	1999	2000	2001	2002
1	550.	973.	547.	337.	169.
2	1221.	880.	1226.	1099.	627.
3	411.	735.	544.	699.	807.
4	179.	145.	231.	132.	313.
5	27.	56.	30.	43.	27.
6	19.	5.	8.	16.	1.
Total	2407.	2794.	2585.	2325.	1944.
AGE	2003	2004	2005	2006	2007
1	120.	238.	943.	1005.	131.
2	265.	269.	334.	2006.	1869.
3	417.	175.	196.	252.	2304.
4	528.	192.	95.	118.	164.
5	141.	226.	95.	47.	79.
6	48.	116.	53.	77.	32.
Total	1519.	1216.	1716.	3506.	4579.

Spawning Stock Biomass

AGE	1973	1974	1975	1976	1977
1	0.	0.	0.	0.	0.
2	1876.	1982.	698.	1947.	1126.
3	7852.	2071.	775.	728.	1956.
4	5731.	3306.	986.	426.	382.
5	5523.	1834.	1403.	586.	213.
6	7833.	1733.	1411.	1304.	525.
Total	28815.	10926.	5272.	4991.	4203.
AGE	1978	1979	1980	1981	1982
1	0.	0.	0.	0.	0.
2	3746.	3330.	2501.	3677.	11021.
3	1300.	3848.	2791.	2092.	4177.
4	900.	670.	1662.	846.	702.
5	187.	343.	303.	404.	207.
6	134.	115.	134.	73.	54.
Total	6267.	8307.	7391.	7092.	16162.
AGE	1983	1984	1985	1986	1987
1	0.	0.	0.	0.	0.
2	4847.	796.	1212.	1104.	397.
3	9553.	2857.	724.	893.	566.
4	1389.	1856.	569.	237.	211.
5	200.	252.	396.	168.	49.
6	122.	107.	106.	77.	23.
Total	16111.	5866.	3007.	2480.	1246.

AGE	1988	1989	1990	1991	1992
1	0.	0.	0.	0.	0.
2	1265.	12807.	1908.	660.	305.
3	378.	1740.	10640.	1995.	851.
4	119.	164.	391.	1062.	484.
5	39.	23.	27.	30.	72.
6	13.	2.	2.	11.	7.
Total	1814.	14736.	12968.	3758.	1718.
AGE	1993	1994	1995	1996	1997
1	0.	0.	0.	0.	0.
2	218.	120.	320.	505.	298.
3	339.	216.	198.	599.	539.
4	340.	92.	77.	120.	175.
5	99.	82.	18.	22.	32.
6	4.	32.	18.	24.	15.
Total	1000.	540.	631.	1270.	1058.
Spawning Stock Biomass					
AGE	1998	1999	2000	2001	2002
1	0.	0.	0.	0.	0.
2	618.	443.	619.	551.	315.
3	417.	740.	551.	708.	818.
4	186.	147.	238.	127.	326.
5	28.	57.	30.	41.	28.
6	19.	5.	9.	16.	1.
Total	1268.	1392.	1447.	1444.	1488.
AGE	2003	2004	2005	2006	2007
1	0.	0.	0.	0.	0.
2	133.	136.	168.	1000.	932.
3	423.	177.	198.	255.	2292.
4	547.	201.	99.	123.	170.
5	146.	236.	99.	49.	81.
6	50.	121.	55.	81.	33.
Total	1299.	870.	619.	1509.	3508.

Catch Biomass

AGE	1973	1974	1975	1976	1977
1	46.	175.	1942.	49.	1185.
2	1667.	8784.	1193.	2023.	1423.
3	4159.	1956.	708.	482.	1863.
4	2992.	2919.	488.	163.	256.
5	1996.	1619.	695.	224.	143.
6	2690.	1530.	698.	499.	352.
Total	13551.	16981.	5725.	3440.	5221.
AGE	1978	1979	1980	1981	1982
1	2035.	39.	207.	5.	38.
2	4158.	5845.	2870.	1842.	9388.
3	829.	3155.	2532.	2592.	5068.
4	788.	504.	1914.	1387.	927.
5	164.	258.	349.	662.	274.
6	117.	87.	154.	119.	72.
Total	8091.	9888.	8028.	6607.	15767.
AGE	1983	1984	1985	1986	1987
1	467.	94.	410.	86.	394.
2	5034.	1469.	2099.	2831.	921.
3	14522.	5897.	794.	1101.	836.
4	1786.	3154.	803.	294.	374.
5	257.	428.	559.	209.	87.
6	157.	181.	150.	96.	41.
Total	22223.	11223.	4814.	4617.	2653.
AGE	1988	1989	1990	1991	1992
1	1593.	7.	58.	92.	80.
2	618.	6733.	672.	422.	459.
3	212.	1319.	16119.	1742.	772.
4	249.	255.	1005.	4017.	1189.
5	82.	35.	69.	114.	178.
6	26.	3.	4.	41.	17.
Total	2781.	8353.	17928.	6427.	2694.
AGE	1993	1994	1995	1996	1997
1	2.	45.	0.	0.	4.
2	162.	168.	85.	179.	123.
3	192.	141.	70.	426.	608.
4	321.	168.	128.	109.	404.
5	93.	150.	30.	20.	73.
6	4.	58.	31.	22.	35.
Total	773.	729.	345.	755.	1248.

Catch Biomass

AGE	1998	1999	2000	2001	2002
1	3.	2.	1.	0.	0.
2	410.	171.	315.	153.	94.
3	436.	953.	570.	747.	457.
4	206.	248.	321.	293.	244.
5	31.	96.	41.	95.	21.
6	21.	9.	12.	36.	1.
Total	1107.	1480.	1259.	1324.	816.
AGE	2003	2004	2005	2006	2007
1	0.	1.	6.	2.	1.
2	54.	90.	67.	80.	67.
3	259.	98.	92.	135.	215.
4	213.	153.	79.	74.	68.
5	57.	180.	79.	30.	32.
6	19.	92.	44.	49.	13.
Total	603.	614.	367.	369.	396.

Catch Numbers

AGE	1973	1974	1975	1976	1977
1	220.0	861.0	8910.0	214.0	5513.0
2	5632.0	28519.0	4129.0	6677.0	5027.0
3	11951.0	5556.0	1884.0	1181.0	4891.0
4	7978.0	7370.0	1130.0	327.0	507.0
5	5226.0	3687.0	1597.0	449.0	278.0
6	6286.0	3347.0	1452.0	896.0	649.0
Total	37293.0	49340.0	19102.0	9744.0	16865.0
AGE	1978	1979	1980	1981	1982
1	8698.0	205.0	1006.0	38.0	169.0
2	14191.0	19419.0	10215.0	7029.0	35696.0
3	2164.0	8667.0	6595.0	7578.0	14358.0
4	1470.0	1062.0	3829.0	2926.0	1858.0
5	247.0	438.0	512.0	1111.0	415.0
6	179.0	131.0	167.0	183.0	86.0
Total	26949.0	29922.0	22324.0	18865.0	52582.0
AGE	1983	1984	1985	1986	1987
1	2668.0	517.0	2239.0	463.0	1594.0
2	19288.0	6200.0	8074.0	9970.0	3437.0
3	42837.0	19990.0	2175.0	3326.0	2368.0
4	3601.0	8129.0	1968.0	635.0	926.0
5	385.0	878.0	1109.0	356.0	167.0
6	192.0	276.0	246.0	149.0	65.0
Total	68971.0	35990.0	15811.0	14899.0	8557.0

AGE	1988	1989	1990	1991	1992
1	5899.0	24.0	192.0	446.0	477.0
2	2109.0	19920.0	2056.0	1610.0	1453.0
3	536.0	3347.0	42644.0	5169.0	2097.0
4	506.0	462.0	2209.0	9703.0	2739.0
5	134.0	48.0	90.0	168.0	297.0
6	32.0	3.0	5.0	51.0	18.0
=====					
Total	9216.0	23804.0	47196.0	17147.0	7081.0

AGE	1993	1994	1995	1996	1997
1	13.0	362.0	1.0	3.0	22.0
2	457.0	851.0	373.0	519.0	485.0
3	447.0	399.0	198.0	1117.0	1512.0
4	711.0	404.0	288.0	232.0	789.0
5	145.0	297.0	51.0	32.0	110.0
6	4.0	86.0	36.0	30.0	42.0
=====					
Total	1777.0	2399.0	947.0	1933.0	2960.0

Catch Numbers

AGE	1998	1999	2000	2001	2002
1	19.0	10.0	4.0	0.0	1.0
2	1463.0	475.0	905.0	405.0	250.0
3	1136.0	2217.0	1190.0	1683.0	966.0
4	396.0	407.0	514.0	477.0	388.0
5	52.0	125.0	55.0	126.0	25.0
6	31.0	8.0	13.0	39.0	1.0
=====					
Total	3097.0	3242.0	2681.0	2730.0	1631.0

AGE	2003	2004	2005	2006	2007
1	2.0	4.0	66.0	19.0	6.0
2	155.0	280.0	226.0	312.0	245.0
3	594.0	243.0	217.0	344.0	564.0
4	344.0	311.0	150.0	139.0	135.0
5	89.0	313.0	118.0	44.0	44.0
6	23.0	124.0	52.0	57.0	15.0
=====					
Total	1207.0	1275.0	829.0	915.0	1009.0

Surplus Production

Average Adjustment Factor (Delta) = 1.0000

Year	Biomass	Delta Biomass	Catch Biomass	Surplus Production
1973	37538.414	-13410.443	13550.710	140.267
1974	24127.971	-10387.375	16981.039	6593.664
1975	13740.596	-2489.861	5725.312	3235.451
1976	11250.735	5357.928	3439.740	8797.668
1977	16608.663	6671.761	5221.307	11893.068
1978	23280.425	-1986.343	8090.965	6104.622
1979	21294.082	-289.976	9888.244	9598.268
1980	21004.106	7096.031	8028.290	15124.321
1981	28100.138	14735.348	6606.624	21341.972
1982	42835.486	-7467.205	15767.296	8300.091
1983	35368.281	-18719.190	22223.335	3504.145
1984	16649.091	-7479.310	11223.238	3743.928
1985	9169.781	-2419.701	4814.300	2394.599
1986	6750.080	-570.480	4617.139	4046.659
1987	6179.600	26724.703	2652.697	29377.400
1988	32904.303	3270.575	2780.527	6051.102
1989	36174.879	-6912.690	8352.779	1440.089
1990	29262.189	-19250.658	17927.721	-1322.937
1991	10011.531	-6373.294	6427.395	54.101
1992	3638.237	-1981.873	2693.656	711.783
1993	1656.364	-184.511	773.340	588.829
1994	1471.854	-363.330	729.415	366.085
1995	1108.524	611.855	344.690	956.545
1996	1720.379	1266.733	754.872	2021.605
1997	2987.111	-310.526	1247.678	937.152
1998	2676.586	381.778	1106.587	1488.365
1999	3058.364	-248.852	1479.685	1230.833
2000	2809.512	-224.160	1259.460	1035.300
2001	2585.352	-498.293	1323.861	825.568
2002	2087.059	-360.390	815.994	455.604
2003	1726.669	-270.103	602.578	332.475
2004	1456.566	61.383	614.028	675.411
2005	1517.950	1237.421	367.132	1604.553
2006	2755.370	1222.253	368.796	1591.049
2007	3977.623	1600.631	396.175	1996.806
2008	5578.254			

Summary of Survey Indices Used in the Estimate

INDEX	Survey Tag	Age	Time	Type	Catchability	Std. Error	CV
1	NEFSC_W	1	JAN-1	NUMBER	0.4537E-01	0.1252E-01	0.2759E+00
2	NEFSC_W	2	JAN-1	NUMBER	0.1426E+01	0.2589E+00	0.1816E+00
3	NEFSC_W	3	JAN-1	NUMBER	0.2292E+01	0.4184E+00	0.1825E+00
4	NEFSC_W	4	JAN-1	NUMBER	0.2548E+01	0.3202E+00	0.1256E+00
5	NEFSC_W	5	JAN-1	NUMBER	0.1895E+01	0.4393E+00	0.2318E+00
6	NEFSC_W	6	JAN-1	NUMBER	0.2341E+01	0.8269E+00	0.3533E+00
7	NEFSC_S	1	JAN-1	NUMBER	0.1420E-01	0.2378E-02	0.1675E+00
8	NEFSC_S	2	JAN-1	NUMBER	0.1830E+00	0.2739E-01	0.1497E+00
9	NEFSC_S	3	JAN-1	NUMBER	0.2834E+00	0.3699E-01	0.1305E+00
10	NEFSC_S	4	JAN-1	NUMBER	0.4193E+00	0.4354E-01	0.1038E+00
11	NEFSC_S	5	JAN-1	NUMBER	0.5500E+00	0.9534E-01	0.1733E+00
12	NEFSC_S	6	JAN-1	NUMBER	0.5684E+00	0.1139E+00	0.2004E+00
13	NEFSC_F	1	MEAN	NUMBER	0.1006E+00	0.1591E-01	0.1582E+00
14	NEFSC_F	2	MEAN	NUMBER	0.1756E+00	0.2861E-01	0.1629E+00
15	NEFSC_F	3	MEAN	NUMBER	0.1996E+00	0.2466E-01	0.1235E+00
16	NEFSC_F	4	MEAN	NUMBER	0.2170E+00	0.2819E-01	0.1299E+00
17	NEFSC_F	5	MEAN	NUMBER	0.2218E+00	0.4204E-01	0.1895E+00
18	NEFSC_F	6	MEAN	NUMBER	0.4497E+00	0.1327E+00	0.2951E+00

Survey Index: 1 Tag: NEFSC_W AGE = 1
Time = JAN-1 Type = NUMBER
Catchability = 0.453675E-01 % Variance Contribution = 5.4089
Residual = LN(Observed) - LN(Predicted)

Year	Observed	Predicted	Residual
1973	N/A	0.192771E+04	N/A
1974	N/A	0.470100E+03	N/A
1975	N/A	0.142810E+04	N/A
1976	N/A	0.650540E+03	N/A
1977	N/A	0.226462E+04	N/A
1978	N/A	0.240976E+04	N/A
1979	N/A	0.140629E+04	N/A
1980	N/A	0.196693E+04	N/A
1981	N/A	0.617046E+04	N/A
1982	N/A	0.285388E+04	N/A
1983	N/A	0.744357E+03	N/A
1984	N/A	0.854531E+03	N/A
1985	N/A	0.932740E+03	N/A
1986	N/A	0.320631E+03	N/A
1987	N/A	0.667675E+03	N/A
1988	N/A	0.549700E+04	N/A
1989	N/A	0.773458E+03	N/A
1990	N/A	0.363809E+03	N/A
1991	N/A	0.185634E+03	N/A
1992	0.137170E+02	0.112338E+03	-0.210287E+01
1993	0.852026E+03	0.100864E+03	0.213385E+01
1994	0.444803E+03	0.201161E+03	0.793525E+00
1995	0.128311E+03	0.194525E+03	-0.416101E+00
1996	0.581540E+02	0.157190E+03	-0.994359E+00
1997	0.222758E+03	0.313234E+03	-0.340865E+00
1998	0.168891E+03	0.164389E+03	0.270156E-01
1999	0.347069E+03	0.243692E+03	0.353620E+00
2000	0.155174E+03	0.190190E+03	-0.203478E+00
2001	0.401510E+02	0.110133E+03	-0.100904E+01
2002	0.172890E+02	0.513845E+02	-0.108927E+01
2003	0.473808E+03	0.601433E+02	0.206407E+01
2004	0.721570E+02	0.755879E+02	-0.464525E-01
2005	0.559397E+03	0.493481E+03	0.125375E+00
2006	0.993912E+03	0.426833E+03	0.845255E+00
2007	0.461520E+02	0.531019E+02	-0.140272E+00
2008	N/A	0.000000E+00	N/A

Survey Index: 2 Tag: NEFSC_W AGE = 2
Time = JAN-1 Type = NUMBER
Catchability = 0.142556E+01 % Variance Contribution = 2.3443
Residual = LN(Observed) - LN(Predicted)

Year	Observed	Predicted	Residual
1973	N/A	0.258425E+05	N/A
1974	N/A	0.493104E+05	N/A
1975	N/A	0.109871E+05	N/A
1976	N/A	0.253369E+05	N/A
1977	N/A	0.164607E+05	N/A
1978	N/A	0.511770E+05	N/A
1979	N/A	0.508310E+05	N/A
1980	N/A	0.359151E+05	N/A
1981	N/A	0.493075E+05	N/A
1982	N/A	0.158696E+06	N/A
1983	N/A	0.732033E+05	N/A
1984	N/A	0.157253E+05	N/A
1985	N/A	0.213188E+05	N/A
1986	N/A	0.211191E+05	N/A
1987	N/A	0.765328E+04	N/A
1988	N/A	0.151287E+05	N/A
1989	N/A	0.133830E+06	N/A
1990	N/A	0.198676E+05	N/A
1991	N/A	0.911244E+04	N/A
1992	0.209870E+04	0.420261E+04	-0.694388E+00
1993	0.274912E+04	0.227824E+04	0.187877E+00
1994	0.105108E+05	0.257814E+04	0.140533E+01
1995	0.152613E+05	0.470977E+04	0.117568E+01
1996	0.183579E+04	0.500318E+04	-0.100260E+01
1997	0.340096E+04	0.404011E+04	-0.172213E+00
1998	0.112032E+05	0.803014E+04	0.333000E+00
1999	0.415597E+04	0.420473E+04	-0.116635E-01
2000	0.702539E+04	0.625649E+04	0.115911E+00
2001	0.127868E+04	0.488781E+04	-0.134091E+01
2002	0.390778E+04	0.283308E+04	0.321604E+00
2003	0.996483E+03	0.132066E+04	-0.281657E+00
2004	0.137384E+04	0.154471E+04	-0.117224E+00
2005	0.111279E+04	0.193947E+04	-0.555545E+00
2006	0.267710E+05	0.126106E+05	0.752779E+00
2007	0.975665E+04	0.109565E+05	-0.115986E+00
2008	N/A	0.135841E+04	N/A

Survey Index: 3 Tag: NEFSC_W AGE = 3
Time = JAN-1 Type = NUMBER
Catchability = 0.229197E+01 % Variance Contribution = 2.3680
Residual = LN(Observed) - LN(Predicted)

Year	Observed	Predicted	Residual
1973	N/A	0.672061E+05	N/A
1974	N/A	0.224367E+05	N/A
1975	N/A	0.775984E+04	N/A
1976	N/A	0.603540E+04	N/A
1977	N/A	0.196478E+05	N/A
1978	N/A	0.113698E+05	N/A
1979	N/A	0.382577E+05	N/A
1980	N/A	0.272906E+05	N/A
1981	N/A	0.263301E+05	N/A
1982	N/A	0.504128E+05	N/A
1983	N/A	0.135519E+06	N/A
1984	N/A	0.567731E+05	N/A
1985	N/A	0.805941E+04	N/A
1986	N/A	0.115863E+05	N/A
1987	N/A	0.758495E+04	N/A
1988	N/A	0.309295E+04	N/A
1989	N/A	0.155656E+05	N/A
1990	N/A	0.135103E+06	N/A
1991	N/A	0.219079E+05	N/A
1992	0.459191E+04	0.867943E+04	-0.636660E+00
1993	0.151073E+04	0.256152E+04	-0.528010E+00
1994	0.901322E+03	0.205861E+04	-0.825924E+00
1995	0.385491E+04	0.165250E+04	0.847059E+00
1996	0.117672E+05	0.542902E+04	0.773556E+00
1997	0.139816E+05	0.551443E+04	0.930376E+00
1998	0.228031E+04	0.431742E+04	-0.638346E+00
1999	0.145400E+05	0.755808E+04	0.654289E+00
2000	0.429471E+04	0.455452E+04	-0.587366E-01
2001	0.122049E+05	0.636984E+04	0.650259E+00
2002	0.368359E+04	0.559737E+04	-0.418409E+00
2003	0.371045E+04	0.321293E+04	0.143970E+00
2004	0.455948E+03	0.141859E+04	-0.113504E+01
2005	0.880318E+03	0.145683E+04	-0.503732E+00
2006	0.651258E+04	0.208663E+04	0.113818E+01
2007	0.107713E+05	0.159541E+05	-0.392836E+00
2008	N/A	0.139154E+05	N/A

Survey Index: 4 Tag: NEFSC_W AGE = 4
Time = JAN-1 Type = NUMBER
Catchability = 0.254824E+01 % Variance Contribution = 1.1217
Residual = LN(Observed) - LN(Predicted)

Year	Observed	Predicted	Residual
1973	N/A	0.428976E+05	N/A
1974	N/A	0.339324E+05	N/A
1975	N/A	0.783276E+04	N/A
1976	N/A	0.279211E+04	N/A
1977	N/A	0.280526E+04	N/A
1978	N/A	0.680259E+04	N/A
1979	N/A	0.542113E+04	N/A
1980	N/A	0.151450E+05	N/A
1981	N/A	0.988786E+04	N/A
1982	N/A	0.687201E+04	N/A
1983	N/A	0.134863E+05	N/A
1984	N/A	0.271054E+05	N/A
1985	N/A	0.706274E+04	N/A
1986	N/A	0.241902E+04	N/A
1987	N/A	0.304274E+04	N/A
1988	N/A	0.158034E+04	N/A
1989	N/A	0.159316E+04	N/A
1990	N/A	0.656137E+04	N/A
1991	N/A	0.271535E+05	N/A
1992	0.106162E+05	0.821519E+04	0.256401E+00
1993	0.355328E+04	0.314572E+04	0.121829E+00
1994	0.200911E+04	0.131246E+04	0.425792E+00
1995	0.853169E+03	0.965426E+03	-0.123612E+00
1996	0.121653E+04	0.105115E+04	0.146113E+00
1997	0.422684E+04	0.240103E+04	0.565555E+00
1998	0.165461E+04	0.160300E+04	0.316914E-01
1999	0.110993E+04	0.135983E+04	-0.203057E+00
2000	0.165804E+04	0.188205E+04	-0.126724E+00
2001	0.230746E+04	0.145295E+04	0.462552E+00
2002	0.292487E+04	0.199096E+04	0.384631E+00
2003	0.756150E+03	0.289221E+04	-0.134154E+01
2004	0.841596E+03	0.157126E+04	-0.624334E+00
2005	0.741861E+03	0.737102E+03	0.643498E-02
2006	0.493669E+03	0.830453E+03	-0.520106E+00
2007	0.190938E+04	0.111450E+04	0.538370E+00
2008	N/A	0.132264E+05	N/A

Survey Index: 5 Tag: NEFSC_W AGE = 5
 Time = JAN-1 Type = NUMBER
 Catchability = 0.189483E+01 % Variance Contribution = 3.8196
 Residual = LN(Observed) - LN(Predicted)

Year	Observed	Predicted	Residual
1973	N/A	0.208949E+05	N/A
1974	N/A	0.126227E+05	N/A
1975	N/A	0.823138E+04	N/A
1976	N/A	0.285077E+04	N/A
1977	N/A	0.114378E+04	N/A
1978	N/A	0.849935E+03	N/A
1979	N/A	0.166254E+04	N/A
1980	N/A	0.150586E+04	N/A
1981	N/A	0.279173E+04	N/A
1982	N/A	0.114135E+04	N/A
1983	N/A	0.107217E+04	N/A
1984	N/A	0.217693E+04	N/A
1985	N/A	0.295945E+04	N/A
1986	N/A	0.100843E+04	N/A
1987	N/A	0.408039E+03	N/A
1988	N/A	0.311198E+03	N/A
1989	N/A	0.123081E+03	N/A
1990	N/A	0.198780E+03	N/A
1991	N/A	0.349591E+03	N/A
1992	0.123539E+04	0.662390E+03	0.623286E+00
1993	0.417369E+03	0.477034E+03	-0.133617E+00
1994	0.117352E+04	0.717450E+03	0.492058E+00
1995	0.361357E+03	0.127124E+03	0.104470E+01
1996	0.200468E+03	0.107810E+03	0.620284E+00
1997	0.755436E+03	0.248912E+03	0.111020E+01
1998	0.160460E+03	0.156521E+03	0.248534E-01
1999	0.444517E+03	0.310550E+03	0.358643E+00
2000	0.103878E+03	0.149748E+03	-0.365740E+00
2001	0.362215E+03	0.285387E+03	0.238392E+00
2002	0.143028E+03	0.953900E+02	0.405067E+00
2003	0.608690E+02	0.556407E+03	-0.221278E+01
2004	0.204612E+03	0.117588E+04	-0.174866E+01
2005	0.837881E+03	0.431172E+03	0.664370E+00
2006	0.127311E+03	0.195472E+03	-0.428785E+00
2007	0.135170E+03	0.270104E+03	-0.692275E+00
2008	N/A	0.449007E+03	N/A

Survey Index: 6 Tag: NEFSC_W AGE = 6
 Time = JAN-1 Type = NUMBER
 Catchability = 0.234050E+01 % Variance Contribution = 5.7652
 Residual = LN(Observed) - LN(Predicted)

Year	Observed	Predicted	Residual
1973	N/A	0.310444E+05	N/A
1974	N/A	0.141538E+05	N/A
1975	N/A	0.924425E+04	N/A
1976	N/A	0.702686E+04	N/A
1977	N/A	0.329821E+04	N/A
1978	N/A	0.760815E+03	N/A
1979	N/A	0.614194E+03	N/A
1980	N/A	0.606693E+03	N/A
1981	N/A	0.568000E+03	N/A
1982	N/A	0.292150E+03	N/A
1983	N/A	0.660450E+03	N/A
1984	N/A	0.845273E+03	N/A
1985	N/A	0.810872E+03	N/A
1986	N/A	0.521340E+03	N/A
1987	N/A	0.196172E+03	N/A
1988	N/A	0.917952E+02	N/A
1989	N/A	0.950186E+01	N/A
1990	N/A	0.136407E+02	N/A
1991	N/A	0.131087E+03	N/A
1992	N/A	0.495869E+02	N/A
1993	N/A	0.162547E+02	N/A
1994	0.571971E+03	0.256609E+03	0.801536E+00
1995	0.286771E+03	0.110840E+03	0.950593E+00
1996	0.136741E+03	0.124844E+03	0.910233E-01
1997	0.535820E+02	0.117392E+03	-0.784308E+00
1998	0.260050E+02	0.115257E+03	-0.148888E+01
1999	0.112880E+03	0.245499E+02	0.152562E+01
2000	0.142457E+03	0.437200E+02	0.118123E+01
2001	0.202469E+03	0.109110E+03	0.618228E+00
2002	0.280060E+02	0.471303E+01	0.178209E+01
2003	0.370070E+02	0.177610E+03	-0.156848E+01
2004	0.621550E+02	0.575412E+03	-0.222546E+01
2005	0.148029E+03	0.234698E+03	-0.460891E+00
2006	0.205041E+03	0.312784E+03	-0.422302E+00
2007	N/A	0.113739E+03	N/A
2008	N/A	0.242387E+03	N/A

Survey Index: 7 Tag: NEFSC_S AGE = 1
Time = JAN-1 Type = NUMBER
Catchability = 0.141979E-01 % Variance Contribution = 7.7271
Residual = LN(Observed) - LN(Predicted)

Year	Observed	Predicted	Residual
1973	0.912670E+03	0.603285E+03	0.413984E+00
1974	0.592291E+03	0.147120E+03	0.139275E+01
1975	0.414470E+03	0.446930E+03	-0.754006E-01
1976	0.498030E+02	0.203589E+03	-0.140803E+01
1977	0.157298E+04	0.708721E+03	0.797266E+00
1978	0.310552E+04	0.754143E+03	0.141535E+01
1979	0.986706E+03	0.440102E+03	0.807365E+00
1980	0.708610E+03	0.615557E+03	0.140777E+00
1981	0.849162E+03	0.193107E+04	-0.821579E+00
1982	0.340099E+03	0.893134E+03	-0.965500E+00
1983	0.663490E+02	0.232949E+03	-0.125589E+01
1984	0.783820E+02	0.267429E+03	-0.122726E+01
1985	0.446057E+03	0.291904E+03	0.424020E+00
1986	0.272410E+02	0.100343E+03	-0.130387E+01
1987	N/A	0.208951E+03	N/A
1988	0.476473E+03	0.172031E+04	-0.128385E+01
1989	0.229797E+03	0.242057E+03	-0.519750E-01
1990	0.127015E+03	0.113855E+03	0.109376E+00
1991	0.346450E+03	0.580948E+02	0.178566E+01
1992	0.601650E+02	0.351565E+02	0.537280E+00
1993	0.272410E+02	0.315656E+02	-0.147346E+00
1994	0.223950E+02	0.629542E+02	-0.103357E+01
1995	0.264060E+02	0.608772E+02	-0.835267E+00
1996	N/A	0.491931E+02	N/A
1997	0.879080E+02	0.980278E+02	-0.108960E+00
1998	0.113478E+03	0.514463E+02	0.791071E+00
1999	0.593290E+02	0.762642E+02	-0.251106E+00
2000	0.320880E+02	0.595208E+02	-0.617843E+00
2001	N/A	0.344666E+02	N/A
2002	0.815570E+02	0.160810E+02	0.162367E+01
2003	0.516420E+02	0.188221E+02	0.100931E+01
2004	0.272410E+02	0.236555E+02	0.141126E+00
2005	0.245507E+03	0.154437E+03	0.463540E+00
2006	0.838970E+02	0.133579E+03	-0.465104E+00
2007	N/A	0.166184E+02	N/A
2008	N/A	0.000000E+00	N/A

Survey Index: 8 Tag: NEFSC_S AGE = 2
Time = JAN-1 Type = NUMBER
Catchability = 0.182963E+00 % Variance Contribution = 8.3641
Residual = LN(Observed) - LN(Predicted)

Year	Observed	Predicted	Residual
1973	0.552365E+04	0.331673E+04	0.510060E+00
1974	0.250771E+04	0.632870E+04	-0.925724E+00
1975	0.151298E+04	0.141013E+04	0.703988E-01
1976	0.426971E+04	0.325184E+04	0.272326E+00
1977	0.164217E+04	0.211264E+04	-0.251918E+00
1978	0.118991E+05	0.656826E+04	0.594216E+00
1979	0.292185E+04	0.652386E+04	-0.803251E+00
1980	0.652005E+04	0.460949E+04	0.346765E+00
1981	0.182614E+05	0.632833E+04	0.105975E+01
1982	0.299506E+05	0.203678E+05	0.385598E+00
1983	0.108319E+05	0.939522E+04	0.142292E+00
1984	0.924034E+03	0.201825E+04	-0.781239E+00
1985	0.269589E+04	0.273614E+04	-0.148198E-01
1986	0.483443E+04	0.271051E+04	0.578624E+00
1987	0.144396E+03	0.982254E+03	-0.191729E+01
1988	0.595801E+03	0.194168E+04	-0.118140E+01
1989	0.159255E+05	0.171763E+05	-0.756077E-01
1990	0.689558E+03	0.254989E+04	-0.130775E+01
1991	0.844483E+03	0.116953E+04	-0.325632E+00
1992	0.847320E+02	0.539381E+03	-0.185093E+01
1993	0.423328E+03	0.292399E+03	0.370029E+00
1994	0.382048E+03	0.330890E+03	0.143761E+00
1995	0.195286E+04	0.604471E+03	0.117269E+01
1996	0.664322E+03	0.642129E+03	0.339782E-01
1997	0.147922E+04	0.518524E+03	0.104829E+01
1998	0.504049E+04	0.103062E+04	0.158734E+01
1999	0.108715E+04	0.539652E+03	0.700389E+00
2000	0.193581E+04	0.802984E+03	0.879945E+00
2001	0.115651E+03	0.627322E+03	-0.169088E+01
2002	0.199029E+04	0.363609E+03	0.169996E+01
2003	0.125678E+03	0.169499E+03	-0.299126E+00
2004	0.227123E+03	0.198255E+03	0.135940E+00
2005	0.343275E+03	0.248920E+03	0.321399E+00
2006	0.264693E+04	0.161850E+04	0.491898E+00
2007	0.962974E+03	0.140621E+04	-0.378624E+00
2008	0.830610E+02	0.174344E+03	-0.741454E+00

Survey Index: 9 Tag: NEFSC_S AGE = 3
Time = JAN-1 Type = NUMBER
Catchability = 0.283400E+00 % Variance Contribution = 6.3554
Residual = LN(Observed) - LN(Predicted)

Year	Observed	Predicted	Residual
1973	0.150969E+05	0.830998E+04	0.597033E+00
1974	0.295694E+04	0.277427E+04	0.637668E-01
1975	0.454914E+03	0.959497E+03	-0.746301E+00
1976	0.580091E+03	0.746271E+03	-0.251904E+00
1977	0.288174E+04	0.242944E+04	0.170733E+00
1978	0.210979E+04	0.140586E+04	0.405935E+00
1979	0.154841E+04	0.473053E+04	-0.111681E+01
1980	0.441845E+04	0.337446E+04	0.269554E+00
1981	0.474351E+04	0.325569E+04	0.376372E+00
1982	0.972283E+04	0.623350E+04	0.444540E+00
1983	0.179486E+05	0.167568E+05	0.687083E-01
1984	0.183821E+04	0.701994E+04	-0.133996E+01
1985	0.677859E+03	0.996539E+03	-0.385349E+00
1986	0.153003E+04	0.143264E+04	0.657680E-01
1987	0.117071E+04	0.937872E+03	0.221753E+00
1988	0.208071E+03	0.382440E+03	-0.608693E+00
1989	0.761923E+03	0.192468E+04	-0.926667E+00
1990	0.218046E+05	0.167053E+05	0.266396E+00
1991	0.356461E+04	0.270890E+04	0.274513E+00
1992	0.954618E+03	0.107320E+04	-0.117092E+00
1993	0.187180E+03	0.316730E+03	-0.525978E+00
1994	0.232300E+02	0.254545E+03	-0.239403E+01
1995	0.114146E+03	0.204330E+03	-0.582258E+00
1996	0.217814E+04	0.671294E+03	0.117702E+01
1997	0.191158E+04	0.681854E+03	0.103087E+01
1998	0.644601E+03	0.533844E+03	0.188527E+00
1999	0.322551E+04	0.934549E+03	0.123878E+01
2000	0.247830E+04	0.563162E+03	0.148176E+01
2001	0.193464E+04	0.787624E+03	0.898655E+00
2002	0.393078E+03	0.692109E+03	-0.565736E+00
2003	0.339431E+03	0.397276E+03	-0.157360E+00
2004	0.488172E+03	0.175407E+03	0.102356E+01
2005	0.161443E+03	0.180135E+03	-0.109555E+00
2006	0.374360E+03	0.258010E+03	0.372219E+00
2007	0.132062E+04	0.197272E+04	-0.401308E+00
2008	0.114481E+04	0.172063E+04	-0.407453E+00

Survey Index: 10 Tag: NEFSC_S AGE = 4
Time = JAN-1 Type = NUMBER
Catchability = 0.419285E+00 % Variance Contribution = 3.7991
Residual = LN(Observed) - LN(Predicted)

Year	Observed	Predicted	Residual
1973	0.849112E+04	0.705835E+04	0.184810E+00
1974	0.571216E+04	0.558321E+04	0.228341E-01
1975	0.588280E+03	0.128880E+04	-0.784260E+00
1976	0.278430E+03	0.459411E+03	-0.500778E+00
1977	0.263222E+03	0.461575E+03	-0.561647E+00
1978	0.900971E+03	0.111929E+04	-0.216980E+00
1979	0.278263E+03	0.891989E+03	-0.116489E+01
1980	0.278614E+04	0.249194E+04	0.111595E+00
1981	0.249752E+04	0.162694E+04	0.428595E+00
1982	0.243785E+04	0.113071E+04	0.768268E+00
1983	0.122018E+04	0.221903E+04	-0.598070E+00
1984	0.430130E+04	0.445990E+04	-0.362110E-01
1985	0.802869E+03	0.116210E+04	-0.369791E+00
1986	0.395251E+03	0.398024E+03	-0.699105E-02
1987	0.278430E+03	0.500650E+03	-0.586741E+00
1988	0.290129E+03	0.260028E+03	0.109535E+00
1989	0.160607E+03	0.262138E+03	-0.489910E+00
1990	0.311571E+04	0.107960E+04	0.105986E+01
1991	0.590369E+04	0.446781E+04	0.278680E+00
1992	0.266949E+04	0.135172E+04	0.680508E+00
1993	0.827102E+03	0.517594E+03	0.468738E+00
1994	N/A	0.215951E+03	N/A
1995	0.154089E+03	0.158850E+03	-0.304329E-01
1996	0.946596E+03	0.172956E+03	0.169984E+01
1997	0.546165E+03	0.395064E+03	0.323873E+00
1998	0.269238E+03	0.263756E+03	0.205704E-01
1999	0.583266E+03	0.223745E+03	0.958135E+00
2000	0.355141E+03	0.309671E+03	0.137004E+00
2001	0.400599E+03	0.239067E+03	0.516217E+00
2002	0.333916E+03	0.327591E+03	0.191226E-01
2003	0.179492E+03	0.475881E+03	-0.975038E+00
2004	0.169465E+03	0.258534E+03	-0.422382E+00
2005	0.112475E+03	0.121282E+03	-0.753896E-01
2006	0.176818E+03	0.136642E+03	0.257756E+00
2007	0.145900E+03	0.183379E+03	-0.228635E+00
2008	0.802367E+03	0.217626E+04	-0.997797E+00

Survey Index: 11 Tag: NEFSC_S AGE = 5
 Time = JAN-1 Type = NUMBER
 Catchability = 0.550028E+00 % Variance Contribution = 7.7397
 Residual = LN(Observed) - LN(Predicted)

Year	Observed	Predicted	Residual
1973	0.658656E+04	0.606533E+04	0.824430E-01
1974	0.345497E+04	0.366409E+04	-0.587638E-01
1975	0.866042E+03	0.238939E+04	-0.101486E+01
1976	0.264559E+03	0.827515E+03	-0.114036E+01
1977	0.164785E+03	0.332013E+03	-0.700533E+00
1978	0.292636E+03	0.246717E+03	0.170687E+00
1979	0.121166E+03	0.482598E+03	-0.138202E+01
1980	0.274419E+03	0.437118E+03	-0.465547E+00
1981	0.554354E+03	0.810378E+03	-0.379697E+00
1982	0.799025E+03	0.331308E+03	0.880345E+00
1983	0.389234E+03	0.311226E+03	0.223661E+00
1984	0.800027E+03	0.631915E+03	0.235890E+00
1985	0.119294E+04	0.859063E+03	0.328332E+00
1986	0.207402E+03	0.292726E+03	-0.344578E+00
1987	N/A	0.118445E+03	N/A
1988	0.491348E+03	0.903339E+02	0.169364E+01
1989	N/A	0.357277E+02	N/A
1990	0.112475E+03	0.577014E+02	0.667449E+00
1991	0.765433E+03	0.101478E+03	0.202060E+01
1992	N/A	0.192277E+03	N/A
1993	0.285780E+02	0.138472E+03	-0.157803E+01
1994	0.972670E+02	0.208260E+03	-0.761327E+00
1995	0.312520E+02	0.369013E+02	-0.166165E+00
1996	0.119829E+03	0.312949E+02	0.134261E+01
1997	0.112141E+03	0.722536E+02	0.439575E+00
1998	0.606660E+02	0.454346E+02	0.289109E+00
1999	0.124341E+03	0.901458E+02	0.321600E+00
2000	N/A	0.434687E+02	N/A
2001	0.137377E+03	0.828415E+02	0.505800E+00
2002	0.111807E+03	0.276896E+02	0.139572E+01
2003	0.541490E+02	0.161513E+03	-0.109284E+01
2004	0.584940E+02	0.341333E+03	-0.176393E+01
2005	0.254531E+03	0.125160E+03	0.709833E+00
2006	N/A	0.567412E+02	N/A
2007	N/A	0.784053E+02	N/A
2008	0.823930E+02	0.130337E+03	-0.458622E+00

Survey Index: 12 Tag: NEFSC_S AGE = 6
Time = JAN-1 Type = NUMBER
Catchability = 0.568391E+00 % Variance Contribution = 6.0197
Residual = LN(Observed) - LN(Predicted)

Year	Observed	Predicted	Residual
1973	0.940747E+04	0.753913E+04	0.221397E+00
1974	0.311454E+04	0.343724E+04	-0.985870E-01
1975	0.102030E+04	0.224497E+04	-0.788596E+00
1976	0.499871E+03	0.170647E+04	-0.122783E+01
1977	0.457923E+03	0.800971E+03	-0.559124E+00
1978	0.483158E+03	0.184764E+03	0.961264E+00
1979	0.610010E+02	0.149157E+03	-0.894110E+00
1980	0.109300E+03	0.147335E+03	-0.298615E+00
1981	0.947600E+02	0.137939E+03	-0.375463E+00
1982	0.273584E+03	0.709485E+02	0.134965E+01
1983	N/A	0.160390E+03	N/A
1984	0.456084E+03	0.205275E+03	0.798328E+00
1985	0.258542E+03	0.196920E+03	0.272259E+00
1986	0.264060E+02	0.126607E+03	-0.156750E+01
1987	N/A	0.476403E+02	N/A
1988	0.481320E+02	0.222925E+02	0.769699E+00
1989	N/A	0.230753E+01	N/A
1990	N/A	0.331265E+01	N/A
1991	0.852340E+02	0.318344E+02	0.984853E+00
1992	N/A	0.120422E+02	N/A
1993	N/A	0.394745E+01	N/A
1994	0.272410E+02	0.623174E+02	-0.827518E+00
1995	0.115316E+03	0.269176E+02	0.145490E+01
1996	N/A	0.303184E+02	N/A
1997	N/A	0.285087E+02	N/A
1998	0.342610E+02	0.279903E+02	0.202151E+00
1999	0.382720E+02	0.596193E+01	0.185932E+01
2000	N/A	0.106174E+02	N/A
2001	0.382720E+02	0.264974E+02	0.367671E+00
2002	N/A	0.114456E+01	N/A
2003	N/A	0.431326E+02	N/A
2004	0.320880E+02	0.139739E+03	-0.147129E+01
2005	0.264060E+02	0.569964E+02	-0.769396E+00
2006	0.528120E+02	0.759596E+02	-0.363463E+00
2007	N/A	0.276214E+02	N/A
2008	N/A	0.588636E+02	N/A

Survey Index: 13 Tag: NEFSC_F AGE = 1
Time = MEAN Type = NUMBER
Catchability = 0.100583E+00 % Variance Contribution = 8.8191
Residual = LN(Observed) - LN(Predicted)

Year	Observed	Predicted	Residual
1973	0.200610E+04	0.386292E+04	-0.655229E+00
1974	0.949631E+03	0.902156E+03	0.512864E-01
1975	0.199415E+04	0.241164E+04	-0.190086E+00
1976	0.275227E+04	0.129679E+04	0.752535E+00
1977	0.272654E+04	0.427720E+04	-0.450264E+00
1978	0.247759E+04	0.440637E+04	-0.575767E+00
1979	0.177829E+04	0.281587E+04	-0.459620E+00
1980	0.137367E+04	0.390332E+04	-0.104434E+01
1981	0.113308E+05	0.123973E+05	-0.899583E-01
1982	0.285854E+04	0.572649E+04	-0.694791E+00
1983	0.269116E+04	0.136207E+04	0.680967E+00
1984	0.202380E+04	0.169187E+04	0.179138E+00
1985	0.848762E+03	0.176327E+04	-0.731148E+00
1986	0.604519E+03	0.621517E+03	-0.277308E-01
1987	0.122639E+04	0.126263E+04	-0.291253E-01
1988	0.501985E+04	0.107566E+05	-0.762123E+00
1989	0.134989E+03	0.155305E+04	-0.244278E+01
1990	0.240797E+03	0.721679E+03	-0.109763E+01
1991	0.574075E+03	0.350906E+03	0.492241E+00
1992	0.192431E+03	0.201691E+03	-0.469991E-01
1993	0.324432E+03	0.202047E+03	0.473577E+00
1994	0.841065E+03	0.386364E+03	0.777888E+00
1995	0.159689E+03	0.390837E+03	-0.895062E+00
1996	0.514910E+03	0.315718E+03	0.489144E+00
1997	0.944691E+03	0.628355E+03	0.407753E+00
1998	0.102247E+04	0.329406E+03	0.113268E+01
1999	0.142215E+04	0.489197E+03	0.106716E+01
2000	0.567530E+02	0.381981E+03	-0.190666E+01
2001	0.448507E+03	0.221296E+03	0.706425E+00
2002	0.291231E+03	0.103205E+03	0.103740E+01
2003	0.134414E+04	0.120757E+03	0.240973E+01
2004	0.806490E+02	0.151695E+03	-0.631765E+00
2005	0.203115E+04	0.988409E+03	0.720260E+00
2006	0.136999E+04	0.856772E+03	0.469388E+00
2007	0.257455E+03	0.106413E+03	0.883516E+00
2008	N/A	0.000000E+00	N/A

Survey Index: 14 Tag: NEFSC_F AGE = 2
Time = MEAN Type = NUMBER
Catchability = 0.175600E+00 % Variance Contribution = 9.3541
Residual = LN(Observed) - LN(Predicted)

Year	Observed	Predicted	Residual
1973	0.293540E+04	0.237641E+04	0.211251E+00
1974	0.173509E+04	0.235777E+04	-0.306657E+00
1975	0.553281E+03	0.829651E+03	-0.405139E+00
1976	0.589251E+04	0.221584E+04	0.978049E+00
1977	0.171407E+04	0.136889E+04	0.224870E+00
1978	0.568423E+04	0.440438E+04	0.255097E+00
1979	0.391088E+04	0.380236E+04	0.281407E-01
1980	0.346409E+04	0.306474E+04	0.122487E+00
1981	0.113153E+05	0.488490E+04	0.840003E+00
1982	0.249403E+05	0.144854E+05	0.543342E+00
1983	0.158066E+05	0.640234E+04	0.903767E+00
1984	0.178656E+04	0.115419E+04	0.436890E+00
1985	0.365790E+03	0.160274E+04	-0.147741E+01
1986	0.183228E+04	0.134791E+04	0.307011E+00
1987	0.518816E+03	0.511104E+03	0.149766E-01
1988	0.373947E+03	0.150318E+04	-0.139122E+01
1989	0.103037E+05	0.131810E+05	-0.246271E+00
1990	0.208928E+04	0.203878E+04	0.244672E-01
1991	0.237235E+03	0.873854E+03	-0.130386E+01
1992	0.274570E+02	0.331382E+03	-0.249065E+01
1993	0.272270E+02	0.213307E+03	-0.205852E+01
1994	0.514450E+03	0.207658E+03	0.907206E+00
1995	0.741001E+03	0.493502E+03	0.406474E+00
1996	0.184733E+03	0.513307E+03	-0.102196E+01
1997	0.596248E+03	0.408555E+03	0.378030E+00
1998	0.186146E+04	0.765896E+03	0.888072E+00
1999	0.450000E+03	0.427894E+03	0.503720E-01
2000	0.191741E+04	0.618626E+03	0.113123E+01
2001	0.701711E+03	0.510573E+03	0.317989E+00
2002	0.197796E+04	0.294584E+03	0.190425E+01
2003	0.284910E+02	0.133873E+03	-0.154730E+01
2004	0.112471E+03	0.147466E+03	-0.270901E+00
2005	0.532832E+03	0.196747E+03	0.996287E+00
2006	0.247207E+04	0.138125E+04	0.582069E+00
2007	0.128636E+04	0.120231E+04	0.675663E-01
2008	N/A	0.000000E+00	N/A

Survey Index: 15 Tag: NEFSC_F AGE = 3
Time = MEAN Type = NUMBER
Catchability = 0.199593E+00 % Variance Contribution = 5.0702
Residual = LN(Observed) - LN(Predicted)

Year	Observed	Predicted	Residual
1973	0.572593E+04	0.404716E+04	0.346989E+00
1974	0.582002E+03	0.115710E+04	-0.687202E+00
1975	0.180023E+03	0.405140E+03	-0.811147E+00
1976	0.490439E+03	0.350702E+03	0.335365E+00
1977	0.618076E+03	0.100988E+04	-0.490979E+00
1978	0.352579E+03	0.667938E+03	-0.638921E+00
1979	0.188054E+04	0.207751E+04	-0.996133E-01
1980	0.901609E+03	0.142887E+04	-0.460461E+00
1981	0.149073E+04	0.121074E+04	0.208036E+00
1982	0.615525E+04	0.234023E+04	0.967056E+00
1983	0.783991E+04	0.564217E+04	0.328958E+00
1984	0.214293E+04	0.200473E+04	0.666625E-01
1985	0.106038E+03	0.391282E+03	-0.130563E+01
1986	0.511119E+03	0.534042E+03	-0.438729E-01
1987	0.411974E+03	0.320536E+03	0.250964E+00
1988	0.153255E+03	0.187887E+03	-0.203738E+00
1989	0.133736E+04	0.867743E+03	0.432561E+00
1990	0.304328E+04	0.563477E+04	-0.616023E+00
1991	0.148028E+04	0.116332E+04	0.240952E+00
1992	0.822570E+02	0.454494E+03	-0.170934E+01
1993	0.126947E+03	0.155245E+03	-0.201237E+00
1994	0.122811E+03	0.120079E+03	0.224940E-01
1995	0.295481E+03	0.110269E+03	0.985686E+00
1996	0.367054E+03	0.308853E+03	0.172645E+00
1997	0.167650E+04	0.264379E+03	0.184708E+01
1998	0.141882E+03	0.213644E+03	-0.409314E+00
1999	0.320526E+03	0.341369E+03	-0.629994E-01
2000	0.348098E+03	0.226525E+03	0.429627E+00
2001	0.181976E+03	0.314248E+03	-0.546309E+00
2002	0.982372E+03	0.340487E+03	0.105959E+01
2003	0.289508E+03	0.190824E+03	0.416830E+00
2004	N/A	0.865036E+02	N/A
2005	0.212880E+03	0.925396E+02	0.833092E+00
2006	0.196222E+03	0.128786E+03	0.421098E+00
2007	0.409331E+03	0.120403E+04	-0.107890E+01
2008	N/A	0.000000E+00	N/A

Survey Index: 16 Tag: NEFSC_F AGE = 4
Time = MEAN Type = NUMBER
Catchability = 0.217045E+00 % Variance Contribution = 5.2731
Residual = LN(Observed) - LN(Predicted)

Year	Observed	Predicted	Residual
1973	0.324846E+04	0.238165E+04	0.310386E+00
1974	0.227378E+04	0.173844E+04	0.268456E+00
1975	0.290312E+03	0.476738E+03	-0.496012E+00
1976	0.647950E+02	0.179140E+03	-0.101694E+01
1977	0.937450E+02	0.157693E+03	-0.520073E+00
1978	0.280776E+03	0.349578E+03	-0.219169E+00
1979	0.286521E+03	0.293756E+03	-0.249378E-01
1980	0.372454E+03	0.695605E+03	-0.624668E+00
1981	0.235397E+03	0.381923E+03	-0.483946E+00
1982	0.749618E+03	0.296194E+03	0.928550E+00
1983	0.642316E+03	0.588765E+03	0.870528E-01
1984	0.468152E+03	0.102671E+04	-0.785321E+00
1985	0.103166E+03	0.294549E+03	-0.104911E+01
1986	0.114769E+03	0.107382E+03	0.665265E-01
1987	0.345800E+02	0.112671E+03	-0.118119E+01
1988	0.161757E+03	0.534093E+02	0.110811E+01
1989	0.707690E+02	0.632645E+02	0.112097E+00
1990	0.189214E+03	0.196826E+03	-0.394405E-01
1991	0.358093E+03	0.654615E+03	-0.603255E+00
1992	0.326845E+03	0.252985E+03	0.256154E+00
1993	0.101213E+03	0.157176E+03	-0.440139E+00
1994	0.163710E+03	0.477016E+02	0.123313E+01
1995	0.132576E+03	0.368582E+02	0.128008E+01
1996	N/A	0.533261E+02	N/A
1997	0.311450E+03	0.766489E+02	0.140200E+01
1998	0.558340E+02	0.750642E+02	-0.295961E+00
1999	0.320530E+02	0.516626E+02	-0.477344E+00
2000	0.196566E+03	0.802597E+02	0.895731E+00
2001	0.815680E+02	0.464865E+02	0.562275E+00
2002	0.191741E+03	0.108160E+03	0.572538E+00
2003	0.263199E+03	0.184934E+03	0.352912E+00
2004	0.264230E+02	0.847089E+02	-0.116499E+01
2005	0.843250E+02	0.391759E+02	0.766616E+00
2006	0.220580E+02	0.481250E+02	-0.780126E+00
2007	N/A	0.709719E+02	N/A
2008	N/A	0.000000E+00	N/A

Survey Index: 17 Tag: NEFSC_F AGE = 5
Time = MEAN Type = NUMBER
Catchability = 0.221817E+00 % Variance Contribution = 3.6367
Residual = LN(Observed) - LN(Predicted)

Year	Observed	Predicted	Residual
1973	0.219164E+04	0.159441E+04	0.318149E+00
1974	0.962842E+03	0.888814E+03	0.800019E-01
1975	0.289852E+03	0.688576E+03	-0.865255E+00
1976	0.102247E+03	0.251384E+03	-0.899590E+00
1977	0.334310E+02	0.883680E+02	-0.972026E+00
1978	0.286060E+02	0.600300E+02	-0.741229E+00
1979	0.312480E+02	0.123817E+03	-0.137685E+01
1980	N/A	0.950588E+02	N/A
1981	0.108336E+03	0.148204E+03	-0.313355E+00
1982	0.301800E+03	0.676119E+02	0.149598E+01
1983	0.536510E+02	0.643317E+02	-0.181552E+00
1984	N/A	0.113331E+03	N/A
1985	N/A	0.169632E+03	N/A
1986	0.397500E+02	0.615253E+02	-0.436839E+00
1987	0.274570E+02	0.207664E+02	0.279284E+00
1988	0.151650E+02	0.144549E+02	0.479537E-01
1989	N/A	0.671745E+01	N/A
1990	N/A	0.819547E+01	N/A
1991	N/A	0.115834E+02	N/A
1992	N/A	0.280353E+02	N/A
1993	N/A	0.327589E+02	N/A
1994	0.606590E+02	0.358388E+02	0.526238E+00
1995	N/A	0.667048E+01	N/A
1996	N/A	0.751704E+01	N/A
1997	0.272270E+02	0.109211E+02	0.913512E+00
1998	N/A	0.100736E+02	N/A
1999	0.320530E+02	0.162158E+02	0.681407E+00
2000	N/A	0.877692E+01	N/A
2001	N/A	0.125494E+02	N/A
2002	N/A	0.712227E+01	N/A
2003	N/A	0.488982E+02	N/A
2004	0.550290E+02	0.871280E+02	-0.459518E+00
2005	0.164744E+03	0.314960E+02	0.165453E+01
2006	N/A	0.155687E+02	N/A
2007	0.303290E+02	0.236402E+02	0.249157E+00
2008	N/A	0.000000E+00	N/A

Survey Index: 18 Tag: NEFSC_F AGE = 6
Time = MEAN Type = NUMBER
Catchability = 0.449687E+00 % Variance Contribution = 7.0141
Residual = LN(Observed) - LN(Predicted)

Year	Observed	Predicted	Residual
1973	0.130244E+04	0.388794E+04	-0.109364E+01
1974	0.698954E+03	0.163572E+04	-0.850253E+00
1975	0.146477E+03	0.126920E+04	-0.215927E+01
1976	0.714348E+03	0.101699E+04	-0.353228E+00
1977	0.928260E+02	0.418226E+03	-0.150529E+01
1978	0.886900E+02	0.881943E+02	0.560509E-02
1979	0.303290E+02	0.750748E+02	-0.906381E+00
1980	N/A	0.628571E+02	N/A
1981	0.577870E+02	0.494896E+02	0.155002E+00
1982	N/A	0.284047E+02	N/A
1983	0.371080E+02	0.650401E+02	-0.561171E+00
1984	N/A	0.722238E+02	N/A
1985	N/A	0.762831E+02	N/A
1986	N/A	0.522043E+02	N/A
1987	0.274570E+02	0.163860E+02	0.516191E+00
1988	0.567530E+02	0.699805E+01	0.209308E+01
1989	N/A	0.851138E+00	N/A
1990	N/A	0.923033E+00	N/A
1991	N/A	0.712871E+01	N/A
1992	N/A	0.344458E+01	N/A
1993	N/A	0.183205E+01	N/A
1994	0.286060E+02	0.210383E+02	0.307271E+00
1995	0.605440E+02	0.954564E+01	0.184729E+01
1996	N/A	0.142868E+02	N/A
1997	N/A	0.845354E+01	N/A
1998	0.263080E+02	0.121748E+02	0.770509E+00
1999	N/A	0.210394E+01	N/A
2000	0.263080E+02	0.420570E+01	0.183343E+01
2001	N/A	0.787470E+01	N/A
2002	N/A	0.577556E+00	N/A
2003	0.569820E+02	0.256181E+02	0.799437E+00
2004	0.284910E+02	0.699763E+02	-0.898568E+00
2005	N/A	0.281379E+02	N/A
2006	N/A	0.408876E+02	N/A
2007	N/A	0.163382E+02	N/A
2008	N/A	0.000000E+00	N/A

Retrospective Summary

Average Fishing Mortality
Ages = 4 - 5

	1973	1974	1975	1976	1977
2000	0.7271	0.9201	0.5145	0.3962	0.6978
2001	0.7271	0.9201	0.5145	0.3962	0.6978
2002	0.7271	0.9201	0.5145	0.3962	0.6978
2003	0.7271	0.9201	0.5145	0.3962	0.6978
2004	0.7271	0.9201	0.5145	0.3962	0.6978
2005	0.7271	0.9201	0.5145	0.3962	0.6978
2006	0.7271	0.9201	0.5145	0.3962	0.6978
2007	0.7271	0.9201	0.5145	0.3962	0.6978
	1978	1979	1980	1981	1982
2000	0.9127	0.7847	1.1947	1.6628	1.3615
2001	0.9127	0.7847	1.1947	1.6628	1.3615
2002	0.9127	0.7847	1.1947	1.6628	1.3615
2003	0.9127	0.7847	1.1947	1.6628	1.3615
2004	0.9127	0.7847	1.1947	1.6628	1.3615
2005	0.9127	0.7847	1.1947	1.6628	1.3615
2006	0.9127	0.7847	1.1947	1.6628	1.3615
2007	0.9127	0.7847	1.1947	1.6628	1.3615
	1983	1984	1985	1986	1987
2000	1.3275	1.7185	1.4502	1.2835	1.7838
2001	1.3275	1.7185	1.4502	1.2835	1.7838
2002	1.3275	1.7185	1.4502	1.2835	1.7838
2003	1.3275	1.7185	1.4502	1.2835	1.7838
2004	1.3275	1.7185	1.4502	1.2835	1.7838
2005	1.3275	1.7185	1.4502	1.2835	1.7838
2006	1.3275	1.7185	1.4502	1.2835	1.7838
2007	1.3275	1.7185	1.4502	1.2835	1.7838
	1988	1989	1990	1991	1992
2000	2.0563	1.5850	2.4359	3.2171	2.3499
2001	2.0563	1.5850	2.4359	3.2171	2.3499
2002	2.0563	1.5850	2.4359	3.2171	2.3499
2003	2.0563	1.5850	2.4359	3.2171	2.3499
2004	2.0563	1.5850	2.4359	3.2171	2.3499
2005	2.0563	1.5850	2.4359	3.2171	2.3499
2006	2.0563	1.5850	2.4359	3.2171	2.3499
2007	2.0563	1.5850	2.4359	3.2171	2.3499
	1993	1994	1995	1996	1997
2000	0.9818	1.8380	1.6948	0.9421	2.2080
2001	0.9818	1.8382	1.6959	0.9442	2.2327
2002	0.9818	1.8382	1.6959	0.9443	2.2346
2003	0.9818	1.8382	1.6959	0.9443	2.2346
2004	0.9818	1.8382	1.6959	0.9443	2.2344
2005	0.9818	1.8382	1.6959	0.9443	2.2342
2006	0.9818	1.8382	1.6959	0.9443	2.2342
2007	0.9818	1.8382	1.6959	0.9443	2.2342

	1998	1999	2000	2001	2002
2000	1.0859	1.3978	0.7097		
2001	1.1416	1.6886	1.3175	1.6830	
2002	1.1459	1.7155	1.4102	2.4534	1.1794
2003	1.1460	1.7161	1.4126	2.4848	1.2591
2004	1.1454	1.7122	1.3983	2.3144	0.9056
2005	1.1451	1.7103	1.3916	2.2431	0.8000
2006	1.1451	1.7101	1.3909	2.2360	0.7904
2007	1.1450	1.7099	1.3900	2.2271	0.7786

	2003	2004	2005	2006	2007
2000					
2001					
2002					
2003	1.2274				
2004	0.5366	1.5025			
2005	0.4238	0.8730	1.0341		
2006	0.4147	0.8375	0.9324	0.8054	
2007	0.4037	0.7969	0.8310	0.6269	0.4129

Spawning Stock Biomass

	1973	1974	1975	1976	1977
2000	28815.	10926.	5272.	4991.	4203.
2001	28815.	10926.	5272.	4991.	4203.
2002	28815.	10926.	5272.	4991.	4203.
2003	28815.	10926.	5272.	4991.	4203.
2004	28815.	10926.	5272.	4991.	4203.
2005	28815.	10926.	5272.	4991.	4203.
2006	28815.	10926.	5272.	4991.	4203.
2007	28815.	10926.	5272.	4991.	4203.

	1978	1979	1980	1981	1982
2000	6267.	8307.	7391.	7092.	16162.
2001	6267.	8307.	7391.	7092.	16162.
2002	6267.	8307.	7391.	7092.	16162.
2003	6267.	8307.	7391.	7092.	16162.
2004	6267.	8307.	7391.	7092.	16162.
2005	6267.	8307.	7391.	7092.	16162.
2006	6267.	8307.	7391.	7092.	16162.
2007	6267.	8307.	7391.	7092.	16162.

	1983	1984	1985	1986	1987
2000	16111.	5866.	3007.	2480.	1246.
2001	16111.	5866.	3007.	2480.	1246.
2002	16111.	5866.	3007.	2480.	1246.
2003	16111.	5866.	3007.	2480.	1246.
2004	16111.	5866.	3007.	2480.	1246.
2005	16111.	5866.	3007.	2480.	1246.
2006	16111.	5866.	3007.	2480.	1246.
2007	16111.	5866.	3007.	2480.	1246.

	1988	1989	1990	1991	1992
--	------	------	------	------	------

2000	1814.	14736.	12968.	3758.	1718.
2001	1814.	14736.	12968.	3758.	1718.
2002	1814.	14736.	12968.	3758.	1718.
2003	1814.	14736.	12968.	3758.	1718.
2004	1814.	14736.	12968.	3758.	1718.
2005	1814.	14736.	12968.	3758.	1718.
2006	1814.	14736.	12968.	3758.	1718.
2007	1814.	14736.	12968.	3758.	1718.

1993	1994	1995	1996	1997
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2000	1000.	540.	632.	1277.	1080.
2001	1000.	540.	631.	1271.	1059.
2002	1000.	540.	631.	1270.	1058.
2003	1000.	540.	631.	1270.	1058.
2004	1000.	540.	631.	1270.	1058.
2005	1000.	540.	631.	1270.	1058.
2006	1000.	540.	631.	1270.	1058.
2007	1000.	540.	631.	1270.	1058.

1998	1999	2000	2001	2002
------	------	------	------	------

2000	1376.	1847.	2815.		
2001	1274.	1421.	1643.	1554.	
2002	1267.	1384.	1391.	1128.	1183.
2003	1267.	1383.	1384.	1150.	1062.
2004	1268.	1389.	1423.	1335.	1266.
2005	1268.	1391.	1442.	1423.	1446.
2006	1268.	1391.	1444.	1432.	1464.
2007	1268.	1392.	1447.	1444.	1488.

2003	2004	2005	2006	2007
------	------	------	------	------

2000					
2001					
2002					
2003	890.				
2004	1015.	695.			
2005	1237.	860.	744.		
2006	1265.	822.	603.	1890.	
2007	1299.	870.	619.	1509.	3508.

Total Population Numbers

1973	1974	1975	1976	1977
------	------	------	------	------

2000	131067.	80766.	53939.	40348.	73150.
2001	131067.	80766.	53939.	40348.	73150.
2002	131067.	80766.	53939.	40348.	73150.
2003	131067.	80766.	53939.	40348.	73150.
2004	131067.	80766.	53939.	40348.	73150.
2005	131067.	80766.	53939.	40348.	73150.
2006	131067.	80766.	53939.	40348.	73150.
2007	131067.	80766.	53939.	40348.	73150.

1978	1979	1980	1981	1982
------	------	------	------	------

2000	97420.	86614.	87453.	187683.	199647.
2001	97420.	86614.	87453.	187683.	199647.
2002	97420.	86614.	87453.	187683.	199647.

2003	97420.	86614.	87453.	187683.	199647.
2004	97420.	86614.	87453.	187683.	199647.
2005	97420.	86614.	87453.	187683.	199647.
2006	97420.	86614.	87453.	187683.	199647.
2007	97420.	86614.	87453.	187683.	199647.

1983	1984	1985	1986	1987
------	------	------	------	------

2000	133026.	66784.	43711.	28641.	24888.
2001	133026.	66784.	43711.	28641.	24888.
2002	133026.	66784.	43711.	28641.	24888.
2003	133026.	66784.	43711.	28641.	24888.
2004	133026.	66784.	43711.	28641.	24888.
2005	133026.	66784.	43711.	28641.	24888.
2006	133026.	66784.	43711.	28641.	24888.
2007	133026.	66784.	43711.	28641.	24888.

1988	1989	1990	1991	1992
------	------	------	------	------

2000	133952.	118413.	83587.	30939.	12806.
2001	133952.	118413.	83587.	30939.	12806.
2002	133952.	118413.	83587.	30939.	12806.
2003	133952.	118413.	83587.	30939.	12806.
2004	133952.	118413.	83587.	30939.	12806.
2005	133952.	118413.	83587.	30939.	12806.
2006	133952.	118413.	83587.	30939.	12806.
2007	133952.	118413.	83587.	30939.	12806.

1993	1994	1995	1996	1997
------	------	------	------	------

2000	6433.	8151.	8847.	9992.	14051.
2001	6432.	8144.	8808.	9873.	13311.
2002	6432.	8144.	8805.	9864.	13257.
2003	6432.	8144.	8805.	9864.	13256.
2004	6432.	8144.	8806.	9865.	13264.
2005	6432.	8144.	8806.	9866.	13267.
2006	6432.	8144.	8806.	9866.	13268.
2007	6432.	8144.	8806.	9866.	13268.

1998	1999	2000	2001	2002
------	------	------	------	------

2000	14049.	18983.	14098.	22776.	
2001	12046.	13568.	10372.	10169.	18743.
2002	11864.	11970.	9724.	9777.	7106.
2003	11859.	11928.	9958.	8581.	5668.
2004	11886.	12178.	10862.	8618.	5702.
2005	11898.	12298.	11300.	9252.	6206.
2006	11899.	12311.	11347.	9319.	6290.
2007	11901.	12327.	11404.	9403.	6396.

2003	2004	2005	2006	2007
------	------	------	------	------

2000					
2001					
2002	16338.				
2003	7468.	16363.			
2004	5466.	4905.	13288.		
2005	5466.	5607.	22375.	28303.	
2006	4975.	5035.	17447.	23839.	29200.
2007	5158.	4852.	13491.	19728.	16446.

2008

2000
 2001
 2002
 2003
 2004
 2005
 2006
 2007

22299.

Age 1 Population

	1973	1974	1975	1976	1977
2000	42491.	10362.	31479.	14339.	49917.
2001	42491.	10362.	31479.	14339.	49917.
2002	42491.	10362.	31479.	14339.	49917.
2003	42491.	10362.	31479.	14339.	49917.
2004	42491.	10362.	31479.	14339.	49917.
2005	42491.	10362.	31479.	14339.	49917.
2006	42491.	10362.	31479.	14339.	49917.
2007	42491.	10362.	31479.	14339.	49917.
	1978	1979	1980	1981	1982
2000	53116.	30998.	43355.	136011.	62906.
2001	53116.	30998.	43355.	136011.	62906.
2002	53116.	30998.	43355.	136011.	62906.
2003	53116.	30998.	43355.	136011.	62906.
2004	53116.	30998.	43355.	136011.	62906.
2005	53116.	30998.	43355.	136011.	62906.
2006	53116.	30998.	43355.	136011.	62906.
2007	53116.	30998.	43355.	136011.	62906.
	1983	1984	1985	1986	1987
2000	16407.	18836.	20560.	7067.	14717.
2001	16407.	18836.	20560.	7067.	14717.
2002	16407.	18836.	20560.	7067.	14717.
2003	16407.	18836.	20560.	7067.	14717.
2004	16407.	18836.	20560.	7067.	14717.
2005	16407.	18836.	20560.	7067.	14717.
2006	16407.	18836.	20560.	7067.	14717.
2007	16407.	18836.	20560.	7067.	14717.
	1988	1989	1990	1991	1992
2000	121166.	17049.	8019.	4092.	2476.
2001	121166.	17049.	8019.	4092.	2476.
2002	121166.	17049.	8019.	4092.	2476.
2003	121166.	17049.	8019.	4092.	2476.
2004	121166.	17049.	8019.	4092.	2476.
2005	121166.	17049.	8019.	4092.	2476.
2006	121166.	17049.	8019.	4092.	2476.
2007	121166.	17049.	8019.	4092.	2476.

	1993	1994	1995	1996	1997
2000	2224.	4440.	4323.	3557.	7584.
2001	2223.	4434.	4290.	3470.	6941.
2002	2223.	4434.	4287.	3464.	6895.
2003	2223.	4434.	4287.	3463.	6894.
2004	2223.	4434.	4288.	3464.	6900.
2005	2223.	4434.	4288.	3465.	6904.
2006	2223.	4434.	4288.	3465.	6904.
2007	2223.	4434.	4288.	3465.	6904.

	1998	1999	2000	2001	2002
2000	5130.	10273.	1451.	13637.	
2001	3733.	6494.	2144.	4038.	12849.
2002	3595.	5045.	2804.	4177.	1527.
2003	3592.	5007.	3073.	2790.	1067.
2004	3612.	5235.	3772.	2086.	1078.
2005	3621.	5345.	4112.	2362.	1065.
2006	3622.	5357.	4147.	2391.	1095.
2007	3624.	5372.	4192.	2428.	1133.

	2003	2004	2005	2006	2007
2000					
2001					
2002	11970.				
2003	4253.	11326.			
2004	2211.	1479.	10405.		
2005	1791.	2172.	19115.	10726.	
2006	1230.	2001.	14667.	10284.	10504.
2007	1326.	1666.	10877.	9408.	1170.

2008

2000	
2001	
2002	
2003	
2004	
2005	
2006	
2007	9744.

In the Retrospective Analysis
The Following Survey Indices Have Predicted
Index Value Set to Zero in Terminal Year + 1

13	NEFSC_F	1
14	NEFSC_F	2
15	NEFSC_F	3
16	NEFSC_F	4
17	NEFSC_F	5
18	NEFSC_F	6

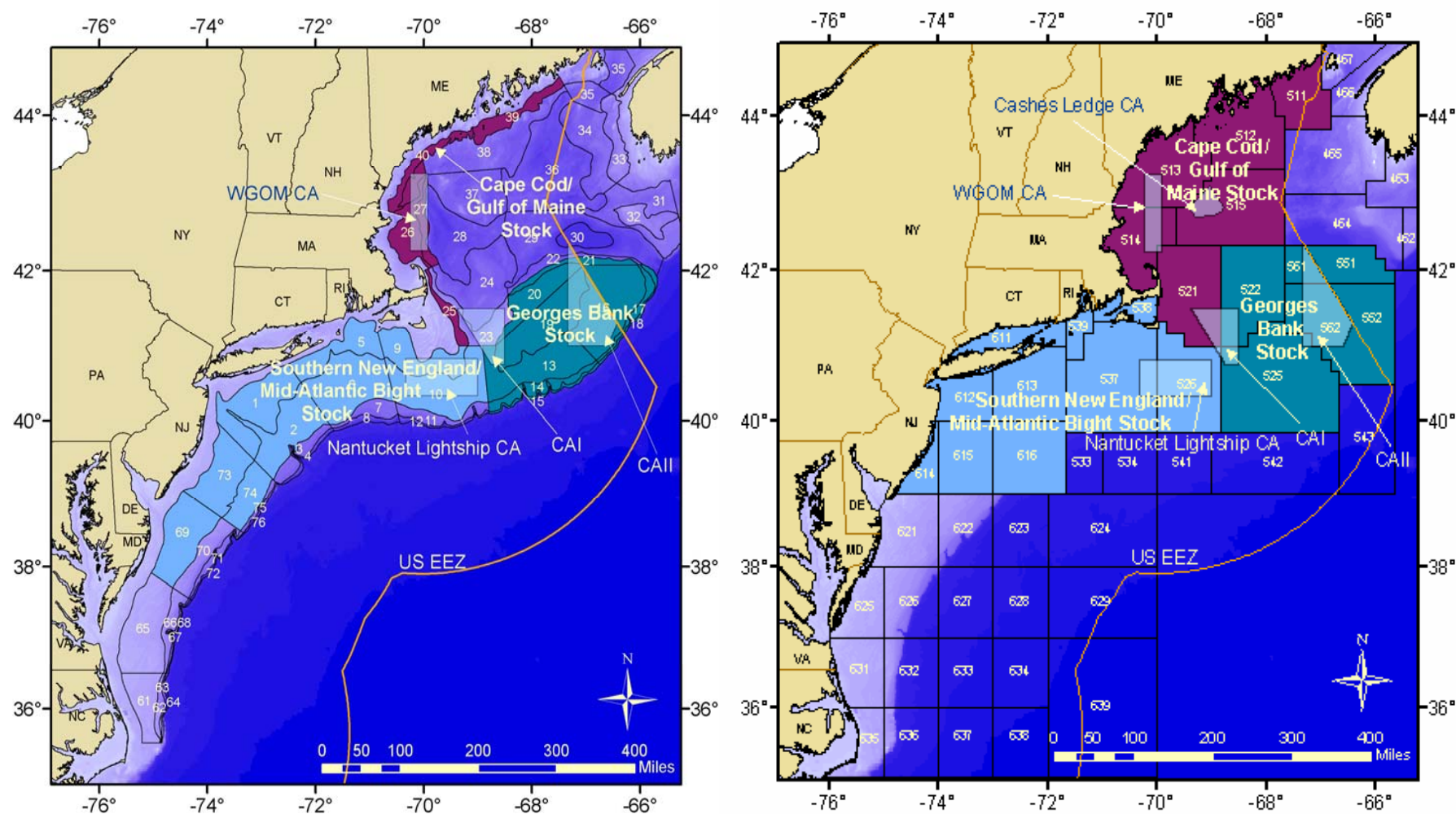
Plus Group Diagnostic Report

Calculation Method Selected = Backward

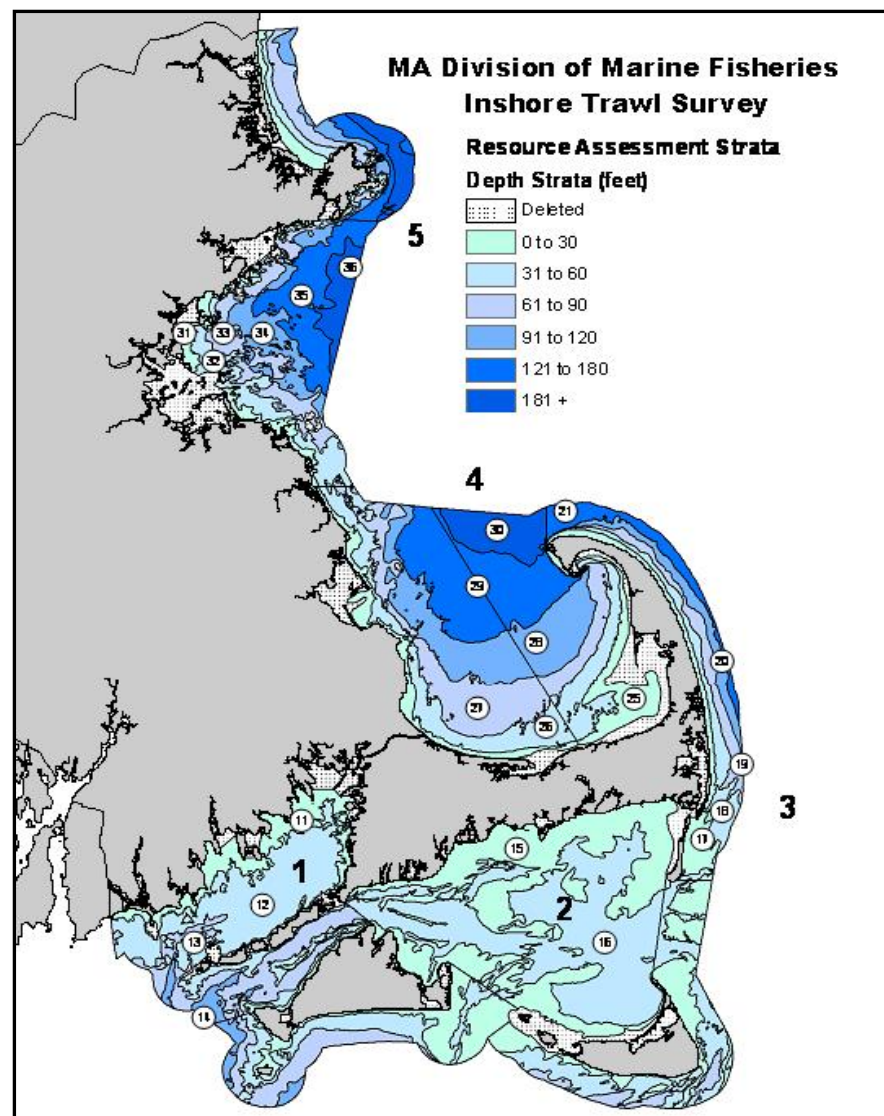
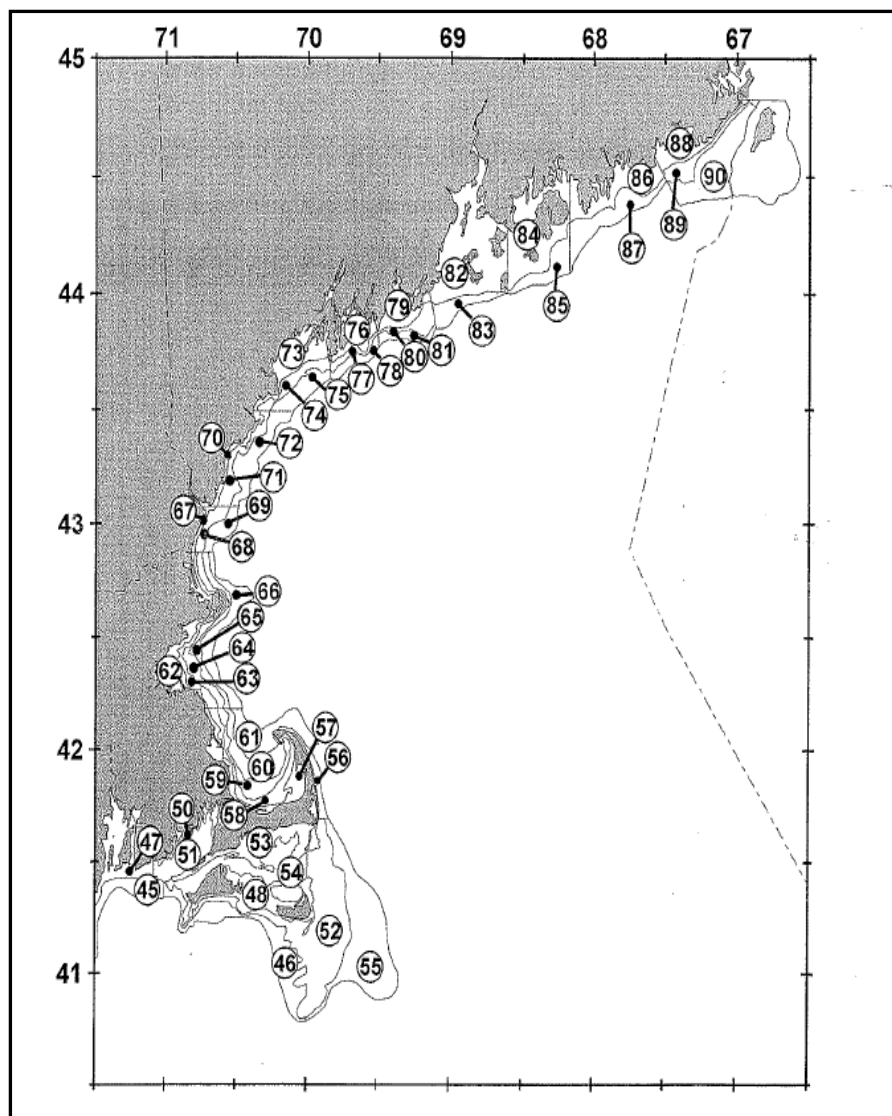
Year	Population Backward	Population Forward	F Forward	F Backward	Ratio
1973	13264.	13264.	0.727051	0.727051	1.000000
1974	6047.	9613.	0.479862	0.920147	1.917523
1975	3950.	7044.	0.256792	0.514455	2.003390
1976	3002.	6587.	0.162134	0.396190	2.443590
1977	1409.	5415.	0.141485	0.697821	4.932119
1978	325.	4094.	0.049398	0.912689	18.476409
1979	262.	3338.	0.044233	0.784670	17.739643
1980	259.	2942.	0.064595	1.194737	18.495734
1981	243.	2455.	0.085683	1.662829	19.406822
1982	125.	2074.	0.046794	1.361505	29.095421
1983	282.	1747.	0.128989	1.327487	10.291440
1984	361.	1380.	0.248175	1.718460	6.924374
1985	346.	1050.	0.297308	1.450164	4.877644
1986	223.	939.	0.191885	1.283485	6.688813
1987	84.	755.	0.099635	1.783814	17.903536
1988	39.	589.	0.061735	2.056284	33.308392
1989	4.	471.	0.007057	1.585008	224.616151
1990	6.	394.	0.014114	2.435921	172.592017
1991	56.	325.	0.189328	3.217134	16.992423
1992	21.	226.	0.091669	2.349867	25.634148
1993	7.	196.	0.022717	0.981795	43.217715
1994	110.	234.	0.513086	1.837998	3.582242
1995	47.	164.	0.275427	1.694802	6.153360
1996	53.	112.	0.347251	0.942136	2.713131
1997	50.	83.	0.799587	2.207958	2.761375
1998	51.	42.	1.543348	1.085870	0.703581
1999	11.	31.	0.333578	1.397762	4.190211
2000	28.	54.	0.304279	0.709683	2.332340
2001	59.	80.	N/A	N/A	

Appendix E. Cape Cod-Gulf of Maine yellowtail flounder

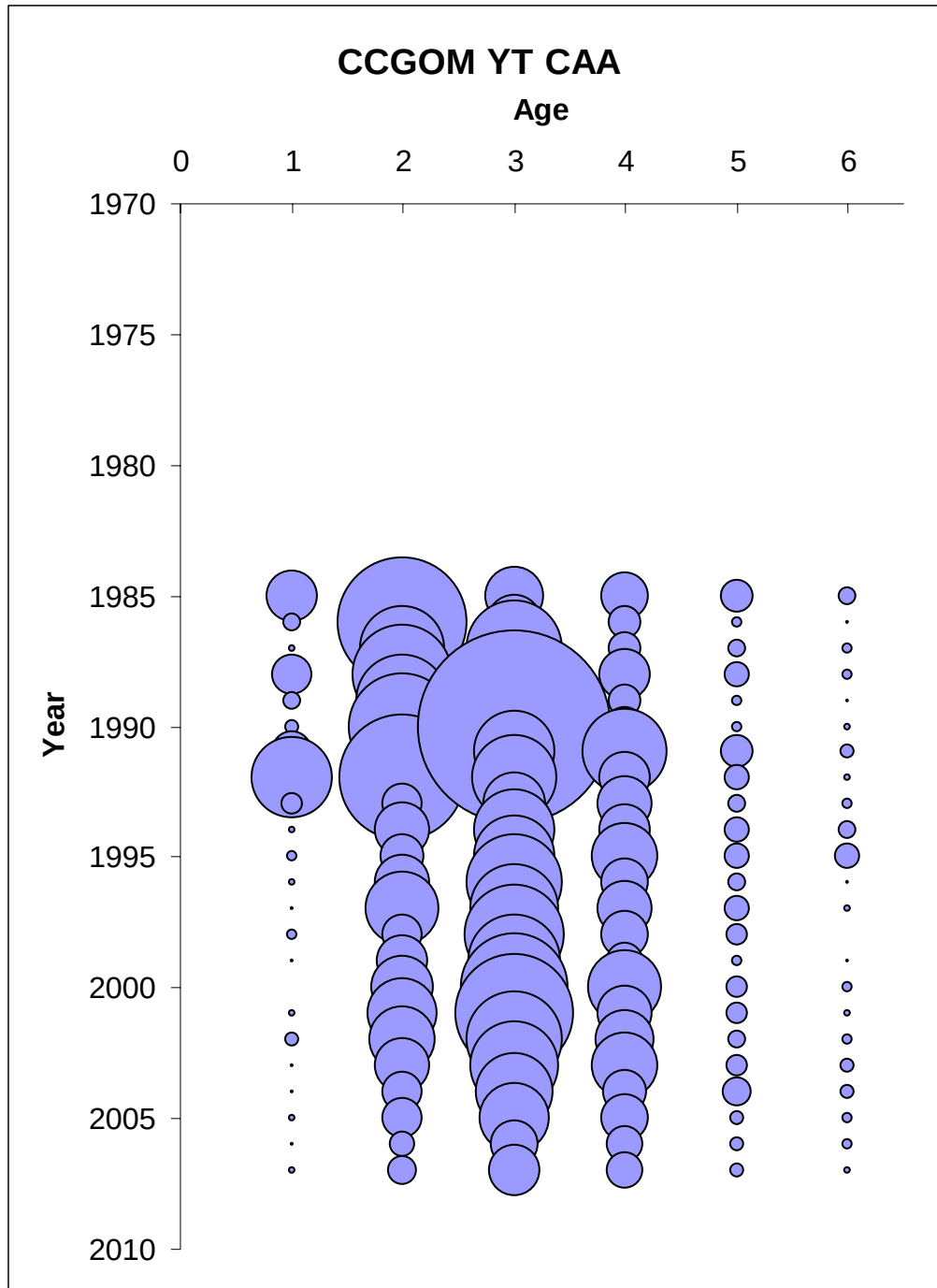
by Chris Legault, Larry Alade, Steve Cadrin, Jeremy King, and Sally Sherman



Appendix Figure E.1. Offshore Survey strata (25-27, 39, 40) used by NEFSC to estimate spring and fall (Stratum 27 excluded from the fall series) survey indices [Left] and the commercial statistical areas [Right] for all three yellowtail flounder stocks.

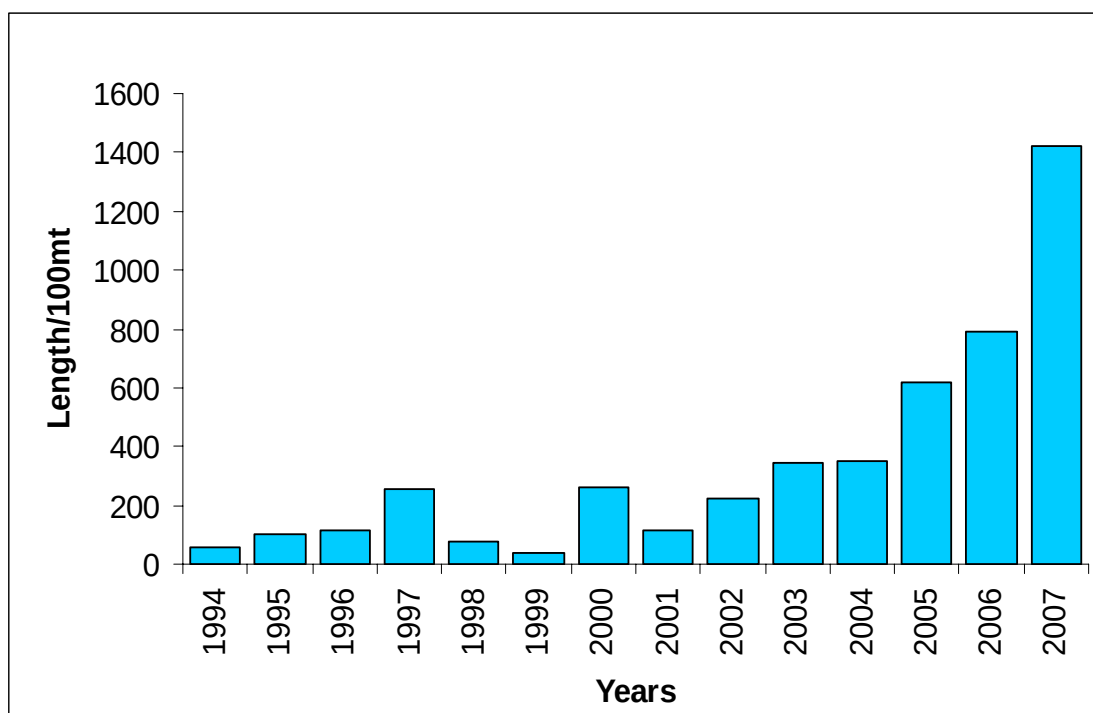


Appendix Figure E.2. Northeast Fisheries Science Center (NEFSC) Inshore Survey strata (56-66) to the left and Massachusetts Division of Marine Fisheries (MADMF) survey strata (17-36) to the right, used for estimating both spring and fall survey indices for the Cape Cod-Gulf of Maine yellowtail flounder stock.

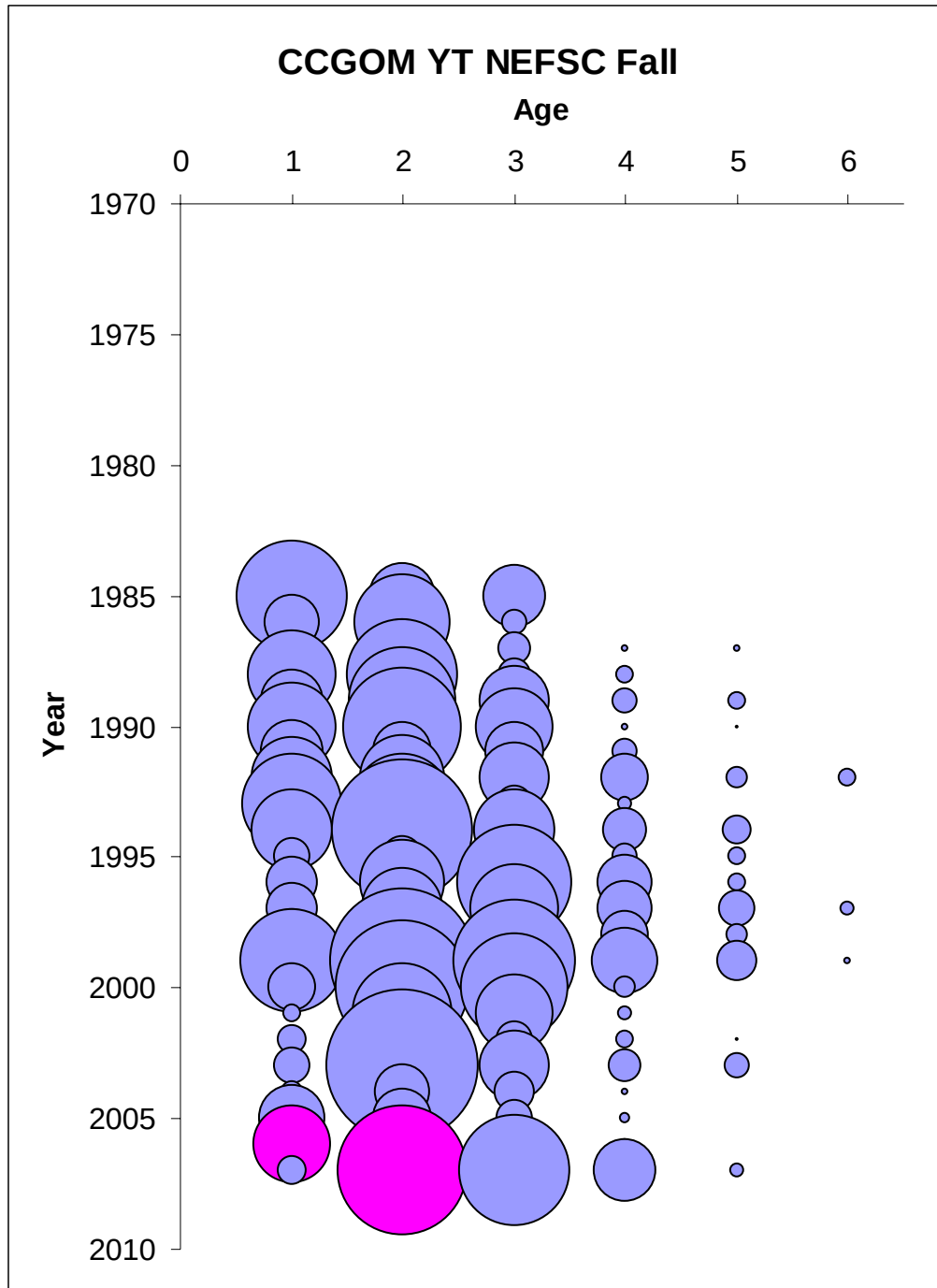


Appendix Figure E.3 Catch at age bubble plot for Cape Cod-Gulf of Maine yellowtail flounder.

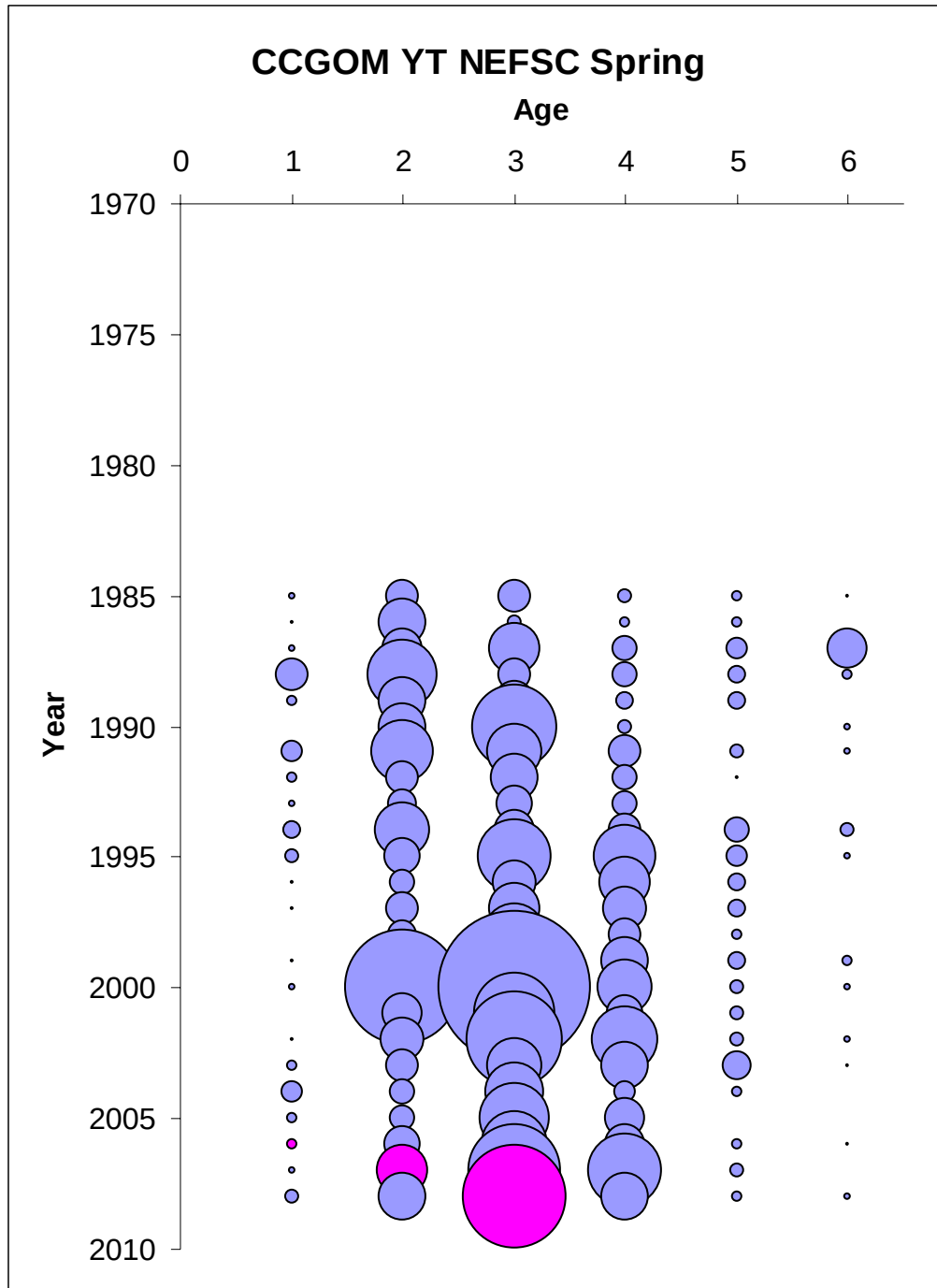
Cape Cod Gulf of Maine yellowtail flounder Biological Sampling



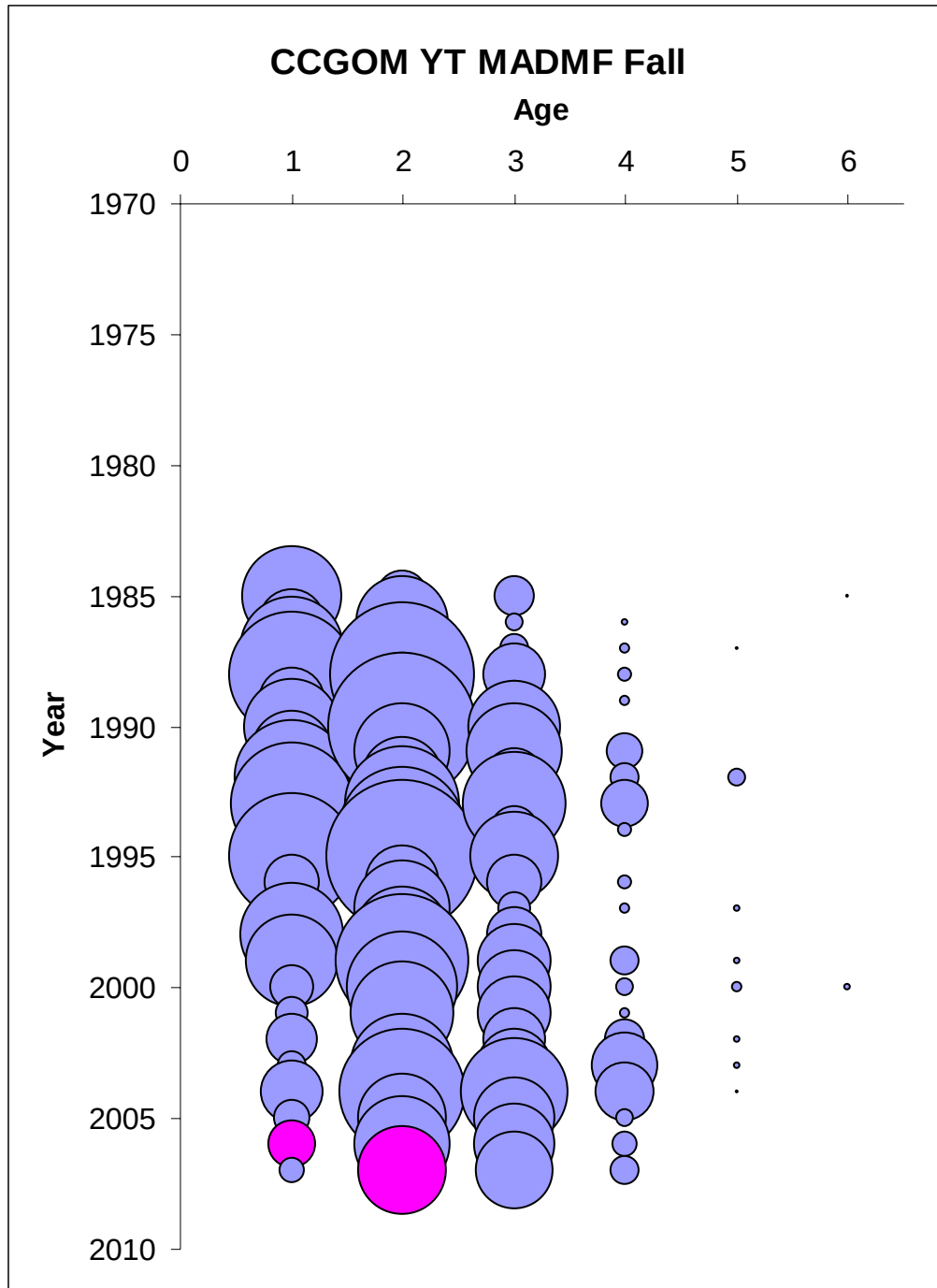
Appendix Figure E.4. Biological sampling for Cape Cod-Gulf of Maine yellowtail flounder.



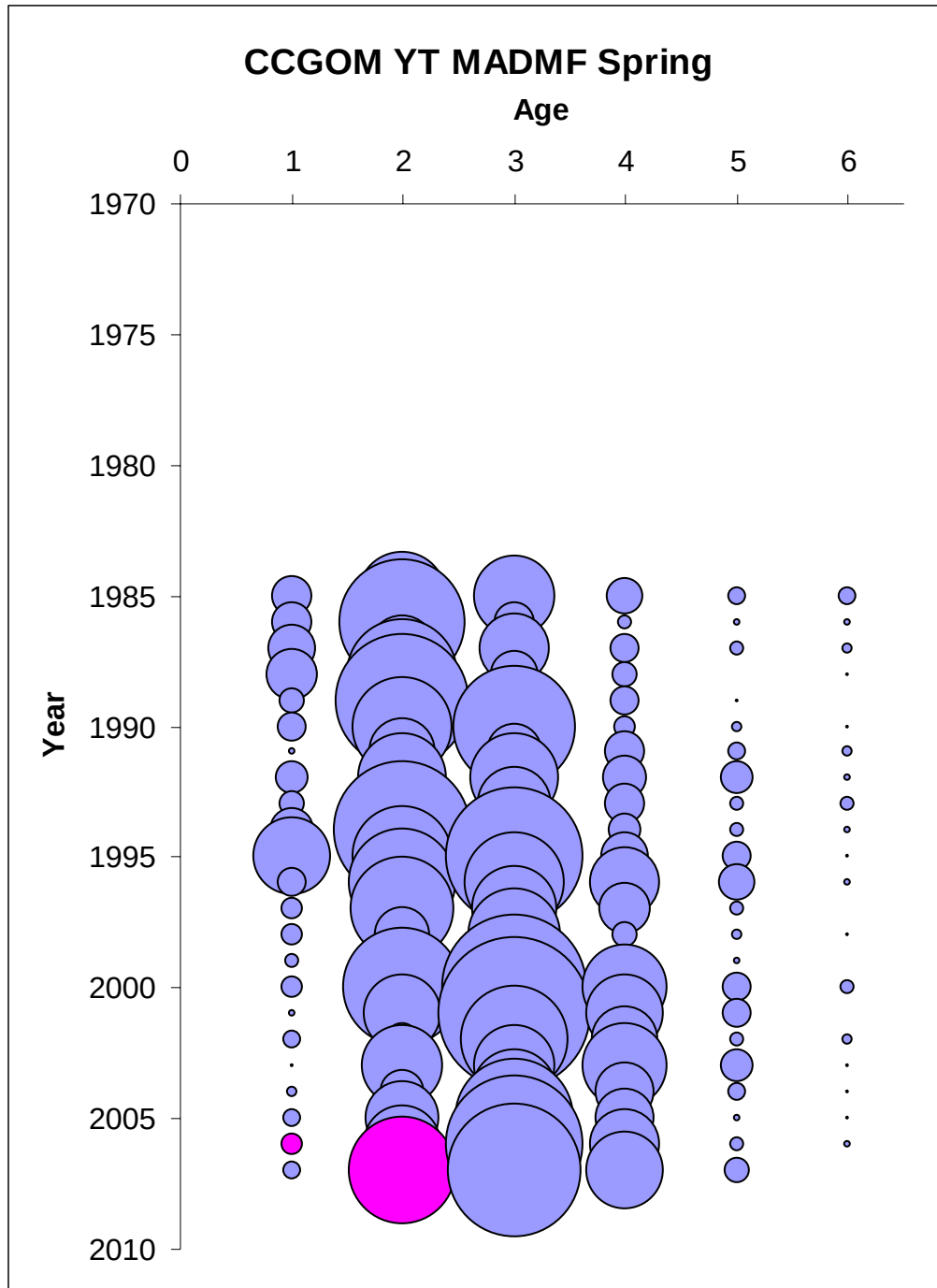
Appendix Figure E.5.a Survey bubble plot for CCGOM yellowtail NEFSC Fall survey. Note the 2005 year class is highlighted in pink.



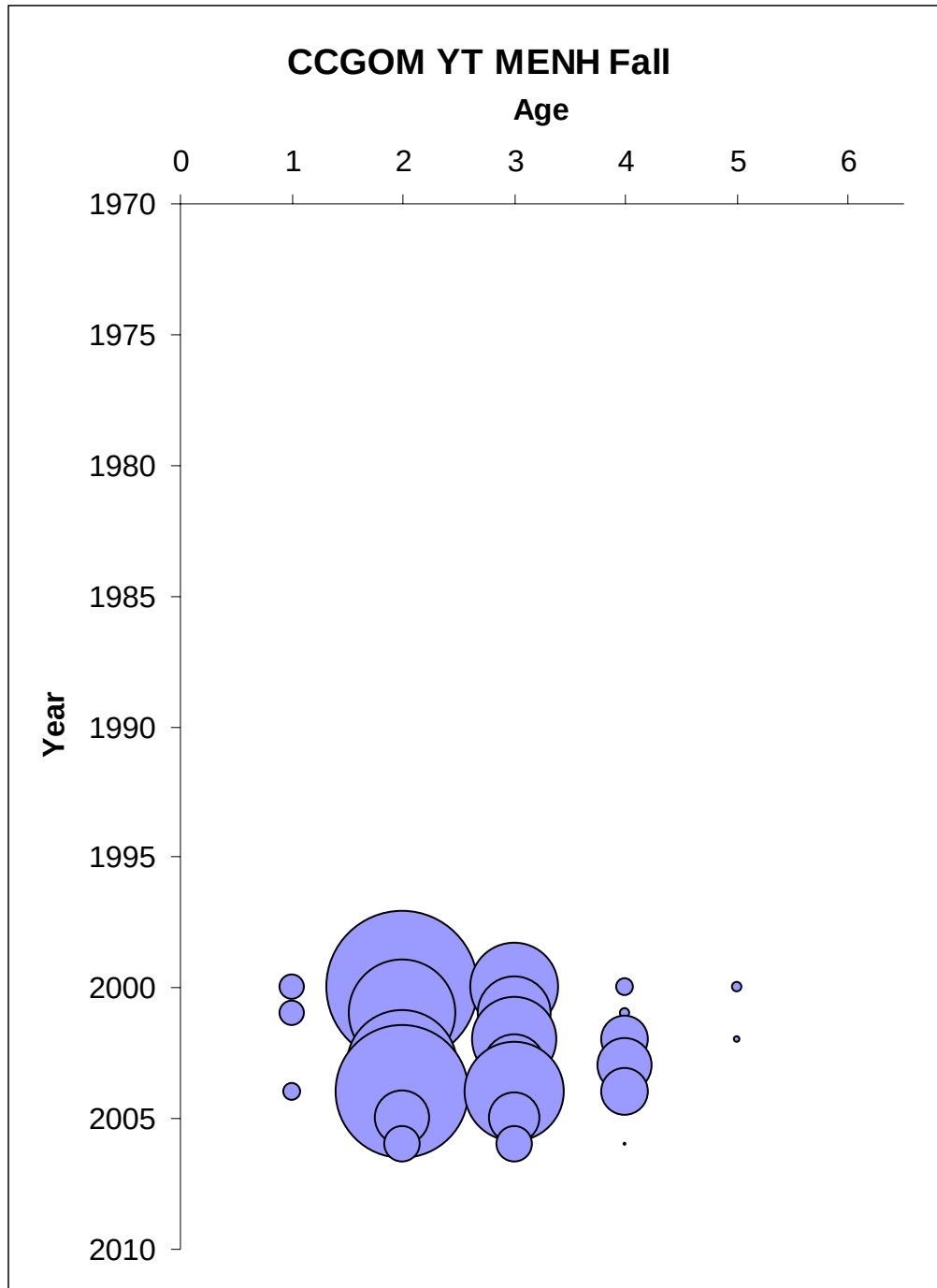
Appendix Figure E.5.b Survey bubble plot for CCGOM yellowtail NEFSC Spring survey. Note the 2005 year class is highlighted in pink.



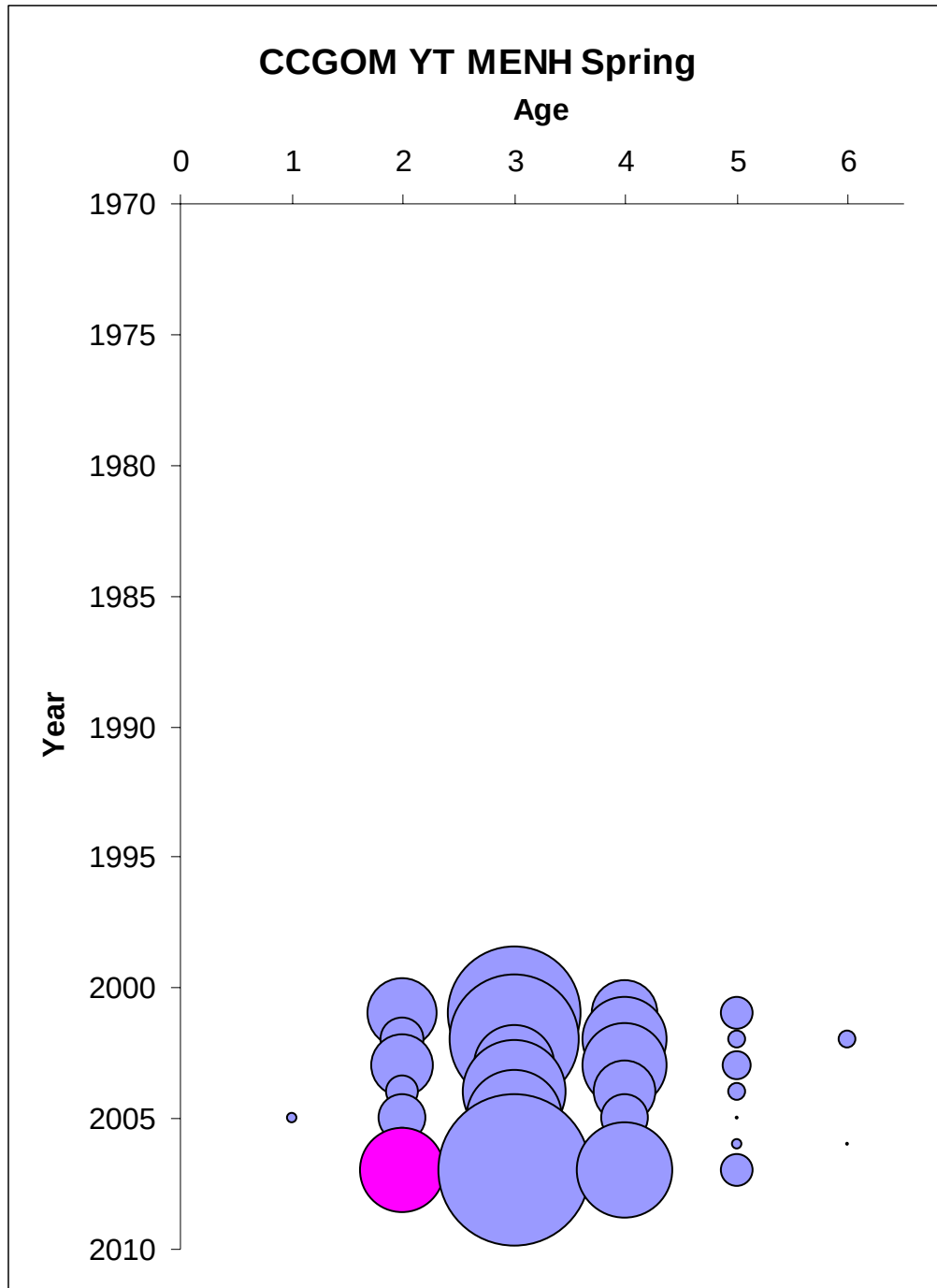
Appendix Figure E.5.c Survey bubble plot for CCGOM yellowtail MADMF Fall survey. Note the 2005 year class is highlighted in pink.



Appendix Figure E.5.d Survey bubble plot for CCGOM yellowtail MADMF Spring survey. Note the 2005 year class is highlighted in pink.

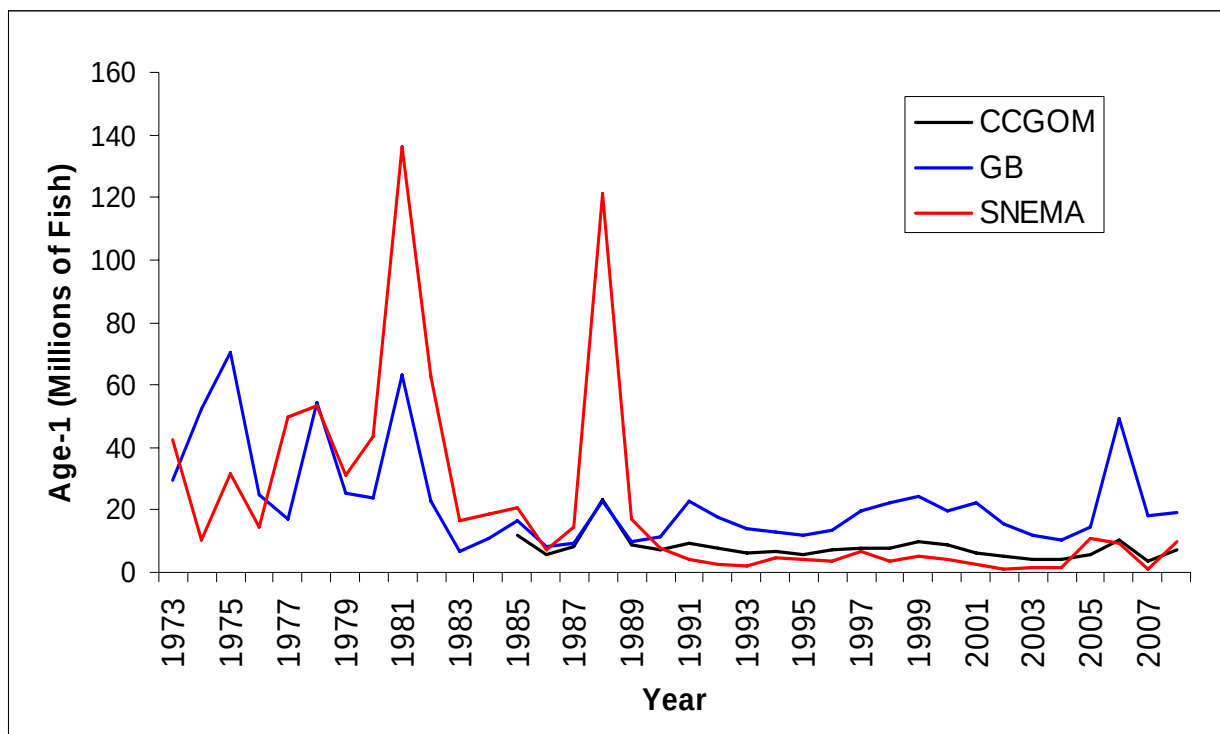


Appendix Figure E.5.e Survey bubble plot for CCGOM yellowtail MENH Fall survey. Note the 2005 year class is highlighted in pink.



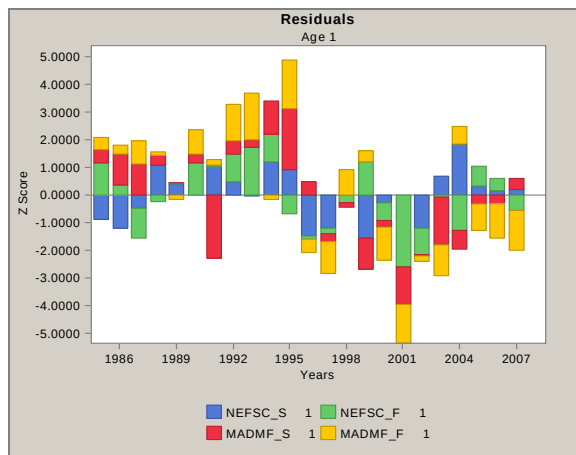
Appendix Figure E.5.f Survey bubble plot for CCGOM yellowtail MENH Spring survey. Note the 2005 year class is highlighted in pink.

Age-1 Recruitment

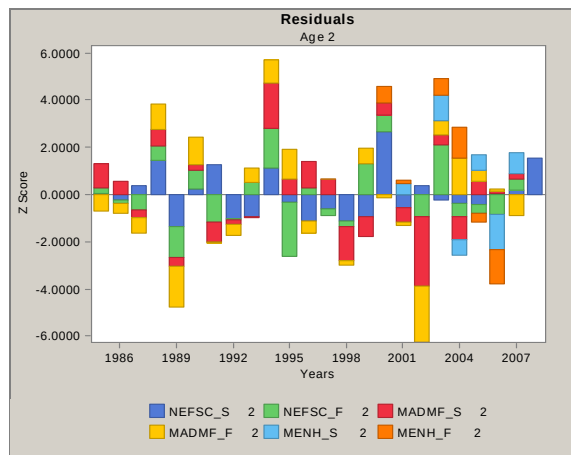


Appendix Figure E.6. Comparison of recruitment trends from the three yellowtail flounder stocks.

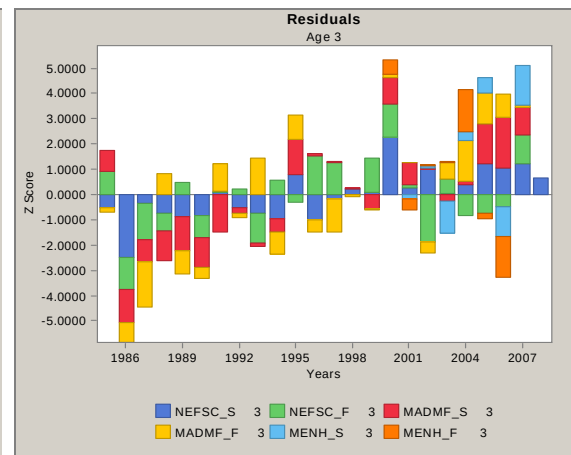
Age-1



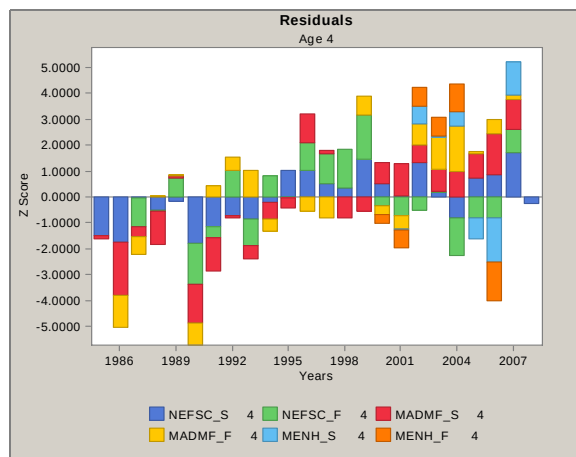
Age-2



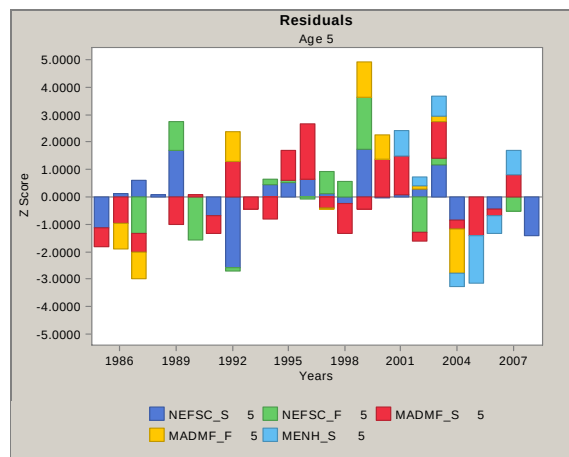
Age-3



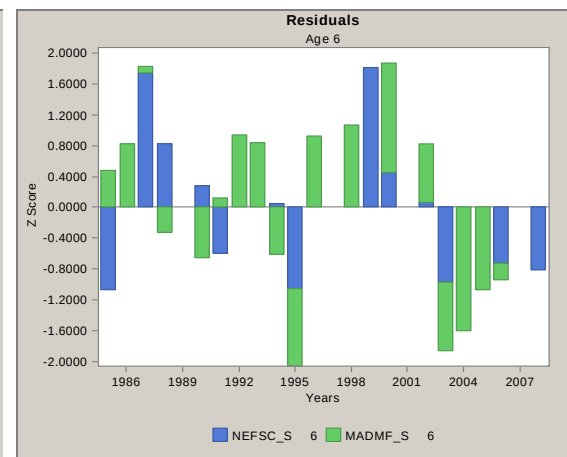
Age-4



Age-5



Age-6+



Appendix Figure E.7. Standardized residuals for all indices by age.

Appendix VPA Output Report

VPA Version 2.8.0

Model ID: ccgom using new data for GARM2008 Biological Reference Points Meeting

Input File:

C:\WORKING\ASSESSMENTS\GARM3THEFINALE\YTASSESSMENTS\CCGOM\VPA\6PLUS\CCGOM6PLUS_R

Date of Run: 08-JUL-2008

Time of Run: 21:04

Levenburg-Marquardt Algorithm Completed 4 Iterations

Residual Sum of Squares = 427.053

Number of Residuals = 507
Number of Parameters = 4
Degrees of Freedom = 503
Mean Squared Residual = 0.849013
Standard Deviation = 0.921419

Number of Years = 23
Number of Ages = 6
First Year = 1985
Youngest Age = 1
Oldest True Age = 5

Number of Survey Indices Available = 36
Number of Survey Indices Used in Estimate = 29

VPA Classic Method - Auto Estimated Q's

Stock Numbers Predicted in Terminal Year Plus One (2008)

Age	Stock Predicted	Std. Error	CV
2	2885.567	0.122086E+04	0.423091E+00
3	6574.688	0.203245E+04	0.309132E+00
4	2295.446	0.692206E+03	0.301556E+00
5	615.057	0.189449E+03	0.308019E+00

Catchability Values for Each Survey Used in Estimate

INDEX	Catchability	Std. Error	CV
-------	--------------	------------	----

1	0.428830E-02	0.110359E-02	0.257350E+00
2	0.904027E-01	0.113937E-01	0.126032E+00
3	0.282809E+00	0.412935E-01	0.146012E+00
4	0.348440E+00	0.571812E-01	0.164106E+00
5	0.413448E+00	0.950862E-01	0.229983E+00
6	0.392500E+00	0.154293E+00	0.393104E+00
7	0.586332E-01	0.963225E-02	0.164280E+00
8	0.205993E+00	0.280670E-01	0.136252E+00
9	0.231381E+00	0.344197E-01	0.148758E+00
10	0.165885E+00	0.485054E-01	0.292403E+00
11	0.548869E+00	0.215644E+00	0.392888E+00
13	0.234298E-01	0.560606E-02	0.239271E+00
14	0.340915E+00	0.440577E-01	0.129234E+00
15	0.662967E+00	0.872223E-01	0.131564E+00
16	0.587346E+00	0.978967E-01	0.166677E+00
17	0.503147E+00	0.835408E-01	0.166037E+00
18	0.349937E+00	0.992091E-01	0.283505E+00
19	0.105901E+00	0.182217E-01	0.172064E+00
20	0.305596E+00	0.447090E-01	0.146301E+00
21	0.301859E+00	0.511952E-01	0.169600E+00

22	0.134206E+00	0.426887E-01	0.318084E+00
23	0.122468E+00	0.499577E-01	0.407925E+00
26	0.661209E-04	0.121755E-04	0.184140E+00
27	0.403312E-03	0.581534E-04	0.144190E+00
28	0.500465E-03	0.864105E-04	0.172661E+00
29	0.220345E-03	0.101714E-03	0.461614E+00
32	0.134794E-03	0.521699E-04	0.387034E+00
33	0.189250E-03	0.416766E-04	0.220220E+00
34	0.805163E-04	0.601412E-04	0.746945E+00

-- Non-Linear Least Squares Fit --

Default Tolerances Used

Scaled Gradient Tolerance	=	6.055454E-06
Scaled Step Tolerance	=	3.666853E-11
Relative Function Tolerance	=	3.666853E-11
Absolute Function Tolerance	=	4.930381E-32

VPA Method Options

- Catchability Values Estimated as an Analytic Function of N
- Catch Equation Used in Cohort Solution
- Plus Group Backward Calculation Method Used
- Rivard Weights Used for JAN-1 Biomass
- Rivard Weights Calculation Used 3 Years for Terminal Year Plus One

- Heincke Rule Used in F-Oldest Calculation
- F-Oldest Calculation in Years Prior to Terminal Year
Uses Stock Sizes in Ages 4 to 5
- Calculation of Population of Age 1 In Year 2008
= Geometric Mean of First Age Populations
Year Range Applied = 1985 to 2007

Stock Estimates

Age 2
Age 3
Age 4
Age 5

Full F in Terminal Year = 0.3603

F in Oldest True Age in Terminal Year = 0.3603

Full F Calculated Using Classic Method

Age	Input Partial Recruitment	Calc Partial Recruitment	Fishing Mortality	Used In Full F	Comments
1	0.010	0.009	0.0044	NO	Stock Estimate in T+1
2	0.100	0.079	0.0369	NO	Stock Estimate in T+1
3	1.000	0.538	0.2522	YES	Stock Estimate in T+1
4	1.000	1.000	0.4684	YES	Stock Estimate in T+1
5	1.000	0.769	0.3603		Input PR * Full F

Catch At Age - Input Data

AGE	1985	1986	1987	1988	1989
1	686.0	95.0	19.0	452.0	118.0
2	1245.0	4225.0	1885.0	2582.0	2297.0
3	907.0	785.0	2331.0	1503.0	1812.0
4	635.0	304.0	309.0	744.0	298.0
5	329.0	40.0	116.0	199.0	38.0
6	121.0	8.0	53.0	41.0	9.0
AGE	1990	1991	1992	1993	1994
1	84.0	465.0	1709.0	159.0	19.0
2	2897.0	1372.0	3979.0	425.0	817.0
3	9400.0	1765.0	1961.0	1074.0	1697.0
4	493.0	1953.0	731.0	795.0	716.0
5	35.0	298.0	191.0	111.0	210.0
6	28.0	74.0	14.0	54.0	109.0
AGE	1995	1996	1997	1998	1999
1	37.0	26.0	8.0	38.0	9.0
2	526.0	787.0	1480.0	495.0	743.0
3	1777.0	2428.0	2007.0	2512.0	2292.0
4	1188.0	645.0	847.0	650.0	397.0
5	178.0	104.0	180.0	152.0	32.0
6	170.0	9.0	20.0	3.0	7.0
AGE	2000	2001	2002	2003	2004
1	2.0	20.0	58.0	10.0	13.0
2	1114.0	1342.0	1204.0	859.0	475.0
3	2981.0	3721.0	2449.0	2122.0	1594.0
4	1408.0	849.0	905.0	1200.0	571.0
5	133.0	145.0	109.0	152.0	243.0
6	35.0	24.0	34.0	70.0	75.0
AGE	2005	2006	2007		
1	15.0	7.0	14.0		
2	494.0	189.0	274.0		
3	1262.0	662.0	732.0		
4	585.0	390.0	410.0		
5	82.0	84.0	71.0		
6	48.0	54.0	14.0		

Weight At Age - Input Data

AGE	1985	1986	1987	1988	1989
1	0.1320	0.1030	0.0560	0.1230	0.1290
2	0.2660	0.2500	0.2320	0.2060	0.2700
3	0.3570	0.4280	0.3930	0.3380	0.3830
4	0.4890	0.5340	0.5480	0.5230	0.6500
5	0.6000	0.7300	0.6520	0.6960	0.9280
6	0.7860	0.9960	0.9160	0.8410	1.3170
AGE	1990	1991	1992	1993	1994
1	0.0790	0.1240	0.0530	0.0890	0.0890
2	0.2540	0.2360	0.1350	0.1600	0.1740
3	0.3700	0.3420	0.3250	0.3580	0.3540
4	0.5500	0.5170	0.4980	0.4180	0.5120
5	0.8240	0.7370	0.6020	0.7370	0.6740
6	0.9700	1.0210	1.1690	0.9990	0.9040
AGE	1995	1996	1997	1998	1999
1	0.0550	0.1090	0.1450	0.0790	0.1480
2	0.3070	0.2660	0.2780	0.2090	0.3440
3	0.3400	0.3830	0.3690	0.3930	0.4060
4	0.4220	0.4620	0.4780	0.6090	0.6040
5	0.6430	0.6090	0.6150	0.8560	0.6010
6	0.7900	1.2660	0.8650	0.7070	0.8010
AGE	2000	2001	2002	2003	2004
1	0.1010	0.2260	0.2180	0.0870	0.0770
2	0.3490	0.3440	0.3620	0.3220	0.2510
3	0.4320	0.4120	0.4400	0.4150	0.3720
4	0.5660	0.5730	0.5650	0.5350	0.4600
5	0.6230	0.7650	0.7740	0.6720	0.6090
6	0.8350	0.8980	1.0420	0.9450	0.8310
AGE	2005	2006	2007		
1	0.0620	0.1060	0.0360		
2	0.2610	0.3050	0.2820		
3	0.3690	0.3920	0.3970		
4	0.5140	0.4780	0.4920		
5	0.6940	0.7810	0.6300		
6	0.9210	0.9260	0.8550		

JAN-1 Weights at Age - Input Data

AGE	1985	1986	1987	1988	1989
1	0.0959	0.0686	0.0292	0.0830	0.0919
2	0.2097	0.1817	0.1546	0.1074	0.1822
3	0.2919	0.3374	0.3134	0.2800	0.2809
4	0.4002	0.4366	0.4843	0.4534	0.4687
5	0.5417	0.5975	0.5901	0.6176	0.6967
6	0.7860	0.9960	0.9160	0.8410	1.3170
AGE	1990	1991	1992	1993	1994
1	0.0457	0.1188	0.0305	0.0637	0.0479
2	0.1810	0.1365	0.1294	0.0921	0.1244
3	0.3161	0.2947	0.2769	0.2198	0.2380
4	0.4590	0.4374	0.4127	0.3686	0.4281
5	0.7318	0.6367	0.5579	0.6058	0.5308
6	0.9700	1.0210	1.1690	0.9990	0.9040
AGE	1995	1996	1997	1998	1999
1	0.0250	0.0683	0.1208	0.0379	0.0964
2	0.1653	0.1210	0.1741	0.1741	0.1649
3	0.2432	0.3429	0.3133	0.3305	0.2913
4	0.3865	0.3963	0.4279	0.4740	0.4872
5	0.5738	0.5069	0.5330	0.6397	0.6050
6	0.7900	1.2660	0.8650	0.7070	0.8010
AGE	2000	2001	2002	2003	2004
1	0.0547	0.1786	0.1794	0.0512	0.0418
2	0.2273	0.1864	0.2860	0.2649	0.1478
3	0.3855	0.3792	0.3891	0.3876	0.3461
4	0.4794	0.4975	0.4825	0.4852	0.4369
5	0.6134	0.6580	0.6660	0.6162	0.5708
6	0.8350	0.8980	1.0420	0.9450	0.8310
AGE	2005	2006	2007	2008	
1	0.0280	0.0650	0.0075	0.0335	
2	0.1418	0.1375	0.1729	0.1507	
3	0.3043	0.3199	0.3480	0.3241	
4	0.4373	0.4200	0.4392	0.4321	
5	0.5650	0.6336	0.5488	0.5825	
6	0.9210	0.9260	0.8550	0.9007	

SSB Weight At Age - Input Data

AGE	1985	1986	1987	1988	1989
1	0.1320	0.1030	0.0560	0.1230	0.1290
2	0.2660	0.2500	0.2320	0.2060	0.2700
3	0.3570	0.4280	0.3930	0.3380	0.3830
4	0.4890	0.5340	0.5480	0.5230	0.6500
5	0.6000	0.7300	0.6520	0.6960	0.9280
6	0.7860	0.9960	0.9160	0.8410	1.3170
AGE	1990	1991	1992	1993	1994
1	0.0790	0.1240	0.0530	0.0890	0.0890
2	0.2540	0.2360	0.1350	0.1600	0.1740
3	0.3700	0.3420	0.3250	0.3580	0.3540
4	0.5500	0.5170	0.4980	0.4180	0.5120
5	0.8240	0.7370	0.6020	0.7370	0.6740
6	0.9700	1.0210	1.1690	0.9990	0.9040
AGE	1995	1996	1997	1998	1999
1	0.0550	0.1090	0.1450	0.0790	0.1480
2	0.3070	0.2660	0.2780	0.2090	0.3440
3	0.3400	0.3830	0.3690	0.3930	0.4060
4	0.4220	0.4620	0.4780	0.6090	0.6040
5	0.6430	0.6090	0.6150	0.8560	0.6010
6	0.7900	1.2660	0.8650	0.7070	0.8010
AGE	2000	2001	2002	2003	2004
1	0.1010	0.2260	0.2180	0.0870	0.0770
2	0.3490	0.3440	0.3620	0.3220	0.2510
3	0.4320	0.4120	0.4400	0.4150	0.3720
4	0.5660	0.5730	0.5650	0.5350	0.4600
5	0.6230	0.7650	0.7740	0.6720	0.6090
6	0.8350	0.8980	1.0420	0.9450	0.8310
AGE	2005	2006	2007		
1	0.0620	0.1060	0.0360		
2	0.2610	0.3050	0.2820		
3	0.3690	0.3920	0.3970		
4	0.5140	0.4780	0.4920		
5	0.6940	0.7810	0.6300		
6	0.9210	0.9260	0.8550		

Natural Mortality - Input Data

AGE	1985	1986	1987	1988	1989
1	0.2000	0.2000	0.2000	0.2000	0.2000
2	0.2000	0.2000	0.2000	0.2000	0.2000
3	0.2000	0.2000	0.2000	0.2000	0.2000
4	0.2000	0.2000	0.2000	0.2000	0.2000
5	0.2000	0.2000	0.2000	0.2000	0.2000
6	0.2000	0.2000	0.2000	0.2000	0.2000
AGE	1990	1991	1992	1993	1994
1	0.2000	0.2000	0.2000	0.2000	0.2000
2	0.2000	0.2000	0.2000	0.2000	0.2000
3	0.2000	0.2000	0.2000	0.2000	0.2000
4	0.2000	0.2000	0.2000	0.2000	0.2000
5	0.2000	0.2000	0.2000	0.2000	0.2000
6	0.2000	0.2000	0.2000	0.2000	0.2000
AGE	1995	1996	1997	1998	1999
1	0.2000	0.2000	0.2000	0.2000	0.2000
2	0.2000	0.2000	0.2000	0.2000	0.2000
3	0.2000	0.2000	0.2000	0.2000	0.2000
4	0.2000	0.2000	0.2000	0.2000	0.2000
5	0.2000	0.2000	0.2000	0.2000	0.2000
6	0.2000	0.2000	0.2000	0.2000	0.2000
AGE	2000	2001	2002	2003	2004
1	0.2000	0.2000	0.2000	0.2000	0.2000
2	0.2000	0.2000	0.2000	0.2000	0.2000
3	0.2000	0.2000	0.2000	0.2000	0.2000
4	0.2000	0.2000	0.2000	0.2000	0.2000
5	0.2000	0.2000	0.2000	0.2000	0.2000
6	0.2000	0.2000	0.2000	0.2000	0.2000
AGE	2005	2006	2007		
1	0.2000	0.2000	0.2000		
2	0.2000	0.2000	0.2000		
3	0.2000	0.2000	0.2000		
4	0.2000	0.2000	0.2000		
5	0.2000	0.2000	0.2000		
6	0.2000	0.2000	0.2000		

Proportion of Natural Mortality Before Spawning = 0.4167
Proportion of Fishing Mortality Before Spawning = 0.4167

Maturity - Input Data

AGE	1985	1986	1987	1988	1989
1	0.0000	0.0000	0.0000	0.0000	0.0000
2	0.1710	0.1710	0.1710	0.1710	0.1710
3	0.8330	0.8330	0.8330	0.8330	0.8330
4	0.9770	0.9770	0.9770	0.9770	0.9770
5	1.0000	1.0000	1.0000	1.0000	1.0000
6	1.0000	1.0000	1.0000	1.0000	1.0000
AGE	1990	1991	1992	1993	1994
1	0.0000	0.0000	0.0000	0.0000	0.0000
2	0.1710	0.1710	0.1710	0.1710	0.1710
3	0.8330	0.8330	0.8330	0.8330	0.8330
4	0.9770	0.9770	0.9770	0.9770	0.9770
5	1.0000	1.0000	1.0000	1.0000	1.0000
6	1.0000	1.0000	1.0000	1.0000	1.0000
AGE	1995	1996	1997	1998	1999
1	0.0000	0.0000	0.0000	0.0000	0.0000
2	0.1710	0.1710	0.1710	0.1710	0.1710
3	0.8330	0.8330	0.8330	0.8330	0.8330
4	0.9770	0.9770	0.9770	0.9770	0.9770
5	1.0000	1.0000	1.0000	1.0000	1.0000
6	1.0000	1.0000	1.0000	1.0000	1.0000
AGE	2000	2001	2002	2003	2004
1	0.0000	0.0000	0.0000	0.0000	0.0000
2	0.1710	0.1710	0.1710	0.1710	0.1710
3	0.8330	0.8330	0.8330	0.8330	0.8330
4	0.9770	0.9770	0.9770	0.9770	0.9770
5	1.0000	1.0000	1.0000	1.0000	1.0000
6	1.0000	1.0000	1.0000	1.0000	1.0000
AGE	2005	2006	2007		
1	0.0000	0.0000	0.0000		
2	0.1710	0.1710	0.1710		
3	0.8330	0.8330	0.8330		
4	0.9770	0.9770	0.9770		
5	1.0000	1.0000	1.0000		
6	1.0000	1.0000	1.0000		

Input Partial Recruitment

AGE

1	0.0100
2	0.1000
3	1.0000
4	1.0000
5	1.0000

Input F-Plus Ratio

YEAR

1985	1.0000
1986	1.0000
1987	1.0000
1988	1.0000
1989	1.0000
1990	1.0000
1991	1.0000
1992	1.0000
1993	1.0000
1994	1.0000
1995	1.0000
1996	1.0000
1997	1.0000
1998	1.0000
1999	1.0000
2000	1.0000
2001	1.0000
2002	1.0000
2003	1.0000
2004	1.0000
2005	1.0000
2006	1.0000
2007	1.0000

SURVEY - INPUT DATA

INDEX	1	2	3	4	5
SURVEY TAG	NEFSC_S	NEFSC_S	NEFSC_S	NEFSC_S	NEFSC_S
AGE	1	2	3	4	5
TIME	JAN-1	JAN-1	JAN-1	JAN-1	JAN-1
TYPE	NUMBERS	NUMBERS	NUMBERS	NUMBERS	NUMBERS
RETRO FLAG	1	1	1	1	1
1985	18.1030	310.9470	333.9900	80.6700	49.9070
1986	6.2530	692.5290	76.4630	52.8020	38.4050
1987	20.4570	524.5110	773.5080	208.8550	177.0110
1988	345.6470	1459.2440	355.9140	197.8160	103.5980
1989	58.1680	714.8390	473.2140	122.1250	127.2580
1990	0.0000	727.5380	2025.3260	81.7120	0.0000
1991	136.7150	1167.4030	945.6560	327.1200	74.1090
1992	59.6730	352.9810	708.2390	192.3740	7.0250
1993	24.5480	253.0500	403.3900	217.3080	0.0000
1994	113.8260	863.0170	517.7180	310.4070	197.9320
1995	70.3650	401.2280	1535.4760	1163.6200	157.3260
1996	5.7130	211.0550	552.1090	775.2840	129.2650
1997	8.1440	360.3530	781.4210	596.4580	111.2010
1998	0.0000	279.7210	1135.6370	347.9240	55.3880

1999	6.7930	327.1580	1402.3500	715.2640	128.1850
2000	26.8640	3717.7030	6558.6090	911.5350	64.3050
2001	0.0000	463.4490	1882.7820	397.4070	83.3340
2002	5.7510	603.2900	2729.2800	1258.9580	82.2530
2003	36.0890	333.2570	928.3640	678.6340	303.8840
2004	141.6940	230.3540	1010.0770	138.3750	54.1920
2005	34.2750	224.6800	1474.6060	495.6400	0.0000
2006	51.9920	429.4440	1319.6730	465.9580	36.6300
2007	19.4540	836.8090	2410.1880	1648.8390	82.4840
2008	90.0500	670.6830	3017.4540	656.2080	56.8940

SURVEY - INPUT DATA

INDEX	6	7	8	9	10
SURVEY TAG	NEFSC_S	NEFSC_F	NEFSC_F	NEFSC_F	NEFSC_F
AGE	6	1	2	3	4
TIME	JAN-1	MEAN	MEAN	MEAN	MEAN
TYPE	NUMBERS	NUMBERS	NUMBERS	NUMBERS	NUMBERS
RETRO FLAG	1	0	0	0	0
1985	12.7370	1481.9910	568.3090	483.1240	0.0000
1986	0.0000	398.4850	1108.1160	97.4740	0.0000
1987	487.2250	181.5650	436.4130	160.7840	14.6050
1988	59.4030	1006.1060	1475.7180	142.5120	43.2040
1989	0.0000	474.0200	1408.5800	609.2610	83.7700
1990	32.6150	957.0150	1695.7260	785.8080	12.4500
1991	15.4390	503.0050	449.1530	448.2520	90.7830
1992	0.0000	810.3210	887.2390	604.1460	304.9680
1993	0.0000	1215.5620	1232.5160	164.1940	27.0550
1994	66.6210	795.3300	2370.1630	835.2530	265.0780
1995	18.4500	179.3460	218.1750	345.6950	91.1040
1996	0.0000	340.4840	935.0750	1585.1910	379.3440
1997	0.0000	337.4920	799.7690	950.4520	403.1180
1998	0.0000	328.6130	959.8460	385.0060	317.0960
1999	56.7010	1324.0380	2602.5560	1777.7590	543.9890
2000	32.1520	287.8540	2183.9010	1443.3550	73.5720
2001	0.0000	43.3330	1227.9470	730.0580	30.4000
2002	19.9940	128.4530	458.0310	180.3430	48.8980
2003	9.7650	192.0210	2822.8220	593.9480	139.6160
2004	0.0000	76.1780	371.3020	202.0580	7.8490
2005	0.0000	533.6620	425.2180	174.6170	21.2000
2006	12.9300	780.3070	487.2410	273.8280	21.9720
2007	0.0000	119.8640	2095.6590	1539.5100	490.7480
2008	17.7550	0.0000	0.0000	0.0000	0.0000

SURVEY - INPUT DATA

INDEX	11	12	13	14	15
SURVEY TAG	NEFSC_F	NEFSC_F	MADMF_S	MADMF_S	MADMF_S
AGE	5	6	1	2	3
TIME	MEAN	MEAN	JAN-1	JAN-1	JAN-1
TYPE	NUMBERS	NUMBERS	NUMBERS	NUMBERS	NUMBERS
RETRO FLAG	0	0	1	1	1
1985	0.0000	0.0000	497.0250	2105.0030	1908.8820
1986	0.0000	0.0000	501.8520	4329.5450	464.1090
1987	11.8710	0.0000	680.9680	1275.2300	1346.4370
1988	0.0000	0.0000	813.9460	3487.8670	665.1130
1989	57.9050	0.0000	203.3910	4952.9930	910.6080
1990	2.6700	0.0000	260.0330	2752.1500	4106.4600
1991	0.0000	0.0000	15.7170	1211.2920	822.4220
1992	58.9030	45.8100	323.1760	2204.7650	2112.4920
1993	0.0000	0.0000	188.2490	1625.2320	1489.0710
1994	114.0090	0.0000	607.6480	5237.6300	1739.8600
1995	55.0740	0.0000	1659.0530	2801.7700	5042.3860
1996	42.9140	0.0000	290.0960	3230.8240	2758.7060
1997	187.6780	37.0270	133.0880	2988.6480	2082.4010
1998	75.2130	0.0000	157.7480	841.1020	2369.4250
1999	228.1470	8.7180	65.0630	1290.6180	2134.1890
2000	0.0000	0.0000	158.4610	3766.1960	5789.4590
2001	0.0000	0.0000	32.1750	1681.2430	6305.2450
2002	6.2090	0.0000	115.7800	296.3500	3236.0910
2003	81.2280	0.0000	12.6720	1873.4150	1796.0640
2004	0.0000	0.0000	42.3510	608.1690	1987.8790
2005	0.0000	0.0000	92.1360	1537.7320	3878.1360
2006	0.0000	0.0000	167.2660	1648.8760	5099.9610
2007	40.1160	0.0000	127.1360	3237.1610	4743.1840
2008	0.0000	0.0000	0.0000	0.0000	0.0000

SURVEY - INPUT DATA

INDEX	16	17	18	19	20
SURVEY TAG	MADMF_S	MADMF_S	MADMF_S	MADMF_F	MADMF_F
AGE	4	5	6	1	2
TIME	JAN-1	JAN-1	JAN-1	MEAN	MEAN
TYPE	NUMBERS	NUMBERS	NUMBERS	NUMBERS	NUMBERS
RETRO FLAG	1	1	1	0	0
1985	411.8830	120.1970	92.1910	1564.3110	447.5140
1986	68.4920	19.2010	15.2510	712.4570	1357.0800
1987	267.2470	69.3420	40.6780	1605.8940	629.5920
1988	183.7780	0.0000	11.1910	2457.5290	3083.3080
1989	252.1060	12.0420	0.0000	723.3600	1431.1860
1990	176.7290	37.9630	8.9970	1425.3250	3273.5870
1991	509.6970	111.9130	36.8650	1030.9690	1409.6080
1992	559.5370	359.5750	20.7370	1968.5960	993.4730
1993	495.4610	62.1560	79.9020	2301.7830	1998.6590
1994	357.3800	81.9870	26.5240	562.1700	2375.2950
1995	635.8460	253.8890	5.7330	2356.2310	3484.5480
1996	1418.9890	393.6150	14.6470	468.3060	815.5100
1997	724.2240	87.2260	0.0000	274.7080	1410.2660
1998	228.6260	38.6760	4.4160	1617.7710	1438.8480

1999	239.7620	17.8290	0.0000	1296.7350	2669.8890
2000	1941.1660	238.9120	82.7000	317.0860	1825.2490
2001	1739.2570	280.3030	0.0000	188.3590	1638.2610
2002	1244.8380	58.5070	40.7060	427.2710	178.8690
2003	1977.8950	301.6710	11.9040	151.0820	1612.4220
2004	978.5240	124.1460	5.0740	638.1770	2381.7410
2005	1018.2970	19.0090	6.3640	242.0940	1165.0450
2006	1370.3840	60.4820	25.1530	343.2540	1370.3840
2007	1731.2200	182.7090	0.0000	105.0550	1206.4640
2008	0.0000	0.0000	0.0000	0.0000	0.0000

SURVEY - INPUT DATA

INDEX	21	22	23	24	25
SURVEY TAG	MADMF_F	MADMF_F	MADMF_F	MADMF_F	MENH_S
AGE	3	4	5	6	1
TIME	MEAN	MEAN	MEAN	MEAN	JAN-1
TYPE	NUMBERS	NUMBERS	NUMBERS	NUMBERS	NUMBERS
RETRO FLAG	0	0	0	0	1
1985	282.6900	0.0000	0.0000	4.8820	-999.0000
1986	55.5450	9.1070	1.9750	0.0000	-999.0000
1987	135.1180	19.3930	5.4580	0.0000	-999.0000
1988	622.6800	41.2820	0.0000	0.0000	-999.0000
1989	263.3520	28.3350	0.0000	0.0000	-999.0000
1990	1327.7580	1.5910	0.0000	0.0000	-999.0000
1991	1379.0510	235.1270	0.0000	0.0000	-999.0000
1992	569.5490	129.3310	55.5720	0.0000	-999.0000
1993	1591.3700	393.0120	0.0000	0.0000	-999.0000
1994	349.2340	36.0700	0.0000	0.0000	-999.0000
1995	1235.5120	0.0000	0.0000	0.0000	-999.0000
1996	463.4230	32.8330	0.0000	0.0000	-999.0000
1997	171.2710	21.6970	12.5900	0.0000	-999.0000
1998	464.0270	0.0000	0.0000	0.0000	-999.0000
1999	846.4780	134.7890	16.5130	0.0000	-999.0000
2000	808.5150	56.1480	23.8640	8.5850	-999.0000
2001	868.5860	29.6790	0.0000	0.0000	0.0000
2002	626.3550	250.7340	9.9300	0.0000	0.0000
2003	856.7370	655.8150	15.9910	0.0000	0.0000
2004	1743.5910	522.5620	2.5240	0.0000	0.0000
2005	1046.9880	56.2310	0.0000	0.0000	0.0210
2006	1044.4370	111.9950	0.0000	0.0000	0.0000
2007	931.7840	155.7180	0.0000	0.0000	0.0000
2008	0.0000	0.0000	0.0000	0.0000	0.0000

SURVEY - INPUT DATA

INDEX	26	27	28	29	30
SURVEY TAG	MENH_S	MENH_S	MENH_S	MENH_S	MENH_S
AGE	2	3	4	5	6
TIME	JAN-1	JAN-1	JAN-1	JAN-1	JAN-1
TYPE	NUMBERS	NUMBERS	NUMBERS	NUMBERS	NUMBERS
RETRO FLAG	1	1	1	1	1
1985	-999.0000	-999.0000	-999.0000	-999.0000	-999.0000
1986	-999.0000	-999.0000	-999.0000	-999.0000	-999.0000
1987	-999.0000	-999.0000	-999.0000	-999.0000	-999.0000
1988	-999.0000	-999.0000	-999.0000	-999.0000	-999.0000
1989	-999.0000	-999.0000	-999.0000	-999.0000	-999.0000
1990	-999.0000	-999.0000	-999.0000	-999.0000	-999.0000
1991	-999.0000	-999.0000	-999.0000	-999.0000	-999.0000
1992	-999.0000	-999.0000	-999.0000	-999.0000	-999.0000
1993	-999.0000	-999.0000	-999.0000	-999.0000	-999.0000
1994	-999.0000	-999.0000	-999.0000	-999.0000	-999.0000
1995	-999.0000	-999.0000	-999.0000	-999.0000	-999.0000
1996	-999.0000	-999.0000	-999.0000	-999.0000	-999.0000
1997	-999.0000	-999.0000	-999.0000	-999.0000	-999.0000
1998	-999.0000	-999.0000	-999.0000	-999.0000	-999.0000
1999	-999.0000	-999.0000	-999.0000	-999.0000	-999.0000
2000	-999.0000	-999.0000	-999.0000	-999.0000	-999.0000
2001	0.5990	2.0870	0.5350	0.1320	0.0000
2002	0.2260	1.9810	0.8450	0.0480	0.0410
2003	0.4730	0.8050	0.8500	0.1140	0.0000
2004	0.1510	1.2410	0.4920	0.0390	0.0000
2005	0.2870	1.1070	0.2800	0.0030	0.0000
2006	0.1480	0.5600	0.1520	0.0140	0.0030
2007	0.8590	2.6610	1.0710	0.1290	0.0000
2008	0.0000	0.0000	0.0000	0.0000	0.0000

SURVEY - INPUT DATA

INDEX	31	32	33	34	35
SURVEY TAG	MENH_F	MENH_F	MENH_F	MENH_F	MENH_F
AGE	1	2	3	4	5
TIME	MEAN	MEAN	MEAN	MEAN	MEAN
TYPE	NUMBERS	NUMBERS	NUMBERS	NUMBERS	NUMBERS
RETRO FLAG	0	0	0	0	0
1985	-999.0000	-999.0000	-999.0000	-999.0000	-999.0000
1986	-999.0000	-999.0000	-999.0000	-999.0000	-999.0000
1987	-999.0000	-999.0000	-999.0000	-999.0000	-999.0000
1988	-999.0000	-999.0000	-999.0000	-999.0000	-999.0000
1989	-999.0000	-999.0000	-999.0000	-999.0000	-999.0000
1990	-999.0000	-999.0000	-999.0000	-999.0000	-999.0000
1991	-999.0000	-999.0000	-999.0000	-999.0000	-999.0000
1992	-999.0000	-999.0000	-999.0000	-999.0000	-999.0000
1993	-999.0000	-999.0000	-999.0000	-999.0000	-999.0000
1994	-999.0000	-999.0000	-999.0000	-999.0000	-999.0000
1995	-999.0000	-999.0000	-999.0000	-999.0000	-999.0000
1996	-999.0000	-999.0000	-999.0000	-999.0000	-999.0000
1997	-999.0000	-999.0000	-999.0000	-999.0000	-999.0000
1998	-999.0000	-999.0000	-999.0000	-999.0000	-999.0000

1999	-999.0000	-999.0000	-999.0000	-999.0000	-999.0000
2000	0.0530	1.7990	0.6400	0.0300	0.0100
2001	0.0620	0.9070	0.4190	0.0110	0.0000
2002	0.0000	0.2020	0.5600	0.1770	0.0050
2003	0.0000	0.9500	0.3340	0.2580	0.0000
2004	0.0320	1.3740	0.7800	0.1840	0.0000
2005	0.0000	0.2520	0.2120	0.0000	0.0000
2006	0.0000	0.1210	0.1200	0.0020	0.0000
2007	-999.0000	-999.0000	-999.0000	-999.0000	-999.0000
2008	0.0000	0.0000	0.0000	0.0000	0.0000

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SURVEY TAG MENH_F

AGE	6	NUMBERS	NUMBERS	NUMBERS	NUMBERS
TIME	MEAN	NUMBERS	NUMBERS	NUMBERS	NUMBERS
TYPE	NUMBERS	NUMBERS	NUMBERS	NUMBERS	NUMBERS
RETRO FLAG	0				

1985	-999.0000
1986	-999.0000
1987	-999.0000
1988	-999.0000
1989	-999.0000
1990	-999.0000
1991	-999.0000
1992	-999.0000
1993	-999.0000
1994	-999.0000
1995	-999.0000
1996	-999.0000
1997	-999.0000
1998	-999.0000
1999	-999.0000
2000	0.0000
2001	0.0000
2002	0.0000
2003	0.0000
2004	0.0000
2005	0.0000
2006	0.0000
2007	-999.0000
2008	0.0000

Additional Output Files

Population File C:\WORKING\ASSESSMENTS\GARM3THEFINALE\YTASSESSMENTS\CCGOM\VPA\6P
 Auxilliary File C:\WORKING\ASSESSMENTS\GARM3THEFINALE\YTASSESSMENTS\CCGOM\VPA\6P
 Covariance File C:\WORKING\ASSESSMENTS\GARM3THEFINALE\YTASSESSMENTS\CCGOM\VPA\6P
 Residuals File C:\WORKING\ASSESSMENTS\GARM3THEFINALE\YTASSESSMENTS\CCGOM\VPA\6P
 Log File C:\WORKING\ASSESSMENTS\GARM3THEFINALE\YTASSESSMENTS\CCGOM\VPA\6P

Estimation Results

JAN-1 Population Numbers

AGE	1985	1986	1987	1988	1989
1	11698.	5778.	8201.	23080.	8673.
2	3324.	8959.	4645.	6697.	18488.
3	1736.	1607.	3563.	2116.	3172.
4	777.	613.	615.	853.	406.
5	403.	81.	231.	228.	52.
6	148.	16.	106.	47.	12.
Total	18086.	17053.	17360.	33021.	30803.
AGE	1990	1991	1992	1993	1994
1	7361.	9443.	7880.	5956.	6707.
2	6994.	5951.	7311.	4915.	4733.
3	13067.	3135.	3639.	2444.	3640.
4	985.	2407.	997.	1233.	1041.
5	70.	367.	261.	172.	305.
6	56.	91.	19.	84.	158.
Total	28534.	21394.	20107.	14804.	16585.
AGE	1995	1996	1997	1998	1999
1	5709.	7197.	7558.	7842.	9755.
2	5474.	4641.	5869.	6181.	6386.
3	3139.	4007.	3091.	3475.	4614.
4	1465.	990.	1125.	753.	630.
5	220.	160.	239.	176.	51.
6	210.	14.	27.	3.	11.
Total	16217.	17008.	17909.	18430.	21446.
AGE	2000	2001	2002	2003	2004
1	8849.	6428.	5264.	3905.	3947.
2	7978.	7243.	5245.	4257.	3188.
3	4559.	5528.	4722.	3212.	2713.
4	1733.	1092.	1235.	1684.	751.
5	164.	187.	149.	213.	320.
6	43.	31.	46.	98.	99.
Total	23325.	20509.	16661.	13370.	11018.
AGE	2005	2006	2007	2008	
1	5653.	10185.	3540.	7211.	
2	3220.	4615.	8332.	2886.	
3	2182.	2191.	3608.	6575.	
4	805.	665.	1200.	2295.	
5	113.	143.	198.	615.	
6	66.	92.	51.	142.	
Total	12040.	17892.	16929.	19724.	

Fishing Mortality Calculated

AGE	1985	1986	1987	1988	1989
1	0.0668	0.0183	0.0026	0.0218	0.0151
2	0.5270	0.7220	0.5860	0.5474	0.1470
3	0.8406	0.7600	1.2296	1.4506	0.9688
4	2.0651	0.7766	0.7919	2.6014	1.5589
5	2.0651	0.7766	0.7919	2.6014	1.5589
6	2.0651	0.7766	0.7919	2.6014	1.5589
AGE	1990	1991	1992	1993	1994
1	0.0127	0.0558	0.2721	0.0299	0.0031
2	0.6023	0.2919	0.8958	0.1001	0.2105
3	1.4919	0.9456	0.8820	0.6533	0.7100
4	0.7872	2.0232	1.5562	1.1960	1.3564
5	0.7872	2.0232	1.5562	1.1960	1.3564
6	0.7872	2.0232	1.5562	1.1960	1.3564
AGE	1995	1996	1997	1998	1999
1	0.0072	0.0040	0.0012	0.0054	0.0010
2	0.1119	0.2064	0.3240	0.0924	0.1371
3	0.9542	1.0700	1.2124	1.5078	0.7790
4	2.0172	1.2204	1.6551	2.4965	1.1474
5	2.0172	1.2204	1.6551	2.4965	1.1474
6	2.0172	1.2204	1.6551	2.4965	1.1474
AGE	2000	2001	2002	2003	2004
1	0.0002	0.0034	0.0122	0.0028	0.0036
2	0.1668	0.2277	0.2904	0.2506	0.1790
3	1.2287	1.2991	0.8312	1.2530	1.0151
4	2.0291	1.7941	1.5559	1.4616	1.6958
5	2.0291	1.7941	1.5559	1.4616	1.6958
6	2.0291	1.7941	1.5559	1.4616	1.6958
AGE	2005	2006	2007		
1	0.0029	0.0008	0.0044		
2	0.1848	0.0462	0.0369		
3	0.9883	0.4021	0.2522		
4	1.5262	1.0118	0.4684		
5	1.5262	1.0118	0.3603		
6	1.5262	1.0118	0.3603		

Average Fishing Mortality For Ages 4- 5

Year Average F N Weighted Biomass Wtd Catch Wtd

1985	2.0651	2.0651	2.0651	2.0651
1986	0.7766	0.7766	0.7766	0.7766
1987	0.7919	0.7919	0.7919	0.7919
1988	2.6014	2.6014	2.6014	2.6014
1989	1.5589	1.5589	1.5589	1.5589
1990	0.7872	0.7872	0.7872	0.7872
1991	2.0232	2.0232	2.0232	2.0232
1992	1.5562	1.5562	1.5562	1.5562
1993	1.1960	1.1960	1.1960	1.1960
1994	1.3564	1.3564	1.3564	1.3564
1995	2.0172	2.0172	2.0172	2.0172
1996	1.2204	1.2204	1.2204	1.2204
1997	1.6551	1.6551	1.6551	1.6551
1998	2.4965	2.4965	2.4965	2.4965
1999	1.1474	1.1474	1.1474	1.1474
2000	2.0291	2.0291	2.0291	2.0291
2001	1.7941	1.7941	1.7941	1.7941
2002	1.5559	1.5559	1.5559	1.5559
2003	1.4616	1.4616	1.4616	1.4616
2004	1.6958	1.6958	1.6958	1.6958
2005	1.5262	1.5262	1.5262	1.5262
2006	1.0118	1.0118	1.0118	1.0118
2007	0.4144	0.4531	0.4500	0.4525

Back Calculated Partial Recruitment

AGE	1985	1986	1987	1988	1989
1	0.0324	0.0236	0.0021	0.0084	0.0097
2	0.2552	0.9297	0.4766	0.2104	0.0943
3	0.4071	0.9787	1.0000	0.5576	0.6215
4	1.0000	1.0000	0.6440	1.0000	1.0000
5	1.0000	1.0000	0.6440	1.0000	1.0000
6	1.0000	1.0000	0.6440	1.0000	1.0000
AGE	1990	1991	1992	1993	1994
1	0.0085	0.0276	0.1748	0.0250	0.0023
2	0.4037	0.1443	0.5756	0.0837	0.1552
3	1.0000	0.4674	0.5667	0.5463	0.5234
4	0.5276	1.0000	1.0000	1.0000	1.0000
5	0.5276	1.0000	1.0000	1.0000	1.0000
6	0.5276	1.0000	1.0000	1.0000	1.0000
AGE	1995	1996	1997	1998	1999
1	0.0036	0.0033	0.0007	0.0021	0.0009
2	0.0555	0.1691	0.1958	0.0370	0.1195
3	0.4730	0.8767	0.7325	0.6040	0.6789
4	1.0000	1.0000	1.0000	1.0000	1.0000
5	1.0000	1.0000	1.0000	1.0000	1.0000
6	1.0000	1.0000	1.0000	1.0000	1.0000
AGE	2000	2001	2002	2003	2004
1	0.0001	0.0019	0.0079	0.0019	0.0021
2	0.0822	0.1269	0.1867	0.1715	0.1056
3	0.6055	0.7241	0.5342	0.8573	0.5986
4	1.0000	1.0000	1.0000	1.0000	1.0000
5	1.0000	1.0000	1.0000	1.0000	1.0000
6	1.0000	1.0000	1.0000	1.0000	1.0000
AGE	2005	2006	2007		
1	0.0019	0.0007	0.0093		
2	0.1211	0.0457	0.0788		
3	0.6476	0.3974	0.5384		
4	1.0000	1.0000	1.0000		
5	1.0000	1.0000	0.7692		
6	1.0000	1.0000	0.7692		

JAN-1 Biomass

AGE	1985	1986	1987	1988	1989
1	1122.	396.	239.	1916.	797.
2	697.	1628.	718.	719.	3369.
3	507.	542.	1117.	593.	891.
4	311.	268.	298.	387.	190.
5	218.	48.	136.	141.	36.
6	116.	16.	97.	40.	16.
Total	2971.	2898.	2605.	3795.	5299.
AGE	1990	1991	1992	1993	1994
1	336.	1122.	240.	379.	321.
2	1266.	812.	946.	453.	589.
3	4130.	924.	1008.	537.	866.
4	452.	1053.	412.	455.	446.
5	51.	234.	145.	104.	162.
6	54.	93.	22.	84.	143.
Total	6291.	4238.	2773.	2012.	2527.
AGE	1995	1996	1997	1998	1999
1	143.	492.	913.	297.	940.
2	905.	562.	1022.	1076.	1053.
3	763.	1374.	968.	1149.	1344.
4	566.	392.	482.	357.	307.
5	126.	81.	127.	113.	31.
6	166.	17.	23.	2.	9.
Total	2669.	2918.	3535.	2994.	3684.
AGE	2000	2001	2002	2003	2004
1	484.	1148.	944.	200.	165.
2	1813.	1350.	1500.	1128.	471.
3	1757.	2096.	1837.	1245.	939.
4	831.	543.	596.	817.	328.
5	100.	123.	99.	131.	182.
6	36.	28.	48.	93.	82.
Total	5022.	5288.	5025.	3614.	2168.
AGE	2005	2006	2007	2008	
1	158.	662.	27.	242.	
2	457.	635.	1441.	435.	
3	664.	701.	1256.	2131.	
4	352.	279.	527.	992.	
5	64.	91.	109.	358.	
6	61.	85.	43.	128.	
Total	1756.	2453.	3402.	4285.	

Mean Biomass

AGE	1985	1986	1987	1988	1989
1	1355.	535.	416.	2546.	1007.
2	628.	1463.	746.	972.	4218.
3	385.	442.	745.	350.	716.
4	150.	209.	214.	150.	124.
5	96.	38.	96.	53.	23.
6	46.	10.	61.	13.	8.
Total	2661.	2697.	2278.	4084.	6095.
AGE	1990	1991	1992	1993	1994
1	524.	1033.	333.	474.	540.
2	1222.	1109.	600.	679.	675.
3	2331.	638.	723.	589.	846.
4	344.	499.	234.	278.	270.
5	37.	109.	74.	68.	104.
6	35.	37.	11.	45.	73.
Total	4492.	3426.	1973.	2133.	2509.
AGE	1995	1996	1997	1998	1999
1	284.	710.	993.	560.	1308.
2	1444.	1014.	1270.	1120.	1865.
3	633.	869.	611.	655.	1195.
4	249.	244.	245.	159.	209.
5	57.	52.	67.	52.	17.
6	67.	9.	10.	1.	5.
Total	2732.	2899.	3195.	2546.	4598.
AGE	2000	2001	2002	2003	2004
1	810.	1315.	1034.	308.	275.
2	2331.	2027.	1501.	1104.	666.
3	1048.	1180.	1296.	703.	584.
4	393.	271.	329.	439.	155.
5	41.	62.	54.	70.	87.
6	14.	12.	23.	45.	37.
Total	4637.	4867.	4237.	2668.	1804.
AGE	2005	2006	2007		
1	317.	978.	115.		
2	698.	1248.	2092.		
3	471.	645.	1152.		
4	197.	184.	431.		
5	37.	65.	95.		
6	29.	49.	33.		
Total	1749.	3170.	3919.		

Spawning Stock Biomass

AGE	1985	1986	1987	1988	1989
1	0.	0.	0.	0.	0.
2	112.	261.	133.	173.	739.
3	335.	384.	643.	300.	622.
4	144.	213.	218.	136.	124.
5	94.	39.	100.	49.	23.
6	45.	11.	64.	12.	8.
Total	730.	908.	1157.	670.	1515.
AGE	1990	1991	1992	1993	1994
1	0.	0.	0.	0.	0.
2	217.	196.	107.	119.	119.
3	1990.	554.	628.	511.	735.
4	351.	481.	233.	282.	272.
5	38.	107.	75.	71.	108.
6	36.	37.	11.	47.	75.
Total	2633.	1375.	1054.	1029.	1308.
AGE	1995	1996	1997	1998	1999
1	0.	0.	0.	0.	0.
2	252.	178.	224.	196.	326.
3	550.	753.	527.	558.	1038.
4	240.	247.	243.	146.	212.
5	56.	54.	68.	49.	17.
6	66.	10.	11.	1.	5.
Total	1164.	1242.	1073.	949.	1599.
AGE	2000	2001	2002	2003	2004
1	0.	0.	0.	0.	0.
2	409.	356.	265.	194.	117.
3	904.	1016.	1126.	606.	507.
4	379.	266.	328.	440.	153.
5	40.	62.	55.	72.	88.
6	14.	12.	23.	46.	37.
Total	1746.	1713.	1797.	1359.	902.
AGE	2005	2006	2007		
1	0.	0.	0.		
2	122.	217.	364.		
3	409.	557.	988.		
4	197.	187.	437.		
5	38.	68.	99.		
6	30.	51.	34.		
Total	796.	1080.	1922.		

Catch Biomass

AGE	1985	1986	1987	1988	1989
1	91.	10.	1.	56.	15.
2	331.	1056.	437.	532.	620.
3	324.	336.	916.	508.	694.
4	311.	162.	169.	389.	194.
5	197.	29.	76.	139.	35.
6	95.	8.	49.	34.	12.
Total	1349.	1602.	1648.	1658.	1570.
AGE	1990	1991	1992	1993	1994
1	7.	58.	91.	14.	2.
2	736.	324.	537.	68.	142.
3	3478.	604.	637.	384.	601.
4	271.	1010.	364.	332.	367.
5	29.	220.	115.	82.	142.
6	27.	76.	16.	54.	99.
Total	4548.	2290.	1760.	935.	1351.
AGE	1995	1996	1997	1998	1999
1	2.	3.	1.	3.	1.
2	161.	209.	411.	103.	256.
3	604.	930.	741.	987.	931.
4	501.	298.	405.	396.	240.
5	114.	63.	111.	130.	19.
6	134.	11.	17.	2.	6.
Total	1518.	1515.	1686.	1622.	1452.
AGE	2000	2001	2002	2003	2004
1	0.	5.	13.	1.	1.
2	389.	462.	436.	277.	119.
3	1288.	1533.	1078.	881.	593.
4	797.	486.	511.	642.	263.
5	83.	111.	84.	102.	148.
6	29.	22.	35.	66.	62.
Total	2586.	2618.	2157.	1968.	1186.
AGE	2005	2006	2007		
1	1.	1.	1.		
2	129.	58.	77.		
3	466.	260.	291.		
4	301.	186.	202.		
5	57.	66.	45.		
6	44.	50.	12.		
Total	997.	620.	627.		

Catch Numbers

AGE	1985	1986	1987	1988	1989
1	686.0	95.0	19.0	452.0	118.0
2	1245.0	4225.0	1885.0	2582.0	2297.0
3	907.0	785.0	2331.0	1503.0	1812.0
4	635.0	304.0	309.0	744.0	298.0
5	329.0	40.0	116.0	199.0	38.0
6	121.0	8.0	53.0	41.0	9.0
Total	3923.0	5457.0	4713.0	5521.0	4572.0
AGE	1990	1991	1992	1993	1994
1	84.0	465.0	1709.0	159.0	19.0
2	2897.0	1372.0	3979.0	425.0	817.0
3	9400.0	1765.0	1961.0	1074.0	1697.0
4	493.0	1953.0	731.0	795.0	716.0
5	35.0	298.0	191.0	111.0	210.0
6	28.0	74.0	14.0	54.0	109.0
Total	12937.0	5927.0	8585.0	2618.0	3568.0
AGE	1995	1996	1997	1998	1999
1	37.0	26.0	8.0	38.0	9.0
2	526.0	787.0	1480.0	495.0	743.0
3	1777.0	2428.0	2007.0	2512.0	2292.0
4	1188.0	645.0	847.0	650.0	397.0
5	178.0	104.0	180.0	152.0	32.0
6	170.0	9.0	20.0	3.0	7.0
Total	3876.0	3999.0	4542.0	3850.0	3480.0
AGE	2000	2001	2002	2003	2004
1	2.0	20.0	58.0	10.0	13.0
2	1114.0	1342.0	1204.0	859.0	475.0
3	2981.0	3721.0	2449.0	2122.0	1594.0
4	1408.0	849.0	905.0	1200.0	571.0
5	133.0	145.0	109.0	152.0	243.0
6	35.0	24.0	34.0	70.0	75.0
Total	5673.0	6101.0	4759.0	4413.0	2971.0
AGE	2005	2006	2007		
1	15.0	7.0	14.0		
2	494.0	189.0	274.0		
3	1262.0	662.0	732.0		
4	585.0	390.0	410.0		
5	82.0	84.0	71.0		
6	48.0	54.0	14.0		
Total	2486.0	1386.0	1515.0		

Surplus Production

Average Adjustment Factor (Delta) = 1.0000

Year	Biomass	Delta Biomass	Catch Biomass	Surplus Production
1985	2971.240	-72.963	1348.542	1275.579
1986	2898.276	-293.185	1601.519	1308.334
1987	2605.091	1189.554	1647.979	2837.533
1988	3794.645	1504.423	1657.599	3162.022
1989	5299.069	991.551	1570.225	2561.776
1990	6290.620	-2052.948	4547.624	2494.676
1991	4237.672	-1464.426	2289.963	825.537
1992	2773.245	-761.449	1760.453	999.004
1993	2011.796	515.692	934.706	1450.398
1994	2527.488	141.546	1351.255	1492.801
1995	2669.034	248.779	1517.787	1766.566
1996	2917.813	617.328	1514.820	2132.148
1997	3535.141	-541.443	1686.049	1144.606
1998	2993.698	690.167	1621.756	2311.923
1999	3683.865	1338.299	1452.103	2790.402
2000	5022.164	266.308	2585.792	2852.100
2001	5288.471	-263.555	2618.174	2354.619
2002	5024.917	-1410.978	2157.171	746.193
2003	3613.938	-1446.130	1968.392	522.262
2004	2167.808	-412.252	1186.166	773.914
2005	1755.557	697.422	997.348	1694.770
2006	2452.978	948.936	619.919	1568.855
2007	3401.915	883.430	626.796	1510.226
2008	4285.345			

Summary of Survey Indices Used in the Estimate

INDEX	Survey Tag	Age	Time	Type	Catchability	Std. Error	CV
1	NEFSC_S	1	JAN-1	NUMBER	0.4288E-02	0.1104E-02	0.2573E+00
2	NEFSC_S	2	JAN-1	NUMBER	0.9040E-01	0.1139E-01	0.1260E+00
3	NEFSC_S	3	JAN-1	NUMBER	0.2828E+00	0.4129E-01	0.1460E+00
4	NEFSC_S	4	JAN-1	NUMBER	0.3484E+00	0.5718E-01	0.1641E+00
5	NEFSC_S	5	JAN-1	NUMBER	0.4134E+00	0.9509E-01	0.2300E+00
6	NEFSC_S	6	JAN-1	NUMBER	0.3925E+00	0.1543E+00	0.3931E+00
7	NEFSC_F	1	MEAN	NUMBER	0.5863E-01	0.9632E-02	0.1643E+00
8	NEFSC_F	2	MEAN	NUMBER	0.2060E+00	0.2807E-01	0.1363E+00
9	NEFSC_F	3	MEAN	NUMBER	0.2314E+00	0.3442E-01	0.1488E+00
10	NEFSC_F	4	MEAN	NUMBER	0.1659E+00	0.4851E-01	0.2924E+00
11	NEFSC_F	5	MEAN	NUMBER	0.5489E+00	0.2156E+00	0.3929E+00
13	MADMF_S	1	JAN-1	NUMBER	0.2343E-01	0.5606E-02	0.2393E+00
14	MADMF_S	2	JAN-1	NUMBER	0.3409E+00	0.4406E-01	0.1292E+00
15	MADMF_S	3	JAN-1	NUMBER	0.6630E+00	0.8722E-01	0.1316E+00
16	MADMF_S	4	JAN-1	NUMBER	0.5873E+00	0.9790E-01	0.1667E+00
17	MADMF_S	5	JAN-1	NUMBER	0.5031E+00	0.8354E-01	0.1660E+00
18	MADMF_S	6	JAN-1	NUMBER	0.3499E+00	0.9921E-01	0.2835E+00
19	MADMF_F	1	MEAN	NUMBER	0.1059E+00	0.1822E-01	0.1721E+00
20	MADMF_F	2	MEAN	NUMBER	0.3056E+00	0.4471E-01	0.1463E+00
21	MADMF_F	3	MEAN	NUMBER	0.3019E+00	0.5120E-01	0.1696E+00
22	MADMF_F	4	MEAN	NUMBER	0.1342E+00	0.4269E-01	0.3181E+00
23	MADMF_F	5	MEAN	NUMBER	0.1225E+00	0.4996E-01	0.4079E+00
26	MENH_S	2	JAN-1	NUMBER	0.6612E-04	0.1218E-04	0.1841E+00
27	MENH_S	3	JAN-1	NUMBER	0.4033E-03	0.5815E-04	0.1442E+00
28	MENH_S	4	JAN-1	NUMBER	0.5005E-03	0.8641E-04	0.1727E+00
29	MENH_S	5	JAN-1	NUMBER	0.2203E-03	0.1017E-03	0.4616E+00
32	MENH_F	2	MEAN	NUMBER	0.1348E-03	0.5217E-04	0.3870E+00
33	MENH_F	3	MEAN	NUMBER	0.1893E-03	0.4168E-04	0.2202E+00
34	MENH_F	4	MEAN	NUMBER	0.8052E-04	0.6014E-04	0.7469E+00

Survey Index: 1 Tag: NEFSC_S AGE = 1
Time = JAN-1 Type = NUMBER
Catchability = 0.428830E-02 % Variance Contribution = 5.8932
Residual = LN(Observed) - LN(Predicted)

Year	Observed	Predicted	Residual
1985	0.181030E+02	0.501646E+02	-0.101923E+01
1986	0.625300E+01	0.247773E+02	-0.137687E+01
1987	0.204570E+02	0.351662E+02	-0.541761E+00
1988	0.345647E+03	0.989729E+02	0.125057E+01
1989	0.581680E+02	0.371928E+02	0.447220E+00
1990	N/A	0.315677E+02	N/A
1991	0.136715E+03	0.404927E+02	0.121678E+01
1992	0.596730E+02	0.337908E+02	0.568692E+00
1993	0.245480E+02	0.255403E+02	-0.396282E-01
1994	0.113826E+03	0.287599E+02	0.137569E+01
1995	0.703650E+02	0.244814E+02	0.105578E+01
1996	0.571300E+01	0.308618E+02	-0.168677E+01
1997	0.814400E+01	0.324103E+02	-0.138119E+01
1998	N/A	0.336267E+02	N/A
1999	0.679300E+01	0.418302E+02	-0.181773E+01
2000	0.268640E+02	0.379451E+02	-0.345353E+00
2001	N/A	0.275666E+02	N/A
2002	0.575100E+01	0.225738E+02	-0.136742E+01
2003	0.360890E+02	0.167461E+02	0.767821E+00
2004	0.141694E+03	0.169265E+02	0.212479E+01
2005	0.342750E+02	0.242436E+02	0.346262E+00
2006	0.519920E+02	0.436764E+02	0.174282E+00
2007	0.194540E+02	0.151801E+02	0.248069E+00
2008	N/A	0.000000E+00	N/A

Survey Index: 2 Tag: NEFSC_S AGE = 2
Time = JAN-1 Type = NUMBER
Catchability = 0.904027E-01 % Variance Contribution = 2.0532
Residual = LN(Observed) - LN(Predicted)

Year	Observed	Predicted	Residual
1985	0.310947E+03	0.300519E+03	0.341103E-01
1986	0.692529E+03	0.809877E+03	-0.156532E+00
1987	0.524511E+03	0.419897E+03	0.222456E+00
1988	0.145924E+04	0.605413E+03	0.879763E+00
1989	0.714839E+03	0.167136E+04	-0.849336E+00
1990	0.727538E+03	0.632309E+03	0.140288E+00
1991	0.116740E+04	0.537996E+03	0.774685E+00
1992	0.352981E+03	0.660960E+03	-0.627279E+00
1993	0.253050E+03	0.444291E+03	-0.562893E+00
1994	0.863017E+03	0.427845E+03	0.701674E+00
1995	0.401228E+03	0.494840E+03	-0.209706E+00
1996	0.211055E+03	0.419525E+03	-0.687005E+00
1997	0.360353E+03	0.530548E+03	-0.386826E+00
1998	0.279721E+03	0.558744E+03	-0.691898E+00
1999	0.327158E+03	0.577290E+03	-0.567902E+00
2000	0.371770E+04	0.721250E+03	0.163988E+01
2001	0.463449E+03	0.654764E+03	-0.345579E+00
2002	0.603290E+03	0.474164E+03	0.240845E+00
2003	0.333257E+03	0.384886E+03	-0.144032E+00
2004	0.230354E+03	0.288220E+03	-0.224105E+00
2005	0.224680E+03	0.291088E+03	-0.258950E+00
2006	0.429444E+03	0.417217E+03	0.288839E-01
2007	0.836809E+03	0.753278E+03	0.105162E+00
2008	0.670683E+03	0.260863E+03	0.944301E+00

Survey Index: 3 Tag: NEFSC_S AGE = 3

Time = JAN-1 Type = NUMBER
Catchability = 0.282809E+00 % Variance Contribution = 2.7557
Residual = LN(Observed) - LN(Predicted)

Year	Observed	Predicted	Residual
1985	0.333990E+03	0.490966E+03	-0.385263E+00
1986	0.764630E+02	0.454406E+03	-0.178218E+01
1987	0.773508E+03	0.100768E+04	-0.264474E+00
1988	0.355914E+03	0.598540E+03	-0.519804E+00
1989	0.473214E+03	0.896934E+03	-0.639434E+00
1990	0.202533E+04	0.369540E+04	-0.601357E+00
1991	0.945656E+03	0.886729E+03	0.643400E-01
1992	0.708239E+03	0.102913E+04	-0.373691E+00
1993	0.403390E+03	0.691164E+03	-0.538473E+00
1994	0.517718E+03	0.102955E+04	-0.687443E+00
1995	0.153548E+04	0.887828E+03	0.547817E+00
1996	0.552109E+03	0.113328E+04	-0.719129E+00
1997	0.781421E+03	0.874144E+03	-0.112131E+00
1998	0.113564E+04	0.982799E+03	0.144544E+00
1999	0.140235E+04	0.130482E+04	0.720842E-01
2000	0.655861E+04	0.128920E+04	0.162675E+01
2001	0.188278E+04	0.156350E+04	0.185825E+00
2002	0.272928E+04	0.133547E+04	0.714754E+00
2003	0.928364E+03	0.908347E+03	0.217973E-01
2004	0.101008E+04	0.767252E+03	0.274966E+00
2005	0.147461E+04	0.617215E+03	0.870928E+00
2006	0.131967E+04	0.619736E+03	0.755846E+00
2007	0.241019E+04	0.102035E+04	0.859557E+00
2008	0.301745E+04	0.185938E+04	0.484171E+00

Survey Index: 4 Tag: NEFSC_S AGE = 4
Time = JAN-1 Type = NUMBER
Catchability = 0.348440E+00 % Variance Contribution = 3.4810
Residual = LN(Observed) - LN(Predicted)

Year	Observed	Predicted	Residual
1985	0.806700E+02	0.270804E+03	-0.121103E+01
1986	0.528020E+02	0.213677E+03	-0.139792E+01
1987	0.208855E+03	0.214358E+03	-0.260054E-01
1988	0.197816E+03	0.297218E+03	-0.407129E+00
1989	0.122125E+03	0.141535E+03	-0.147499E+00
1990	0.817120E+02	0.343377E+03	-0.143563E+01
1991	0.327120E+03	0.838555E+03	-0.941353E+00
1992	0.192374E+03	0.347444E+03	-0.591162E+00
1993	0.217308E+03	0.429734E+03	-0.681850E+00
1994	0.310407E+03	0.362773E+03	-0.155892E+00
1995	0.116362E+04	0.510602E+03	0.823700E+00
1996	0.775284E+03	0.344909E+03	0.809949E+00
1997	0.596458E+03	0.392134E+03	0.419404E+00
1998	0.347924E+03	0.262323E+03	0.282408E+00
1999	0.715264E+03	0.219494E+03	0.118133E+01
2000	0.911535E+03	0.603967E+03	0.411611E+00
2001	0.397407E+03	0.380616E+03	0.431705E-01
2002	0.125896E+04	0.430193E+03	0.107381E+01
2003	0.678634E+03	0.586732E+03	0.145514E+00
2004	0.138375E+03	0.261737E+03	-0.637373E+00
2005	0.495640E+03	0.280462E+03	0.569412E+00
2006	0.465958E+03	0.231735E+03	0.698499E+00
2007	0.164884E+04	0.418164E+03	0.137195E+01
2008	0.656208E+03	0.799825E+03	-0.197916E+00

Survey Index: 5 Tag: NEFSC_S AGE = 5
Time = JAN-1 Type = NUMBER

Catchability = 0.413448E+00 % Variance Contribution = 5.2019
 Residual = LN(Observed) - LN(Predicted)

Year	Observed	Predicted	Residual
1985	0.499070E+02	0.166483E+03	-0.120473E+01
1986	0.384050E+02	0.333609E+02	0.140804E+00
1987	0.177011E+03	0.954842E+02	0.617251E+00
1988	0.103598E+03	0.943297E+02	0.937219E-01
1989	0.127258E+03	0.214153E+02	0.178211E+01
1990	N/A	0.289258E+02	N/A
1991	0.741090E+02	0.151823E+03	-0.717181E+00
1992	0.702500E+01	0.107719E+03	-0.273005E+01
1993	N/A	0.711949E+02	N/A
1994	0.197932E+03	0.126251E+03	0.449653E+00
1995	0.157326E+03	0.907778E+02	0.549905E+00
1996	0.129265E+03	0.659889E+02	0.672377E+00
1997	0.111201E+03	0.988820E+02	0.117412E+00
1998	0.553880E+02	0.727880E+02	-0.273188E+00
1999	0.128185E+03	0.209930E+02	0.180928E+01
2000	0.643050E+02	0.676948E+02	-0.513715E-01
2001	0.833340E+02	0.771330E+02	0.773252E-01
2002	0.822530E+02	0.614801E+02	0.291086E+00
2003	0.303884E+03	0.881851E+02	0.123721E+01
2004	0.541920E+02	0.132169E+03	-0.891545E+00
2005	N/A	0.466472E+02	N/A
2006	0.366300E+02	0.592244E+02	-0.480466E+00
2007	0.824840E+02	0.818512E+02	0.770083E-02
2008	0.568940E+02	0.254294E+03	-0.149730E+01

Survey Index: 6 Tag: NEFSC_S AGE = 6
 Time = JAN-1 Type = NUMBER
 Catchability = 0.392500E+00 % Variance Contribution = 5.6449
 Residual = LN(Observed) - LN(Predicted)

Year	Observed	Predicted	Residual
1985	0.127370E+02	0.581269E+02	-0.151812E+01
1986	N/A	0.633411E+01	N/A
1987	0.487225E+03	0.414159E+02	0.246506E+01
1988	0.594030E+02	0.184500E+02	0.116928E+01
1989	N/A	0.481504E+01	N/A
1990	0.326150E+02	0.219682E+02	0.395177E+00
1991	0.154390E+02	0.357909E+02	-0.840796E+00
1992	N/A	0.749561E+01	N/A
1993	N/A	0.328804E+02	N/A
1994	0.666210E+02	0.622099E+02	0.685058E-01
1995	0.184500E+02	0.823051E+02	-0.149537E+01
1996	N/A	0.542124E+01	N/A
1997	N/A	0.104302E+02	N/A
1998	N/A	0.136381E+01	N/A
1999	0.567010E+02	0.435955E+01	0.256542E+01
2000	0.321520E+02	0.169118E+02	0.642464E+00
2001	N/A	0.121200E+02	N/A
2002	0.199940E+02	0.182056E+02	0.937026E-01
2003	0.976500E+01	0.385539E+02	-0.137325E+01
2004	N/A	0.387259E+02	N/A
2005	N/A	0.259221E+02	N/A
2006	0.129300E+02	0.361437E+02	-0.102795E+01
2007	N/A	0.199195E+02	N/A
2008	0.177550E+02	0.557452E+02	-0.114412E+01

Survey Index: 7 Tag: NEFSC_F AGE = 1
 Time = MEAN Type = NUMBER
 Catchability = 0.586332E-01 % Variance Contribution = 3.1977

Residual = LN(Observed) - LN(Predicted)

Year	Observed	Predicted	Residual
1985	0.148199E+04	0.602014E+03	0.900862E+00
1986	0.398485E+03	0.304348E+03	0.269497E+00
1987	0.181565E+03	0.435253E+03	-0.874313E+00
1988	0.100611E+04	0.121365E+04	-0.187546E+00
1989	0.474020E+03	0.457553E+03	0.353561E-01
1990	0.957015E+03	0.388812E+03	0.900723E+00
1991	0.503005E+03	0.488506E+03	0.292487E-01
1992	0.810321E+03	0.368272E+03	0.788608E+00
1993	0.121556E+04	0.311977E+03	0.136003E+01
1994	0.795330E+03	0.355863E+03	0.804211E+00
1995	0.179346E+03	0.302332E+03	-0.522210E+00
1996	0.340484E+03	0.381712E+03	-0.114299E+00
1997	0.337492E+03	0.401412E+03	-0.173446E+00
1998	0.328613E+03	0.415636E+03	-0.234929E+00
1999	0.132404E+04	0.518119E+03	0.938236E+00
2000	0.287854E+03	0.470172E+03	-0.490644E+00
2001	0.433330E+02	0.341048E+03	-0.206311E+01
2002	0.128453E+03	0.278095E+03	-0.772400E+00
2003	0.192021E+03	0.207240E+03	-0.762730E-01
2004	0.761780E+02	0.209391E+03	-0.101113E+01
2005	0.533662E+03	0.300010E+03	0.575947E+00
2006	0.780307E+03	0.541054E+03	0.366168E+00
2007	0.119864E+03	0.187720E+03	-0.448591E+00
2008	N/A	0.000000E+00	N/A

Survey Index: 8 Tag: NEFSC_F AGE = 2
Time = MEAN Type = NUMBER
Catchability = 0.205993E+00 % Variance Contribution = 2.1997
Residual = LN(Observed) - LN(Predicted)

Year	Observed	Predicted	Residual
1985	0.568309E+03	0.486626E+03	0.155169E+00
1986	0.110812E+04	0.120548E+04	-0.842183E-01
1987	0.436413E+03	0.662607E+03	-0.417593E+00
1988	0.147572E+04	0.971591E+03	0.417965E+00
1989	0.140858E+04	0.321779E+04	-0.826113E+00
1990	0.169573E+04	0.990745E+03	0.537409E+00
1991	0.449153E+03	0.968300E+03	-0.768178E+00
1992	0.887239E+03	0.914974E+03	-0.307815E-01
1993	0.123252E+04	0.874581E+03	0.343068E+00
1994	0.237016E+04	0.799590E+03	0.108662E+01
1995	0.218175E+03	0.968669E+03	-0.149063E+01
1996	0.935075E+03	0.785542E+03	0.174252E+00
1997	0.799769E+03	0.940951E+03	-0.162568E+00
1998	0.959846E+03	0.110393E+04	-0.139861E+00
1999	0.260256E+04	0.111668E+04	0.846138E+00
2000	0.218390E+04	0.137575E+04	0.462116E+00
2001	0.122795E+04	0.121389E+04	0.115111E-01
2002	0.458031E+03	0.853982E+03	-0.622973E+00
2003	0.282282E+04	0.706022E+03	0.138585E+01
2004	0.371302E+03	0.546627E+03	-0.386751E+00
2005	0.425218E+03	0.550563E+03	-0.258340E+00
2006	0.487241E+03	0.842689E+03	-0.547839E+00
2007	0.209566E+04	0.152824E+04	0.315751E+00
2008	N/A	0.000000E+00	N/A

Survey Index: 9 Tag: NEFSC_F AGE = 3
Time = MEAN Type = NUMBER
Catchability = 0.231381E+00 % Variance Contribution = 2.6220
Residual = LN(Observed) - LN(Predicted)

Year	Observed	Predicted	Residual
1985	0.483124E+03	0.249656E+03	0.660188E+00
1986	0.974740E+02	0.238979E+03	-0.896791E+00
1987	0.160784E+03	0.438623E+03	-0.100358E+01
1988	0.142512E+03	0.239732E+03	-0.520094E+00
1989	0.609261E+03	0.432743E+03	0.342104E+00
1990	0.785808E+03	0.145790E+04	-0.618039E+00
1991	0.448252E+03	0.431867E+03	0.372376E-01
1992	0.604146E+03	0.514440E+03	0.160737E+00
1993	0.164194E+03	0.380383E+03	-0.840131E+00
1994	0.835253E+03	0.553049E+03	0.412288E+00
1995	0.345695E+03	0.430901E+03	-0.220322E+00
1996	0.158519E+04	0.525057E+03	0.110495E+01
1997	0.950452E+03	0.383038E+03	0.908805E+00
1998	0.385006E+03	0.385487E+03	-0.124917E-02
1999	0.177776E+04	0.680778E+03	0.959872E+00
2000	0.144336E+04	0.561369E+03	0.944347E+00
2001	0.730058E+03	0.662720E+03	0.967711E-01
2002	0.180343E+03	0.681754E+03	-0.132981E+01
2003	0.593948E+03	0.391857E+03	0.415895E+00
2004	0.202058E+03	0.363344E+03	-0.586796E+00
2005	0.174617E+03	0.295454E+03	-0.525919E+00
2006	0.273828E+03	0.380921E+03	-0.330091E+00
2007	0.153951E+04	0.671558E+03	0.829619E+00
2008	N/A	0.000000E+00	N/A

Survey Index: 10 Tag: NEFSC_F AGE = 4
Time = MEAN Type = NUMBER
Catchability = 0.165885E+00 % Variance Contribution = 8.4087
Residual = LN(Observed) - LN(Predicted)

Year	Observed	Predicted	Residual
1985	N/A	0.510089E+02	N/A
1986	N/A	0.649383E+02	N/A
1987	0.146050E+02	0.647273E+02	-0.148882E+01
1988	0.432040E+02	0.474427E+02	-0.935895E-01
1989	0.837700E+02	0.317112E+02	0.971404E+00
1990	0.124500E+02	0.103892E+03	-0.212163E+01
1991	0.907830E+02	0.160128E+03	-0.567504E+00
1992	0.304968E+03	0.779196E+02	0.136453E+01
1993	0.270550E+02	0.110270E+03	-0.140506E+01
1994	0.265078E+03	0.875638E+02	0.110766E+01
1995	0.911040E+02	0.976972E+02	-0.698714E-01
1996	0.379344E+03	0.876716E+02	0.146485E+01
1997	0.403118E+03	0.848911E+02	0.155786E+01
1998	0.317096E+03	0.431915E+02	0.199356E+01
1999	0.543989E+03	0.573972E+02	0.224893E+01
2000	0.735720E+02	0.115111E+03	-0.447634E+00
2001	0.304000E+02	0.784981E+02	-0.948631E+00
2002	0.488980E+02	0.964908E+02	-0.679711E+00
2003	0.139616E+03	0.136199E+03	0.247783E-01
2004	0.784900E+01	0.558562E+02	-0.196239E+01
2005	0.212000E+02	0.635859E+02	-0.109839E+01
2006	0.219720E+02	0.639434E+02	-0.106823E+01
2007	0.490748E+03	0.145188E+03	0.121790E+01
2008	N/A	0.000000E+00	N/A

Survey Index: 11 Tag: NEFSC_F AGE = 5
Time = MEAN Type = NUMBER
Catchability = 0.548869E+00 % Variance Contribution = 5.6387
Residual = LN(Observed) - LN(Predicted)

Year	Observed	Predicted	Residual
1985	N/A	0.874437E+02	N/A
1986	N/A	0.282714E+02	N/A
1987	0.118710E+02	0.803984E+02	-0.191290E+01
1988	N/A	0.419865E+02	N/A
1989	0.579050E+02	0.133795E+02	0.146508E+01
1990	0.267000E+01	0.244042E+02	-0.221268E+01
1991	N/A	0.808430E+02	N/A
1992	0.589030E+02	0.673632E+02	-0.134207E+00
1993	N/A	0.509418E+02	N/A
1994	0.114009E+03	0.849750E+02	0.293921E+00
1995	0.550740E+02	0.484335E+02	0.128485E+00
1996	0.429140E+02	0.467728E+02	-0.861029E-01
1997	0.187678E+03	0.596914E+02	0.114554E+01
1998	0.752130E+02	0.334187E+02	0.811210E+00
1999	0.228147E+03	0.153077E+02	0.270163E+01
2000	N/A	0.359771E+02	N/A
2001	N/A	0.443588E+02	N/A
2002	0.620900E+01	0.384524E+02	-0.182342E+01
2003	0.812280E+02	0.570817E+02	0.352777E+00
2004	N/A	0.786505E+02	N/A
2005	N/A	0.294903E+02	N/A
2006	N/A	0.455691E+02	N/A
2007	0.401160E+02	0.831890E+02	-0.729340E+00
2008	N/A	0.000000E+00	N/A

Survey Index: 13 Tag: MADMF_S AGE = 1
Time = JAN-1 Type = NUMBER
Catchability = 0.234298E-01 % Variance Contribution = 6.7834
Residual = LN(Observed) - LN(Predicted)

Year	Observed	Predicted	Residual
1985	0.497025E+03	0.274082E+03	0.595212E+00
1986	0.501852E+03	0.135375E+03	0.131026E+01
1987	0.680968E+03	0.192136E+03	0.126531E+01
1988	0.813946E+03	0.540753E+03	0.408931E+00
1989	0.203391E+03	0.203209E+03	0.897570E-03
1990	0.260033E+03	0.172475E+03	0.410556E+00
1991	0.157170E+02	0.221238E+03	-0.264450E+01
1992	0.323176E+03	0.184621E+03	0.559892E+00
1993	0.188249E+03	0.139543E+03	0.299389E+00
1994	0.607648E+03	0.157134E+03	0.135250E+01
1995	0.165905E+04	0.133758E+03	0.251797E+01
1996	0.290096E+03	0.168618E+03	0.542575E+00
1997	0.133088E+03	0.177078E+03	-0.285582E+00
1998	0.157748E+03	0.183725E+03	-0.152441E+00
1999	0.650630E+02	0.228546E+03	-0.125638E+01
2000	0.158461E+03	0.207319E+03	-0.268750E+00
2001	0.321750E+02	0.150615E+03	-0.154353E+01
2002	0.115780E+03	0.123335E+03	-0.632160E-01
2003	0.126720E+02	0.914951E+02	-0.197689E+01
2004	0.423510E+02	0.924808E+02	-0.781009E+00
2005	0.921360E+02	0.132459E+03	-0.363006E+00
2006	0.167266E+03	0.238633E+03	-0.355340E+00
2007	0.127136E+03	0.829387E+02	0.427156E+00
2008	N/A	0.000000E+00	N/A

Survey Index: 14 Tag: MADMF_S AGE = 2
Time = JAN-1 Type = NUMBER
Catchability = 0.340915E+00 % Variance Contribution = 1.9789
Residual = LN(Observed) - LN(Predicted)

Year	Observed	Predicted	Residual
1985	0.210500E+04	0.113328E+04	0.619200E+00
1986	0.432955E+04	0.305410E+04	0.348976E+00
1987	0.127523E+04	0.158346E+04	-0.216488E+00
1988	0.348787E+04	0.228306E+04	0.423775E+00
1989	0.495299E+04	0.630282E+04	-0.241006E+00
1990	0.275215E+04	0.238448E+04	0.143400E+00
1991	0.121129E+04	0.202882E+04	-0.515769E+00
1992	0.220476E+04	0.249253E+04	-0.122677E+00
1993	0.162523E+04	0.167545E+04	-0.304335E-01
1994	0.523763E+04	0.161343E+04	0.117750E+01
1995	0.280177E+04	0.186608E+04	0.406412E+00
1996	0.323082E+04	0.158206E+04	0.714009E+00
1997	0.298865E+04	0.200073E+04	0.401307E+00
1998	0.841102E+03	0.210706E+04	-0.918338E+00
1999	0.129062E+04	0.217700E+04	-0.522829E+00
2000	0.376620E+04	0.271989E+04	0.325475E+00
2001	0.168124E+04	0.246917E+04	-0.384347E+00
2002	0.296350E+03	0.178811E+04	-0.179737E+01
2003	0.187341E+04	0.145143E+04	0.255213E+00
2004	0.608169E+03	0.108690E+04	-0.580629E+00
2005	0.153773E+04	0.109772E+04	0.337077E+00
2006	0.164888E+04	0.157336E+04	0.468819E-01
2007	0.323716E+04	0.284067E+04	0.130658E+00
2008	N/A	0.983734E+03	N/A

Survey Index: 15 Tag: MADMF_S AGE = 3
Time = JAN-1 Type = NUMBER
Catchability = 0.662967E+00 % Variance Contribution = 2.0509
Residual = LN(Observed) - LN(Predicted)

Year	Observed	Predicted	Residual
1985	0.190888E+04	0.115093E+04	0.505943E+00
1986	0.464109E+03	0.106523E+04	-0.830826E+00
1987	0.134644E+04	0.236224E+04	-0.562148E+00
1988	0.665113E+03	0.140311E+04	-0.746491E+00
1989	0.910608E+03	0.210262E+04	-0.836825E+00
1990	0.410646E+04	0.866284E+04	-0.746481E+00
1991	0.822422E+03	0.207869E+04	-0.927240E+00
1992	0.211249E+04	0.241252E+04	-0.132805E+00
1993	0.148907E+04	0.162024E+04	-0.844244E-01
1994	0.173986E+04	0.241349E+04	-0.327269E+00
1995	0.504239E+04	0.208127E+04	0.884901E+00
1996	0.275871E+04	0.265667E+04	0.376873E-01
1997	0.208240E+04	0.204919E+04	0.160768E-01
1998	0.236943E+04	0.230390E+04	0.280426E-01
1999	0.213419E+04	0.305879E+04	-0.359934E+00
2000	0.578946E+04	0.302219E+04	0.650058E+00
2001	0.630524E+04	0.366519E+04	0.542501E+00
2002	0.323609E+04	0.313065E+04	0.331266E-01
2003	0.179606E+04	0.212937E+04	-0.170229E+00
2004	0.198788E+04	0.179861E+04	0.100053E+00
2005	0.387814E+04	0.144689E+04	0.985937E+00
2006	0.509996E+04	0.145280E+04	0.125574E+01
2007	0.474318E+04	0.239194E+04	0.684606E+00
2008	N/A	0.435880E+04	N/A

Survey Index: 16 Tag: MADMF_S AGE = 4
Time = JAN-1 Type = NUMBER
Catchability = 0.587346E+00 % Variance Contribution = 3.2917
Residual = LN(Observed) - LN(Predicted)

Year	Observed	Predicted	Residual
1985	0.411883E+03	0.456478E+03	-0.102802E+00
1986	0.684920E+02	0.360183E+03	-0.165990E+01
1987	0.267247E+03	0.361330E+03	-0.301620E+00
1988	0.183778E+03	0.501004E+03	-0.100288E+01
1989	0.252106E+03	0.238577E+03	0.551578E-01
1990	0.176729E+03	0.578812E+03	-0.118636E+01
1991	0.509697E+03	0.141351E+04	-0.102001E+01
1992	0.559537E+03	0.585667E+03	-0.456414E-01
1993	0.495461E+03	0.724378E+03	-0.379825E+00
1994	0.357380E+03	0.611506E+03	-0.537124E+00
1995	0.635846E+03	0.860693E+03	-0.302782E+00
1996	0.141899E+04	0.581393E+03	0.892273E+00
1997	0.724224E+03	0.660999E+03	0.913486E-01
1998	0.228626E+03	0.442183E+03	-0.659636E+00
1999	0.239762E+03	0.369989E+03	-0.433825E+00
2000	0.194117E+04	0.101807E+04	0.645378E+00
2001	0.173926E+04	0.641582E+03	0.997276E+00
2002	0.124484E+04	0.725152E+03	0.540379E+00
2003	0.197789E+04	0.989021E+03	0.693073E+00
2004	0.978524E+03	0.441195E+03	0.796558E+00
2005	0.101830E+04	0.472759E+03	0.767301E+00
2006	0.137038E+04	0.390623E+03	0.125510E+01
2007	0.173122E+04	0.704876E+03	0.898560E+00
2008	N/A	0.134822E+04	N/A

Survey Index: 17 Tag: MADMF_S AGE = 5
Time = JAN-1 Type = NUMBER
Catchability = 0.503147E+00 % Variance Contribution = 2.9824
Residual = LN(Observed) - LN(Predicted)

Year	Observed	Predicted	Residual
1985	0.120197E+03	0.202602E+03	-0.522110E+00
1986	0.192010E+02	0.405986E+02	-0.748771E+00
1987	0.693420E+02	0.116200E+03	-0.516259E+00
1988	N/A	0.114795E+03	N/A
1989	0.120420E+02	0.260613E+02	-0.772052E+00
1990	0.379630E+02	0.352014E+02	0.755275E-01
1991	0.111913E+03	0.184762E+03	-0.501346E+00
1992	0.359575E+03	0.131089E+03	0.100904E+01
1993	0.621560E+02	0.866407E+02	-0.332123E+00
1994	0.819870E+02	0.153641E+03	-0.628059E+00
1995	0.253889E+03	0.110472E+03	0.832133E+00
1996	0.393615E+03	0.803054E+02	0.158954E+01
1997	0.872260E+02	0.120335E+03	-0.321774E+00
1998	0.386760E+02	0.885795E+02	-0.828681E+00
1999	0.178290E+02	0.255475E+02	-0.359714E+00
2000	0.238912E+03	0.823813E+02	0.106474E+01
2001	0.280303E+03	0.938672E+02	0.109399E+01
2002	0.585070E+02	0.748183E+02	-0.245917E+00
2003	0.301671E+03	0.107317E+03	0.103355E+01
2004	0.124146E+03	0.160843E+03	-0.258970E+00
2005	0.190090E+02	0.567673E+02	-0.109405E+01
2006	0.604820E+02	0.720732E+02	-0.175337E+00
2007	0.182709E+03	0.996090E+02	0.606642E+00
2008	N/A	0.309464E+03	N/A

Survey Index: 18 Tag: MADMF_S AGE = 6
Time = JAN-1 Type = NUMBER
Catchability = 0.349937E+00 % Variance Contribution = 5.7592
Residual = LN(Observed) - LN(Predicted)

Year	Observed	Predicted	Residual
1985	0.921910E+02	0.518236E+02	0.576016E+00
1986	0.152510E+02	0.564724E+01	0.993479E+00
1987	0.406780E+02	0.369248E+02	0.968040E-01
1988	0.111910E+02	0.164493E+02	-0.385174E+00
1989	N/A	0.429290E+01	N/A
1990	0.899700E+01	0.195859E+02	-0.777921E+00
1991	0.368650E+02	0.319097E+02	0.144352E+00
1992	0.207370E+02	0.668278E+01	0.113238E+01
1993	0.799020E+02	0.293149E+02	0.100271E+01
1994	0.265240E+02	0.554639E+02	-0.737682E+00
1995	0.573300E+01	0.733799E+02	-0.254941E+01
1996	0.146470E+02	0.483336E+01	0.110869E+01
1997	N/A	0.929916E+01	N/A
1998	0.441600E+01	0.121592E+01	0.128973E+01
1999	N/A	0.388680E+01	N/A
2000	0.827000E+02	0.150779E+02	0.170199E+01
2001	N/A	0.108057E+02	N/A
2002	0.407060E+02	0.162314E+02	0.919428E+00
2003	0.119040E+02	0.343731E+02	-0.106040E+01
2004	0.507400E+01	0.345265E+02	-0.191760E+01
2005	0.636400E+01	0.231111E+02	-0.128966E+01
2006	0.251530E+02	0.322243E+02	-0.247744E+00
2007	N/A	0.177594E+02	N/A
2008	N/A	0.497002E+02	N/A

Survey Index: 19 Tag: MADMF_F AGE = 1
Time = MEAN Type = NUMBER
Catchability = 0.105901E+00 % Variance Contribution = 3.5079
Residual = LN(Observed) - LN(Predicted)

Year	Observed	Predicted	Residual
1985	0.156431E+04	0.108733E+04	0.363722E+00
1986	0.712457E+03	0.549700E+03	0.259348E+00
1987	0.160589E+04	0.786133E+03	0.714310E+00
1988	0.245753E+04	0.219204E+04	0.114324E+00
1989	0.723360E+03	0.826411E+03	-0.133185E+00
1990	0.142533E+04	0.702254E+03	0.707860E+00
1991	0.103097E+04	0.882316E+03	0.155704E+00
1992	0.196860E+04	0.665156E+03	0.108505E+01
1993	0.230178E+04	0.563478E+03	0.140731E+01
1994	0.562170E+03	0.642743E+03	-0.133941E+00
1995	0.235623E+04	0.546058E+03	0.146209E+01
1996	0.468306E+03	0.689431E+03	-0.386744E+00
1997	0.274708E+03	0.725011E+03	-0.970478E+00
1998	0.161777E+04	0.750702E+03	0.767796E+00
1999	0.129673E+04	0.935802E+03	0.326201E+00
2000	0.317086E+03	0.849201E+03	-0.985123E+00
2001	0.188359E+03	0.615984E+03	-0.118487E+01
2002	0.427271E+03	0.502282E+03	-0.161744E+00
2003	0.151082E+03	0.374307E+03	-0.907254E+00
2004	0.638177E+03	0.378191E+03	0.523215E+00
2005	0.242094E+03	0.541864E+03	-0.805688E+00
2006	0.343254E+03	0.977226E+03	-0.104625E+01
2007	0.105055E+03	0.339050E+03	-0.117166E+01
2008	N/A	0.000000E+00	N/A

Survey Index: 20 Tag: MADMF_F AGE = 2
Time = MEAN Type = NUMBER
Catchability = 0.305596E+00 % Variance Contribution = 2.5361
Residual = LN(Observed) - LN(Predicted)

Year	Observed	Predicted	Residual
1985	0.447514E+03	0.721923E+03	-0.478211E+00
1986	0.135708E+04	0.178836E+04	-0.275966E+00
1987	0.629592E+03	0.982994E+03	-0.445532E+00
1988	0.308331E+04	0.144138E+04	0.760402E+00
1989	0.143119E+04	0.477368E+04	-0.120461E+01
1990	0.327359E+04	0.146980E+04	0.800762E+00
1991	0.140961E+04	0.143650E+04	-0.188966E-01
1992	0.993473E+03	0.135739E+04	-0.312111E+00
1993	0.199866E+04	0.129746E+04	0.432065E+00
1994	0.237530E+04	0.118621E+04	0.694356E+00
1995	0.348455E+04	0.143705E+04	0.885749E+00
1996	0.815510E+03	0.116537E+04	-0.356983E+00
1997	0.141027E+04	0.139593E+04	0.102209E-01
1998	0.143885E+04	0.163771E+04	-0.129457E+00
1999	0.266989E+04	0.165662E+04	0.477259E+00
2000	0.182525E+04	0.204096E+04	-0.111702E+00
2001	0.163826E+04	0.180084E+04	-0.946191E-01
2002	0.178869E+03	0.126690E+04	-0.195768E+01
2003	0.161242E+04	0.104740E+04	0.431425E+00
2004	0.238174E+04	0.810936E+03	0.107740E+01
2005	0.116505E+04	0.816775E+03	0.355151E+00
2006	0.137038E+04	0.125015E+04	0.918261E-01
2007	0.120646E+04	0.226718E+04	-0.630845E+00
2008	N/A	0.000000E+00	N/A

Survey Index: 21 Tag: MADMF_F AGE = 3
Time = MEAN Type = NUMBER
Catchability = 0.301859E+00 % Variance Contribution = 3.4082
Residual = LN(Observed) - LN(Predicted)

Year	Observed	Predicted	Residual
1985	0.282690E+03	0.325701E+03	-0.141629E+00
1986	0.555450E+02	0.311772E+03	-0.172508E+01
1987	0.135118E+03	0.572227E+03	-0.144339E+01
1988	0.622680E+03	0.312753E+03	0.688618E+00
1989	0.263352E+03	0.564555E+03	-0.762546E+00
1990	0.132776E+04	0.190197E+04	-0.359399E+00
1991	0.137905E+04	0.563413E+03	0.895138E+00
1992	0.569549E+03	0.671137E+03	-0.164129E+00
1993	0.159137E+04	0.496247E+03	0.116528E+01
1994	0.349234E+03	0.721506E+03	-0.725599E+00
1995	0.123551E+04	0.562153E+03	0.787467E+00
1996	0.463423E+03	0.684987E+03	-0.390760E+00
1997	0.171271E+03	0.499710E+03	-0.107078E+01
1998	0.464027E+03	0.502906E+03	-0.804600E-01
1999	0.846478E+03	0.888142E+03	-0.480471E-01
2000	0.808515E+03	0.732360E+03	0.989266E-01
2001	0.868586E+03	0.864583E+03	0.461909E-02
2002	0.626355E+03	0.889414E+03	-0.350646E+00
2003	0.856737E+03	0.511216E+03	0.516339E+00
2004	0.174359E+04	0.474018E+03	0.130246E+01
2005	0.104699E+04	0.385449E+03	0.999264E+00
2006	0.104444E+04	0.496948E+03	0.742748E+00
2007	0.931784E+03	0.876113E+03	0.616059E-01
2008	N/A	0.000000E+00	N/A

Survey Index: 22 Tag: MADMF_F AGE = 4
Time = MEAN Type = NUMBER
Catchability = 0.134206E+00 % Variance Contribution = 9.0029
Residual = LN(Observed) - LN(Predicted)

Year	Observed	Predicted	Residual
1985	N/A	0.412676E+02	N/A
1986	0.910700E+01	0.525369E+02	-0.175247E+01
1987	0.193930E+02	0.523662E+02	-0.993349E+00
1988	0.412820E+02	0.383825E+02	0.728261E-01
1989	0.283350E+02	0.256553E+02	0.993490E-01
1990	0.159100E+01	0.840516E+02	-0.396707E+01
1991	0.235127E+03	0.129548E+03	0.596072E+00
1992	0.129331E+03	0.630391E+02	0.718620E+00
1993	0.393012E+03	0.892116E+02	0.148283E+01
1994	0.360700E+02	0.708415E+02	-0.674984E+00
1995	N/A	0.790398E+02	N/A
1996	0.328330E+02	0.709288E+02	-0.770242E+00
1997	0.216970E+02	0.686793E+02	-0.115227E+01
1998	N/A	0.349431E+02	N/A
1999	0.134789E+03	0.464359E+02	0.106564E+01
2000	0.561480E+02	0.931281E+02	-0.505985E+00
2001	0.296790E+02	0.635071E+02	-0.760712E+00
2002	0.250734E+03	0.780637E+02	0.116687E+01
2003	0.655815E+03	0.110189E+03	0.178368E+01
2004	0.522562E+03	0.451892E+02	0.244789E+01
2005	0.562310E+02	0.514428E+02	0.889985E-01
2006	0.111995E+03	0.517320E+02	0.772378E+00
2007	0.155718E+03	0.117461E+03	0.281939E+00
2008	N/A	0.000000E+00	N/A

Survey Index: 23 Tag: MADMF_F AGE = 5
Time = MEAN Type = NUMBER
Catchability = 0.122468E+00 % Variance Contribution = 2.8055
Residual = LN(Observed) - LN(Predicted)

Year	Observed	Predicted	Residual
1985	N/A	0.195111E+02	N/A
1986	0.197500E+01	0.630813E+01	-0.116127E+01
1987	0.545800E+01	0.179391E+02	-0.118990E+01
1988	N/A	0.936834E+01	N/A
1989	N/A	0.298534E+01	N/A
1990	N/A	0.544524E+01	N/A
1991	N/A	0.180383E+02	N/A
1992	0.555720E+02	0.150306E+02	0.130759E+01
1993	N/A	0.113665E+02	N/A
1994	N/A	0.189602E+02	N/A
1995	N/A	0.108068E+02	N/A
1996	N/A	0.104363E+02	N/A
1997	0.125900E+02	0.133188E+02	-0.562724E-01
1998	N/A	0.745662E+01	N/A
1999	0.165130E+02	0.341557E+01	0.157580E+01
2000	0.238640E+02	0.802749E+01	0.108950E+01
2001	N/A	0.989766E+01	N/A
2002	0.993000E+01	0.857980E+01	0.146150E+00
2003	0.159910E+02	0.127365E+02	0.227555E+00
2004	0.252400E+01	0.175491E+02	-0.193916E+01
2005	N/A	0.658009E+01	N/A
2006	N/A	0.101677E+02	N/A
2007	N/A	0.185617E+02	N/A
2008	N/A	0.000000E+00	N/A

Survey Index: 26 Tag: MENH_S AGE = 2
Time = JAN-1 Type = NUMBER
Catchability = 0.661209E-04 % Variance Contribution = 0.3335
Residual = LN(Observed) - LN(Predicted)

Year	Observed	Predicted	Residual
1985	N/A	0.219801E+00	N/A
1986	N/A	0.592347E+00	N/A
1987	N/A	0.307114E+00	N/A
1988	N/A	0.442801E+00	N/A
1989	N/A	0.122244E+01	N/A
1990	N/A	0.462473E+00	N/A
1991	N/A	0.393492E+00	N/A
1992	N/A	0.483428E+00	N/A
1993	N/A	0.324956E+00	N/A
1994	N/A	0.312927E+00	N/A
1995	N/A	0.361928E+00	N/A
1996	N/A	0.306842E+00	N/A
1997	N/A	0.388045E+00	N/A
1998	N/A	0.408667E+00	N/A
1999	N/A	0.422232E+00	N/A
2000	N/A	0.527525E+00	N/A
2001	0.599000E+00	0.478897E+00	0.223776E+00
2002	0.226000E+00	0.346805E+00	-0.428228E+00
2003	0.473000E+00	0.281507E+00	0.518939E+00
2004	0.151000E+00	0.210805E+00	-0.333653E+00
2005	0.287000E+00	0.212903E+00	0.298645E+00
2006	0.148000E+00	0.305154E+00	-0.723605E+00
2007	0.859000E+00	0.550950E+00	0.444125E+00
2008	N/A	0.190796E+00	N/A

Survey Index: 27 Tag: MENH_S AGE = 3
Time = JAN-1 Type = NUMBER
Catchability = 0.403312E-03 % Variance Contribution = 0.2045
Residual = LN(Observed) - LN(Predicted)

Year	Observed	Predicted	Residual
1985	N/A	0.700164E+00	N/A
1986	N/A	0.648026E+00	N/A
1987	N/A	0.143705E+01	N/A
1988	N/A	0.853575E+00	N/A
1989	N/A	0.127911E+01	N/A
1990	N/A	0.526999E+01	N/A
1991	N/A	0.126456E+01	N/A
1992	N/A	0.146764E+01	N/A
1993	N/A	0.985666E+00	N/A
1994	N/A	0.146823E+01	N/A
1995	N/A	0.126613E+01	N/A
1996	N/A	0.161617E+01	N/A
1997	N/A	0.124661E+01	N/A
1998	N/A	0.140157E+01	N/A
1999	N/A	0.186080E+01	N/A
2000	N/A	0.183853E+01	N/A
2001	0.208700E+01	0.222970E+01	-0.661379E-01
2002	0.198100E+01	0.190451E+01	0.393773E-01
2003	0.805000E+00	0.129539E+01	-0.475724E+00
2004	0.124100E+01	0.109417E+01	0.125917E+00
2005	0.110700E+01	0.880208E+00	0.229251E+00
2006	0.560000E+00	0.883803E+00	-0.456297E+00
2007	0.266100E+01	0.145512E+01	0.603614E+00
2008	N/A	0.265165E+01	N/A

Survey Index: 28 Tag: MENH_S AGE = 4
 Time = JAN-1 Type = NUMBER
 Catchability = 0.500465E-03 % Variance Contribution = 0.2932

Residual = LN(Observed) - LN(Predicted)

Year	Observed	Predicted	Residual
1985	N/A	0.388955E+00	N/A
1986	N/A	0.306904E+00	N/A
1987	N/A	0.307882E+00	N/A
1988	N/A	0.426894E+00	N/A
1989	N/A	0.203286E+00	N/A
1990	N/A	0.493193E+00	N/A
1991	N/A	0.120442E+01	N/A
1992	N/A	0.499034E+00	N/A
1993	N/A	0.617227E+00	N/A
1994	N/A	0.521051E+00	N/A
1995	N/A	0.733378E+00	N/A
1996	N/A	0.495393E+00	N/A
1997	N/A	0.563223E+00	N/A
1998	N/A	0.376775E+00	N/A
1999	N/A	0.315259E+00	N/A
2000	N/A	0.867477E+00	N/A
2001	0.535000E+00	0.546679E+00	-0.215944E-01
2002	0.845000E+00	0.617887E+00	0.313032E+00
2003	0.850000E+00	0.842724E+00	0.859729E-02
2004	0.492000E+00	0.375933E+00	0.269068E+00
2005	0.280000E+00	0.402828E+00	-0.363719E+00
2006	0.152000E+00	0.332842E+00	-0.783787E+00
2007	0.107100E+01	0.600609E+00	0.578403E+00
2008	N/A	0.114879E+01	N/A

Survey Index: 29 Tag: MENH_S AGE = 5
 Time = JAN-1 Type = NUMBER
 Catchability = 0.220345E-03 % Variance Contribution = 2.0957
 Residual = LN(Observed) - LN(Predicted)

Year	Observed	Predicted	Residual
1985	N/A	0.887262E-01	N/A
1986	N/A	0.177795E-01	N/A
1987	N/A	0.508878E-01	N/A
1988	N/A	0.502725E-01	N/A
1989	N/A	0.114131E-01	N/A
1990	N/A	0.154159E-01	N/A
1991	N/A	0.809135E-01	N/A
1992	N/A	0.574085E-01	N/A
1993	N/A	0.379429E-01	N/A
1994	N/A	0.672847E-01	N/A
1995	N/A	0.483795E-01	N/A
1996	N/A	0.351684E-01	N/A
1997	N/A	0.526986E-01	N/A
1998	N/A	0.387920E-01	N/A
1999	N/A	0.111881E-01	N/A
2000	N/A	0.360776E-01	N/A
2001	0.132000E+00	0.411076E-01	0.116661E+01
2002	0.480000E-01	0.327655E-01	0.381825E+00
2003	0.114000E+00	0.469978E-01	0.886098E+00
2004	0.390000E-01	0.704385E-01	-0.591179E+00
2005	0.300000E-02	0.248603E-01	-0.211466E+01
2006	0.140000E-01	0.315633E-01	-0.812938E+00
2007	0.129000E+00	0.436222E-01	0.108425E+01
2008	N/A	0.135525E+00	N/A

Survey Index: 32 Tag: MENH_F AGE = 2
Time = MEAN Type = NUMBER
Catchability = 0.134794E-03 % Variance Contribution = 1.4732
Residual = LN(Observed) - LN(Predicted)

Year	Observed	Predicted	Residual
1985	N/A	0.318431E+00	N/A
1986	N/A	0.788824E+00	N/A
1987	N/A	0.433586E+00	N/A
1988	N/A	0.635774E+00	N/A
1989	N/A	0.210561E+01	N/A
1990	N/A	0.648308E+00	N/A
1991	N/A	0.633620E+00	N/A
1992	N/A	0.598726E+00	N/A
1993	N/A	0.572294E+00	N/A
1994	N/A	0.523223E+00	N/A
1995	N/A	0.633862E+00	N/A
1996	N/A	0.514031E+00	N/A
1997	N/A	0.615724E+00	N/A
1998	N/A	0.722373E+00	N/A
1999	N/A	0.730712E+00	N/A
2000	0.179900E+01	0.900238E+00	0.692327E+00
2001	0.907000E+00	0.794328E+00	0.132646E+00
2002	0.202000E+00	0.558815E+00	-0.101755E+01
2003	0.950000E+00	0.461995E+00	0.720908E+00
2004	0.137400E+01	0.357693E+00	0.134581E+01
2005	0.252000E+00	0.360269E+00	-0.357421E+00
2006	0.121000E+00	0.551425E+00	-0.151672E+01
2007	N/A	0.100003E+01	N/A
2008	N/A	0.000000E+00	N/A

Survey Index: 33 Tag: MENH_F AGE = 3
Time = MEAN Type = NUMBER
Catchability = 0.189250E-03 % Variance Contribution = 0.4770
Residual = LN(Observed) - LN(Predicted)

Year	Observed	Predicted	Residual
1985	N/A	0.204198E+00	N/A
1986	N/A	0.195465E+00	N/A
1987	N/A	0.358757E+00	N/A
1988	N/A	0.196080E+00	N/A
1989	N/A	0.353947E+00	N/A
1990	N/A	0.119244E+01	N/A
1991	N/A	0.353231E+00	N/A
1992	N/A	0.420769E+00	N/A
1993	N/A	0.311122E+00	N/A
1994	N/A	0.452348E+00	N/A
1995	N/A	0.352441E+00	N/A
1996	N/A	0.429453E+00	N/A
1997	N/A	0.313293E+00	N/A
1998	N/A	0.315296E+00	N/A
1999	N/A	0.556820E+00	N/A
2000	0.640000E+00	0.459153E+00	0.332085E+00
2001	0.419000E+00	0.542050E+00	-0.257487E+00
2002	0.560000E+00	0.557618E+00	0.426276E-02
2003	0.334000E+00	0.320506E+00	0.412388E-01
2004	0.780000E+00	0.297185E+00	0.964938E+00
2005	0.212000E+00	0.241657E+00	-0.130933E+00
2006	0.120000E+00	0.311561E+00	-0.954104E+00
2007	N/A	0.549279E+00	N/A
2008	N/A	0.000000E+00	N/A

Survey Index: 34 Tag: MENH_F AGE = 4
Time = MEAN Type = NUMBER
Catchability = 0.805163E-04 % Variance Contribution = 3.9194
Residual = LN(Observed) - LN(Predicted)

Year	Observed	Predicted	Residual
1985	N/A	0.247583E-01	N/A
1986	N/A	0.315193E-01	N/A
1987	N/A	0.314169E-01	N/A
1988	N/A	0.230274E-01	N/A
1989	N/A	0.153918E-01	N/A
1990	N/A	0.504264E-01	N/A
1991	N/A	0.777219E-01	N/A
1992	N/A	0.378200E-01	N/A
1993	N/A	0.535221E-01	N/A
1994	N/A	0.425011E-01	N/A
1995	N/A	0.474196E-01	N/A
1996	N/A	0.425534E-01	N/A
1997	N/A	0.412038E-01	N/A
1998	N/A	0.209640E-01	N/A
1999	N/A	0.278590E-01	N/A
2000	0.300000E-01	0.558718E-01	-0.621862E+00
2001	0.110000E-01	0.381008E-01	-0.124234E+01
2002	0.177000E+00	0.468340E-01	0.132954E+01
2003	0.258000E+00	0.661073E-01	0.136168E+01
2004	0.184000E+00	0.271111E-01	0.191499E+01
2005	N/A	0.308629E-01	N/A
2006	0.200000E-02	0.310364E-01	-0.274201E+01
2007	N/A	0.704703E-01	N/A
2008	N/A	0.000000E+00	N/A

Retrospective Summary

Average Fishing Mortality
Ages = 4 - 5

	1985	1986	1987	1988	1989
2000	2.0651	0.7766	0.7919	2.6014	1.5589
2001	2.0651	0.7766	0.7919	2.6014	1.5589
2002	2.0651	0.7766	0.7919	2.6014	1.5589
2003	2.0651	0.7766	0.7919	2.6014	1.5589
2004	2.0651	0.7766	0.7919	2.6014	1.5589
2005	2.0651	0.7766	0.7919	2.6014	1.5589
2006	2.0651	0.7766	0.7919	2.6014	1.5589
2007	2.0651	0.7766	0.7919	2.6014	1.5589
	1990	1991	1992	1993	1994
2000	0.7872	2.0232	1.5562	1.1959	1.3564
2001	0.7872	2.0232	1.5562	1.1960	1.3564
2002	0.7872	2.0232	1.5562	1.1960	1.3564
2003	0.7872	2.0232	1.5562	1.1960	1.3564
2004	0.7872	2.0232	1.5562	1.1960	1.3564
2005	0.7872	2.0232	1.5562	1.1960	1.3564
2006	0.7872	2.0232	1.5562	1.1960	1.3564
2007	0.7872	2.0232	1.5562	1.1960	1.3564
	1995	1996	1997	1998	1999
2000	2.0165	1.2187	1.6454	2.3832	0.9267
2001	2.0172	1.2205	1.6554	2.4999	1.1553
2002	2.0172	1.2204	1.6551	2.4963	1.1471
2003	2.0172	1.2204	1.6551	2.4966	1.1476
2004	2.0172	1.2204	1.6551	2.4966	1.1478
2005	2.0172	1.2204	1.6551	2.4965	1.1474
2006	2.0172	1.2204	1.6551	2.4965	1.1474
2007	2.0172	1.2204	1.6551	2.4965	1.1474
	2000	2001	2002	2003	2004
2000	0.8876				
2001	2.1027	1.4728			
2002	2.0263	1.7791	1.2118		
2003	2.0313	1.8067	1.6116	1.6662	
2004	2.0325	1.8129	1.6408	1.8980	2.6370
2005	2.0295	1.7965	1.5662	1.5045	1.9693
2006	2.0291	1.7946	1.5576	1.4688	1.7367
2007	2.0291	1.7941	1.5559	1.4616	1.6958
	2005	2006	2007		
2000					
2001					
2002					
2003					
2004					
2005	1.7047				
2006	1.7192	0.9288			
2007	1.5262	1.0118	0.4144		

Spawning Stock Biomass

	1985	1986	1987	1988	1989
2000	730.	908.	1157.	670.	1515.
2001	730.	908.	1157.	670.	1515.
2002	730.	908.	1157.	670.	1515.
2003	730.	908.	1157.	670.	1515.
2004	730.	908.	1157.	670.	1515.
2005	730.	908.	1157.	670.	1515.
2006	730.	908.	1157.	670.	1515.
2007	730.	908.	1157.	670.	1515.
	1990	1991	1992	1993	1994
2000	2633.	1375.	1054.	1029.	1308.
2001	2633.	1375.	1054.	1029.	1308.
2002	2633.	1375.	1054.	1029.	1308.
2003	2633.	1375.	1054.	1029.	1308.
2004	2633.	1375.	1054.	1029.	1308.
2005	2633.	1375.	1054.	1029.	1308.
2006	2633.	1375.	1054.	1029.	1308.
2007	2633.	1375.	1054.	1029.	1308.
	1995	1996	1997	1998	1999
2000	1164.	1244.	1085.	1041.	2077.
2001	1164.	1242.	1072.	947.	1592.
2002	1164.	1242.	1073.	949.	1599.
2003	1164.	1242.	1073.	949.	1598.
2004	1164.	1242.	1073.	949.	1598.
2005	1164.	1242.	1073.	949.	1598.
2006	1164.	1242.	1073.	949.	1599.
2007	1164.	1242.	1073.	949.	1599.
	2000	2001	2002	2003	2004
2000	2921.				
2001	1813.	2034.			
2002	1758.	1743.	1592.		
2003	1743.	1693.	1711.	1162.	
2004	1741.	1682.	1685.	1190.	936.
2005	1746.	1709.	1781.	1316.	844.
2006	1746.	1712.	1795.	1350.	877.
2007	1746.	1713.	1797.	1359.	902.
	2005	2006	2007		
2000					
2001					
2002					
2003					
2004					
2005	889.				
2006	781.	1279.			
2007	796.	1080.	1922.		

Total Population Numbers

	1985	1986	1987	1988	1989
2000	18086.	17053.	17360.	33021.	30803.
2001	18086.	17053.	17360.	33021.	30803.
2002	18086.	17053.	17360.	33021.	30803.
2003	18086.	17053.	17360.	33021.	30803.
2004	18086.	17053.	17360.	33021.	30803.
2005	18086.	17053.	17360.	33021.	30803.
2006	18086.	17053.	17360.	33021.	30803.
2007	18086.	17053.	17360.	33021.	30803.
	1990	1991	1992	1993	1994
2000	28534.	21394.	20107.	14805.	16591.
2001	28534.	21394.	20107.	14804.	16584.
2002	28534.	21394.	20107.	14804.	16585.
2003	28534.	21394.	20107.	14804.	16585.
2004	28534.	21394.	20107.	14804.	16585.
2005	28534.	21394.	20107.	14804.	16585.
2006	28534.	21394.	20107.	14804.	16585.
2007	28534.	21394.	20107.	14804.	16585.
	1995	1996	1997	1998	1999
2000	16239.	17186.	19520.	21983.	25513.
2001	16216.	17003.	17867.	18472.	22911.
2002	16217.	17008.	17910.	18438.	21659.
2003	16217.	17008.	17907.	18423.	21406.
2004	16217.	17008.	17907.	18420.	21386.
2005	16217.	17008.	17908.	18428.	21438.
2006	16217.	17008.	17909.	18429.	21445.
2007	16217.	17008.	17909.	18430.	21446.
	2000	2001	2002	2003	2004
2000	22722.	21837.			
2001	22995.	15440.	14758.		
2002	22924.	16949.	12098.	13184.	
2003	23109.	19780.	16720.	11858.	13293.
2004	22959.	19974.	16983.	14003.	12377.
2005	23278.	20394.	16411.	13755.	12228.
2006	23317.	20489.	16571.	13213.	11942.
2007	23325.	20509.	16661.	13370.	11018.
	2005	2006	2007	2008	
2000					
2001					
2002					
2003					
2004	15142.				
2005	12473.	15427.			
2006	12590.	18200.	21185.		
2007	12040.	17892.	16929.	19724.	

Age 1 Population

	1985	1986	1987	1988	1989
2000	11698.	5778.	8201.	23080.	8673.
2001	11698.	5778.	8201.	23080.	8673.
2002	11698.	5778.	8201.	23080.	8673.
2003	11698.	5778.	8201.	23080.	8673.
2004	11698.	5778.	8201.	23080.	8673.
2005	11698.	5778.	8201.	23080.	8673.
2006	11698.	5778.	8201.	23080.	8673.
2007	11698.	5778.	8201.	23080.	8673.
	1990	1991	1992	1993	1994
2000	7361.	9443.	7880.	5957.	6712.
2001	7361.	9443.	7880.	5956.	6706.
2002	7361.	9443.	7880.	5956.	6707.
2003	7361.	9443.	7880.	5956.	6707.
2004	7361.	9443.	7880.	5956.	6707.
2005	7361.	9443.	7880.	5956.	6707.
2006	7361.	9443.	7880.	5956.	6707.
2007	7361.	9443.	7880.	5956.	6707.
	1995	1996	1997	1998	1999
2000	5726.	7356.	9024.	10077.	10916.
2001	5708.	7192.	7521.	7917.	11186.
2002	5709.	7197.	7559.	7848.	9961.
2003	5709.	7197.	7557.	7836.	9720.
2004	5709.	7197.	7556.	7833.	9702.
2005	5709.	7197.	7558.	7840.	9748.
2006	5709.	7197.	7558.	7841.	9753.
2007	5709.	7197.	7558.	7842.	9755.
	2000	2001	2002	2003	2004
2000	4907.	8291.			
2001	7318.	1623.	7521.		
2002	8273.	3197.	3611.	7499.	
2003	8665.	5876.	5919.	2345.	7484.
2004	8531.	6193.	6024.	4278.	4758.
2005	8808.	6351.	5109.	4495.	4842.
2006	8841.	6415.	5191.	3822.	5000.
2007	8849.	6428.	5264.	3905.	3947.
	2005	2006	2007	2008	
2000					
2001					
2002					
2003					
2004	7559.				
2005	5071.	7404.			
2006	5446.	10011.	7497.		
2007	5653.	10185.	3540.	7211.	

In the Retrospective Analysis
The Following Survey Indices Have Predicted
Index Value Set to Zero in Terminal Year + 1

7	NEFSC_F	1
8	NEFSC_F	2
9	NEFSC_F	3
10	NEFSC_F	4
11	NEFSC_F	5
19	MADMF_F	1
20	MADMF_F	2
21	MADMF_F	3
22	MADMF_F	4
23	MADMF_F	5
32	MENH_F	2
33	MENH_F	3
34	MENH_F	4

Plus Group Diagnostic Report

Calculation Method Selected = Backward

Year	Population Backward	Population Forward	F Forward	F Backward	Ratio
1985	148.	148.	2.065062	2.065076	1.000007
1986	16.	57.	0.167157	0.776571	4.645765
1987	106.	70.	1.679518	0.791916	0.471514
1988	47.	96.	0.625021	2.601429	4.162144
1989	12.	56.	0.194222	1.558876	8.026244
1990	56.	47.	1.049754	0.787178	0.749869
1991	91.	90.	2.078124	2.023215	0.973578
1992	19.	40.	0.479173	1.556243	3.247765
1993	84.	65.	2.133503	1.195943	0.560553
1994	159.	133.	2.078124	1.356350	0.652680
1995	210.	208.	2.078124	2.016532	0.970362
1996	14.	25.	0.498768	1.218703	2.443428
1997	27.	51.	0.558001	1.645354	2.948657
1998	4.	62.	0.054967	2.383208	43.357246
1999	13.	61.	0.134164	0.926671	6.906985
2000	67.	63.	0.935291	0.847839	0.906497
2001	105.	101.	N/A	N/A	

Warning **** Infeasible Mass Balance in Plus Group
Year = 1987

Appendix F. Gulf of Maine cod

by R Mayo, G Shepherd, L O'Brien, L Col, M Traver

Appendix 1. Commercial landings at age, discard at age, recreational landings at age and total catch at age, 1982-2007 for the Gulf of Maine stock of Atlantic cod.

Year	Total Commercial Landings in Numbers (000's) at Age							Revised LAA 1994+			Jul-08	
	1	2	3	4	5	6	7	8	9	10	11+	Total
1982	30	1380	1633	1143	633	69	91	61	41	4	33	5118
1983	0	866	2357	1058	638	422	47	61	23	9	15	5496
1984	4	446	1240	1500	437	194	74	19	15	11	17	3957
1985	0	407	1445	991	630	128	78	32	4	11	11	3737
1986	0	84	2164	813	250	177	39	24	20	4	8	3583
1987	2	216	595	1109	277	66	51	9	8	8	3	2344
1988	0	160	1443	953	406	43	9	17	1	2	1	3035
1989	0	337	1583	1454	449	81	35	6	3	5	7	3960
1990	0	205	3425	2064	430	157	27	30	10	15	17	6380
1991	0	344	934	4161	851	143	41	30	6	1	1	6512
1992	0	313	530	484	2018	202	62	7	12	3	0	3631
1993	0	76	1487	641	129	457	28	6	2	0	0	2825
1994	0	37	1094	1114	305	69	84	29	7	1	1	2742
1995	18	221	885	1035	222	27	14	18	1	2	0	2443
1996	0	69	513	1744	365	37	4	0	1	0	0	2734
1997	0	79	445	427	801	68	5	3	0	1	0	1829
1998	0	94	396	530	146	176	25	4	0	1	0	1373
1999	0	3	184	176	81	16	22	2	0	2	0	487
2000	0	102	256	501	122	69	11	5	0	0	0	1067
2001	0	46	484	323	212	68	39	6	9	1	0	1187
2002	0	2	115	439	172	106	43	12	4	4	0	898
2003	0	7	48	205	393	124	54	21	9	5	3	870
2004	0	1	156	133	226	178	54	28	15	8	2	799
2005	0	1	40	437	65	181	85	22	13	6	5	856
2006	0	1	120	192	307	22	66	31	11	6	5	761
2007	0	5	101	643	101	187	6	17	8	4	5	1077

Total Commercial Landings in Weight (Tons) at												
Age	1	2	3	4	5	6	7	8	9	10	11+	Total
Year												
1982	24	1595	2717	3160	3019	461	813	608	531	41	613	13582
1983	0	1009	3913	2619	2410	2518	271	643	227	102	269	13981
1984	3	516	2071	4080	1607	1145	603	186	193	152	250	10816
1985	0	513	2523	2816	2814	705	615	363	51	141	152	10693
1986	0	110	3976	2375	1153	1072	296	243	253	54	132	9664
1987	2	283	1001	3641	1340	451	455	88	116	110	40	7527
1988	0	203	2715	2311	2097	295	85	191	11	36	14	7958
1989	0	420	2811	4351	1737	325	323	67	43	87	163	10397
1990	0	219	5794	4687	1834	1200	290	354	153	214	350	15095
1991	0	388	1463	10455	3520	1045	399	369	93	32	17	17781
1992	0	480	1019	1313	6175	1011	594	88	161	49	0	10891
1993	0	99	2809	1611	561	2819	281	79	27	0	0	8286
1994	0	52	2060	3379	1054	440	603	306	68	11	26	7998
1995	5	307	1641	2870	1143	156	150	211	15	31	5	6535
1996	0	106	1139	4098	1295	269	46	6	18	0	0	6978
1997	0	140	997	1320	2539	333	42	30	4	12	2	5420
1998	0	124	813	1527	614	759	132	43	7	16	7	4045
1999	0	4	333	442	300	92	163	24	0	20	0	1379
2000	0	170	643	1828	566	401	71	47	0	0	0	3726
2001	0	85	1205	1087	1034	432	287	50	82	11	9	4282
2002	0	2	296	1457	716	646	292	104	38	45	6	3601
2003	0	13	116	653	1645	664	389	176	97	57	42	3852
2004	0	1	397	478	933	1024	388	258	171	100	27	3776
2005	0	2	86	1319	290	838	530	174	137	73	77	3526
2006	0	2	291	627	1164	107	358	224	102	76	79	3030
2007	0	10	251	2083	402	902	39	116	78	47	65	3993

Total
Commercial
Landings
Mean
Weight (kg)
at Age

Year	1	2	3	4	5	6	7	8	9	10	11+	Average
1982	0.801	1.156	1.664	2.764	4.770	6.739	8.944	9.931	12.922	10.618	18.456	2.654
1983	0.000	1.164	1.660	2.475	3.778	5.962	5.808	10.522	10.089	10.898	17.813	2.544
1984	0.589	1.159	1.670	2.721	3.677	5.898	8.119	9.595	12.889	13.951	15.028	2.731
1985	0.000	1.260	1.746	2.840	4.466	5.525	7.901	11.218	11.420	13.386	14.523	2.861
1986	0.000	1.304	1.837	2.923	4.619	6.067	7.669	10.030	12.463	12.907	16.554	2.698
1987	1.028	1.313	1.684	3.283	4.831	6.824	8.878	10.023	13.752	14.738	14.596	3.212
1988	0.000	1.268	1.881	2.426	5.166	6.767	9.932	11.126	14.960	15.763	20.356	2.622
1989	0.000	1.247	1.776	2.993	3.864	4.872	9.267	11.938	14.806	18.196	21.521	2.626
1990	0.000	1.071	1.692	2.271	4.265	7.645	10.734	11.758	15.015	14.784	20.295	2.366
1991	0.000	1.130	1.568	2.512	4.136	7.309	9.642	12.322	15.547	24.328	21.885	2.731
1992	0.000	1.533	1.922	2.714	3.061	5.000	9.566	12.462	13.449	16.631		2.999
1993	0.000	1.293	1.889	2.513	4.356	6.174	9.999	13.869	17.544			2.933
1994	0.000	1.401	1.882	3.034	3.452	6.324	7.159	10.464	10.362	18.542	20.637	2.915
1995	0.274	1.388	1.854	2.774	5.138	5.837	10.760	11.510	18.893	20.064	20.347	2.675
1996	0.000	1.543	2.220	2.350	3.543	7.347	10.406	14.126	14.929	0.000	0.000	2.551
1997	0.000	1.777	2.242	3.090	3.171	4.880	8.409	11.560	14.726	15.814	21.874	2.964
1998	0.000	1.323	2.055	2.879	4.204	4.321	5.254	11.391	18.893	14.953	20.347	2.947
1999	0.000	1.483	1.809	2.511	3.691	5.712	7.311	10.081	0.000	13.402	0.000	2.837
2000	0.000	1.673	2.513	3.646	4.637	5.813	6.394	8.580	0.000	0.000	0.000	3.488
2001	0.000	1.843	2.491	3.365	4.880	6.359	7.451	8.733	8.789	12.414	24.418	3.605
2002	0.000	1.348	2.569	3.320	4.152	6.066	6.792	8.618	9.589	10.482	14.333	4.013
2003	0.000	1.810	2.415	3.179	4.183	5.343	7.247	8.480	10.295	11.771	12.638	4.426
2004	0.000	1.483	2.550	3.588	4.138	5.742	7.167	9.329	11.688	12.822	12.914	4.723
2005	0.000	1.876	2.185	3.018	4.467	4.622	6.226	7.736	10.355	13.331	14.098	4.120
2006	0.000	2.394	2.430	3.271	3.790	4.789	5.453	7.284	9.245	11.974	15.718	3.980
2007	0.000	1.945	2.493	3.241	3.961	4.827	6.243	6.839	9.625	11.369	14.255	3.703

Total
Commercial

Landings
Mean
Length
(cm) at Age

Year	1	2	3	4	5	6	7	8	9	10	11+	Average
1982	43.2	48.3	53.8	63.4	76.8	86.1	94.6	97.9	107.4	101.0	120.7	59.9
1983	0.0	48.6	53.8	61.4	70.8	82.4	80.5	98.8	97.5	100.0	118.7	59.8
1984	39.0	48.4	54.1	63.4	69.7	81.8	91.5	96.7	106.9	109.6	112.0	61.6
1985	0.0	49.8	55.1	64.6	74.9	80.3	90.8	101.9	103.1	108.2	109.7	62.8
1986	0.0	50.3	55.9	65.0	75.4	82.6	89.9	98.7	105.8	107.5	116.2	61.6
1987	47.0	50.4	54.4	67.8	76.9	86.5	93.8	98.7	109.5	111.7	111.3	65.4
1988	0.0	50.1	56.4	61.1	78.7	86.4	98.6	102.3	113.0	114.8	125.0	61.4
1989	0.0	49.8	55.5	65.7	71.5	76.7	95.8	103.4	112.6	120.4	126.8	61.7
1990	0.0	47.5	54.8	60.0	73.7	90.0	100.9	104.0	111.8	112.6	124.6	59.2
1991	0.0	47.7	52.6	61.8	72.6	88.6	97.2	105.0	113.3	132.5	128.0	62.2
1992	0.0	53.1	56.6	62.9	65.6	77.0	97.3	106.1	109.1	117.0		64.3
1993	0.0	50.5	56.8	61.7	74.2	83.7	98.6	110.0	119.1			63.5
1994	0.0	51.8	56.6	65.8	68.3	83.3	86.8	98.3	100.0	121.2	125.5	63.8
1995	30.4	50.5	56.2	63.7	78.7	78.1	101.1	102.7	122.0	124.4	125.0	61.6
1996	0.0	52.8	59.6	60.4	68.6	88.6	100.0	110.8	112.6	0.0	0.0	61.6
1997	0.0	55.4	59.8	66.0	66.3	76.2	92.3	102.9	112.1	115.0	128.0	64.7
1998	0.0	50.7	58.1	64.4	73.0	73.3	75.8	101.9	122.0	113.0	125.0	64.1
1999	0.0	53.0	55.8	62.0	69.2	78.6	87.6	99.3	0.0	109.0	0.0	62.9
2000	0.0	54.6	61.7	70.1	76.1	82.3	84.3	93.9	0.0	0.0	0.0	68.4
2001	0.0	56.1	62.0	68.1	77.4	84.6	89.2	93.6	94.1	106.2	132.4	68.8
2002	0.0	51.3	62.5	68.0	72.9	83.2	86.1	93.5	96.9	99.3	110.0	71.5
2003	0.0	56.3	61.5	67.0	73.2	79.5	88.2	92.7	98.7	103.5	106.3	73.8
2004	0.0	53.0	62.7	70.1	73.1	81.4	87.8	96.1	103.7	107.1	106.4	75.2
2005	0.0	57.0	59.7	66.1	75.2	75.9	83.3	89.8	99.2	108.1	109.8	71.9
2006	0.0	62.0	61.7	67.9	71.0	76.3	79.7	87.1	94.7	103.6	113.8	71.2
2007	0.0	57.8	62.3	67.9	72.1	77.0	83.7	86.0	96.7	102.6	110.0	70.2

Total Commercial Discards in Numbers (000's) at Age						Revised Discards 1999+						Total
Year	1	2	3	4	5	6	7	8	9	10	11+	
1999	0	6	350	335	155	31	43	4	0	3	0	925
2000	0	27	69	134	33	19	3	1	0	0	0	286
2001	0	15	155	104	68	22	12	2	3	0	0	382
2002	0	1	49	187	74	45	18	5	2	2	0	383
2003	0	2	15	65	125	39	17	7	3	2	1	277
2004	0	0	19	17	28	22	7	3	2	1	0	99
2005	0	0	3	33	5	14	6	2	1	0	0	65
2006	0	0	18	29	46	3	10	5	2	1	1	114
2007	0	1	13	83	13	24	1	2	1	1	1	139

Total Commercial Discards in Weight (Tons) at Age						Revised Discards 1999+						Total
Year	1	2	3	4	5	6	7	8	9	10	11+	
1999	0	8.229152	632.3211	840.8807	570.5593	175.6108	310.7809	44.92337	0	38.4042	0	2626.099
2000	0	45.69613	172.5082	490.2897	151.7367	107.5641	18.96529	12.59727	0	0	0	992.4665
2001	0	27.26515	387.2823	349.5529	332.4472	138.964	92.24515	16.02044	26.24963	3.653747	2.836484	1375.022
2002	0	0.894573	126.3784	621.6192	305.4864	275.5153	124.4507	44.46742	16.24992	18.99534	2.67322	1541.092
2003	0	4.041596	36.94529	207.3986	522.9986	210.9961	123.682	55.84634	30.87597	17.99572	13.4672	1223.025
2004	0	0.094445	49.38522	59.43709	116.1658	127.4585	48.25518	32.15067	21.24175	12.4877	3.384399	468.9256
2005	0	0.171457	6.598477	100.6273	22.12268	63.95506	40.40933	13.25934	10.42035	5.597503	5.891383	268.328
2006	0	0.362839	43.68574	94.059	174.4595	15.98146	53.74157	33.53138	15.2962	11.3954	11.77911	451.9766
2007	0	1.345042	32.46468	268.9374	51.85083	116.4489	5.086826	14.94985	10.0594	6.010341	8.426732	510.4338

Year	Total Recreational Landings in Numbers (000's) at Age						Revised Recr Catch 1982+						Total
	1	2	3	4	5	6	7	8	9	10	11+		
1982	41	601	787	279	114	8	7	5	0	0	0	1842	
1983	11	458	561	131	49	31	3	4	2	3	4	1258	
1984	21	356	342	137	33	14	4	0	0	1	1	908	
1985	44	658	743	146	37	5	0	0	0	0	0	1634	
1986	13	102	593	117	27	23	7	6	16	4	51	958	
1987	94	674	726	397	69	25	33	5	6	2	0	2031	
1988	2	389	685	164	23	6	2	1	0	0	0	1273	
1989	4	183	698	262	39	12	6	0	0	0	0	1203	
1990	0	49	701	392	93	20	0	0	0	0	0	1254	
1991	0	94	407	750	80	16	6	0	2	0	0	1355	
1992	0	25	57	48	170	17	3	0	0	0	0	322	
1993	0	52	545	142	10	17	1	0	0	0	0	767	
1994	1	17	394	103	26	2	1	0	0	0	0	543	
1995	0	56	285	157	10	2	0	0	0	0	0	510	
1996	0	21	117	193	19	0	0	0	0	0	0	351	
1997	0	6	51	28	52	3	0	0	0	0	0	140	
1998	0	14	87	64	13	16	1	0	0	0	0	194	
1999	1	14	114	57	37	11	14	1	0	0	0	249	
2000	0	72	209	192	36	11	2	0	0	0	0	523	
2001	0	86	544	259	98	19	9	1	1	0	0	1018	
2002	0	1	95	258	100	52	20	18	4	3	0	551	
2003	0	7	55	172	248	68	33	13	9	4	3	611	
2004	0	0	183	100	156	65	14	6	3	3	1	531	
2005	0	6	92	344	25	70	29	8	5	2	2	584	
2006	0	0	39	61	96	7	22	13	5	3	3	250	
2007	0	2	41	182	26	43	1	4	3	2	2	307	

Total Recreational Landings in Weight (Tons) at												
Age	1	2	3	4	5	6	7	8	9	10	11+	Total
Year												
1982	22	606	1201	676	506	46	41	32	0	0	0	3131
1983	5	398	785	282	168	209	18	37	24	50	82	2056
1984	10	302	481	336	114	61	30	2	0	11	26	1371
1985	21	546	980	340	113	18	2	1	0	0	0	2020
1986	5	99	976	308	108	131	75	84	230	55	1033	3104
1987	18	564	1042	1073	326	204	342	52	64	25	0	3709
1988	1	326	982	345	89	23	15	7	0	0	0	1788
1989	3	203	1117	683	139	75	49	4	0	0	0	2272
1990	0	55	1160	961	357	108	0	0	0	0	0	2642
1991	0	130	605	1492	208	133	55	0	18	1	0	2642
1992	0	46	126	145	566	83	26	1	0	0	0	993
1993	0	53	891	267	28	71	11	0	0	0	0	1321
1994	0	22	630	224	53	7	13	2	1	0	0	953
1995	0	85	462	303	31	3	0	0	0	0	0	884
1996	0	33	212	376	45	2	1	1	2	0	0	672
1997	0	11	101	68	123	9	0	0	0	0	0	311
1998	0	24	186	165	42	49	3	0	0	0	0	470
1999	0	17	223	174	177	67	96	9	0	0	0	764
2000	0	109	404	517	126	56	7	1	0	0	0	1221
2001	0	148	1233	753	422	116	55	9	7	0	0	2744
2002	0	1	215	813	372	277	127	260	42	37	0	2144
2003	0	15	133	495	894	349	264	118	108	47	42	2463
2004	0	0	391	269	444	247	78	57	36	34	15	1572
2005	0	9	183	886	98	294	184	68	53	30	36	1842
2006	0	1	95	196	347	35	124	108	58	44	47	1054
2007	0	4	107	572	98	199	10	34	39	26	34	1124

Year	Total Recreational Landings Mean Weight (kg) at Age											Average
	1	2	3	4	5	6	7	8	9	10	11+	
1982	0.531	1.009	1.526	2.423	4.431	5.686	6.100	7.050	10.522	12.655	16.456	1.700
1983	0.446	0.867	1.399	2.156	3.412	6.831	5.913	8.331	10.808	17.726	18.784	1.635
1984	0.459	0.849	1.408	2.460	3.428	4.476	6.755	6.618	5.621	16.868	17.991	1.510
1985	0.466	0.830	1.320	2.326	3.021	3.370	3.798	4.458	10.522	12.655	16.456	1.236
1986	0.399	0.968	1.646	2.641	4.014	5.740	11.181	13.651	14.756	13.780	20.055	3.240
1987	0.189	0.837	1.435	2.705	4.704	8.009	10.456	10.559	11.344	10.943	16.456	1.826
1988	0.318	0.838	1.434	2.104	3.881	3.669	6.773	7.109	10.522	12.655	16.456	1.405
1989	0.680	1.111	1.601	2.610	3.555	6.351	7.837	9.095	10.522	12.655	16.456	1.888
1990	0.421	1.141	1.656	2.453	3.830	5.508	7.176	8.160	10.522	12.655	16.456	2.107
1991	0.421	1.378	1.485	1.990	2.609	8.450	9.387	8.160	9.387	3.468	16.456	1.950
1992	0.421	1.810	2.205	3.030	3.323	4.827	7.781	2.515	10.522	12.655	16.456	3.087
1993	0.421	1.023	1.636	1.877	2.681	4.207	9.685	8.160	10.522	12.655	16.456	1.722
1994	0.131	1.342	1.601	2.182	2.086	4.300	8.623	8.476	9.095	12.655	16.456	1.755
1995	0.482	1.523	1.620	1.924	3.120	1.798	7.176	5.833	10.522	12.655	16.456	1.734
1996	0.582	1.542	1.808	1.952	2.387	8.127	12.664	12.664	12.664	12.655	16.456	1.915
1997	0.421	1.733	1.992	2.381	2.388	2.806	6.275	6.501	10.522	12.655	16.456	2.224
1998	0.456	1.718	2.151	2.570	3.332	3.140	3.288	6.735	10.522	12.655	16.456	2.423
1999	0.334	1.253	1.958	3.048	4.820	6.032	6.706	8.851	10.522	12.655	16.456	3.070
2000	0.421	1.521	1.929	2.688	3.543	4.898	3.419	4.826	10.522	12.655	16.456	2.334
2001	0.421	1.716	2.266	2.912	4.308	6.000	6.211	6.261	6.966	12.655	16.456	2.695
2002	0.421	1.381	2.265	3.147	3.716	5.357	6.422	14.256	11.036	10.987	16.456	3.890
2003	0.421	2.083	2.402	2.869	3.611	5.159	8.120	9.367	11.555	13.161	13.712	4.031
2004	0.421	1.459	2.140	2.681	2.849	3.780	5.664	9.757	12.265	13.369	14.001	2.960
2005	0.421	1.523	1.990	2.574	3.857	4.187	6.270	8.120	10.685	13.692	15.088	3.154
2006	0.421	2.053	2.409	3.222	3.610	5.054	5.727	8.514	10.601	12.556	15.562	4.217
2007	0.421	2.292	2.617	3.146	3.776	4.634	6.958	8.142	11.376	12.503	14.439	3.661

Total Recreational Landings Mean Length (cm) at Age												
Year	1	2	3	4	5	6	7	8	9	10	11+	Average
1982	36.3	44.8	51.5	60.1	74.4	81.0	83.7	88.7	99.4	104.6	115.5	52.0
1983	34.5	42.8	50.2	57.9	67.4	85.4	80.6	91.6	99.2	118.0	121.0	50.4
1984	34.4	42.3	50.1	60.1	67.4	72.6	84.3	85.6	83.0	116.1	119.4	49.5
1985	35.0	42.0	48.9	59.9	65.5	68.7	72.0	77.0	99.4	104.6	115.5	47.2
1986	34.0	44.3	53.2	62.0	71.5	81.2	101.6	108.7	111.9	110.0	124.1	59.9
1987	25.9	41.8	50.4	62.9	75.2	90.0	99.4	99.6	102.8	101.0	115.5	51.3
1988	32.0	42.4	50.5	57.7	70.1	67.1	85.2	86.6	99.4	104.6	115.5	49.4
1989	40.0	46.6	52.7	61.9	68.3	84.3	91.8	95.0	99.4	104.6	115.5	54.8
1990	33.7	47.3	53.3	60.9	71.0	81.1	86.3	90.3	99.4	104.6	115.5	57.2
1991	33.7	50.6	51.6	56.9	61.6	93.2	98.0	90.3	98.0	71.0	115.5	55.8
1992	33.7	54.9	58.1	64.6	66.7	75.6	89.7	62.0	99.4	104.6	115.5	64.6
1993	33.7	45.2	53.3	55.8	61.8	69.0	98.0	90.3	99.4	104.6	115.5	53.7
1994	23.6	49.3	52.9	58.1	57.4	70.9	93.4	93.0	95.0	104.6	115.5	54.2
1995	36.0	52.1	53.1	55.9	65.5	54.6	86.3	83.0	99.4	104.6	115.5	54.1
1996	38.0	52.3	55.0	56.4	60.0	89.9	107.0	107.0	107.0	104.6	115.5	56.0
1997	33.7	54.5	57.0	60.1	60.0	62.8	85.0	86.0	99.4	104.6	115.5	58.8
1998	35.0	54.2	58.4	61.7	66.9	65.3	67.2	86.0	99.4	104.6	115.5	60.3
1999	33.0	47.9	56.4	65.0	75.6	81.5	84.9	94.0	99.4	104.6	115.5	63.6
2000	33.7	52.1	56.1	62.3	68.2	76.3	67.1	77.0	99.4	104.6	115.5	59.1
2001	33.7	54.1	59.2	64.0	73.6	82.6	83.2	84.0	87.8	104.6	115.5	62.1
2002	33.7	51.1	59.2	66.1	69.6	79.0	83.6	108.7	101.2	101.0	115.5	69.2
2003	33.7	58.0	60.6	64.0	68.5	76.9	90.4	95.1	102.4	107.0	108.9	70.0
2004	33.7	51.6	58.5	62.9	63.9	69.2	78.7	97.0	105.2	108.4	109.9	63.8
2005	33.7	51.6	57.0	61.8	70.4	72.1	81.8	89.9	99.9	108.5	112.1	64.7
2006	33.7	57.2	60.6	66.6	68.9	76.1	79.3	90.4	98.7	105.0	113.4	70.9
2007	33.7	60.1	62.6	66.4	70.0	74.7	85.7	90.5	102.2	105.9	111.1	68.8

Year	Total Catch in Numbers (000's) at Age							Revised LAA 1994+				Total
	1	2	3	4	5	6	7	8	9	10	11+	
1982	71.4	1980.9	2420.3	1422.1	747.1	77.1	97.7	65.6	41.0	4.0	33.0	6960.1
1983	11.3	1324.4	2917.6	1189.0	687.2	452.6	50.0	65.4	25.2	11.8	19.4	6754.0
1984	24.7	801.5	1581.5	1636.5	470.1	207.6	78.4	19.3	15.0	11.6	18.4	4864.9
1985	44.3	1064.5	2187.8	1137.1	667.5	133.2	78.5	32.1	4.0	11.0	11.0	5371.0
1986	12.8	186.0	2756.8	929.6	277.0	199.9	45.7	30.2	35.6	8.0	59.5	4541.1
1987	96.3	889.6	1321.0	1505.8	346.4	91.5	83.7	13.9	13.6	10.3	3.0	4375.0
1988	2.4	549.1	2128.0	1117.1	428.8	49.3	11.2	17.9	1.0	2.0	1.0	4308.0
1989	3.8	519.5	2280.6	1715.7	488.0	92.8	41.2	6.4	3.0	5.0	7.0	5163.0
1990	0.0	253.6	4125.6	2455.9	523.3	176.6	27.0	30.0	10.0	15.0	17.0	7634.0
1991	0.0	438.5	1341.1	4910.7	930.6	158.8	46.8	30.0	7.9	1.3	1.0	7866.6
1992	0.0	338.3	587.1	531.9	2188.4	219.1	65.3	7.4	12.0	3.0	0.0	3952.5
1993	0.0	127.8	2031.8	783.0	139.4	473.8	29.2	6.0	2.0	0.0	0.0	3592.0
1994	0.9	54.0	1488.2	1216.6	330.9	71.0	85.7	29.5	6.7	0.6	1.2	3285.3
1995	18.1	277.0	1169.9	1192.0	232.5	28.6	13.9	18.4	0.8	1.6	0.2	2953.2
1996	0.0	90.0	630.7	1936.7	384.3	36.9	4.5	0.5	1.3	0.0	0.0	3085.0
1997	0.0	85.4	495.2	455.5	852.4	71.4	5.0	2.6	0.3	0.7	0.1	1968.6
1998	0.0	107.5	482.4	594.8	158.7	191.4	26.2	3.9	0.4	1.1	0.4	1566.7
1999	1.2	22.1	647.2	568.0	272.6	58.0	79.2	7.9	0.0	4.4	0.0	1660.7
2000	0.0	201.1	534.0	828.3	190.3	98.9	16.1	7.1	0.0	0.0	0.0	1875.8
2001	0.0	147.2	1183.5	685.5	378.0	109.1	59.8	8.9	13.3	1.2	0.5	2587.1
2002	0.0	3.0	259.5	884.3	346.0	203.5	81.0	35.5	9.5	9.4	0.6	1832.4
2003	0.0	16.4	118.6	442.9	766.1	231.4	103.3	39.9	21.7	9.9	7.4	1757.5
2004	0.0	0.9	357.8	249.9	409.6	266.0	74.6	36.9	19.3	11.3	3.5	1429.8
2005	0.0	7.5	134.1	813.8	95.2	265.3	120.9	32.5	19.2	8.1	8.3	1504.9
2006	0.0	1.6	177.4	281.3	449.3	32.5	97.2	48.0	18.2	10.8	8.8	1124.9
2007	0.0	7.9	154.8	907.5	140.4	253.8	8.5	23.3	12.6	6.7	7.5	1523.3

Total Catch in Weight (Tons) at Age												
Year	1	2	3	4	5	6	7	8	9	10	11+	Total
1982	46.0	2201.2	3918.4	3836.2	3524.6	507.1	853.8	640.4	531.0	41.0	613.0	16712.7
1983	5.1	1406.6	4697.6	2901.4	2578.0	2726.9	288.7	679.9	250.6	151.8	350.8	16037.4
1984	12.5	817.8	2551.7	4415.8	1720.6	1206.0	633.0	188.0	193.3	162.9	275.9	12187.3
1985	20.6	1058.9	3503.3	3155.7	2927.2	722.6	616.9	363.7	51.0	141.0	152.0	12712.9
1986	5.1	208.7	4952.0	2682.8	1261.2	1203.5	371.5	327.1	482.7	109.0	1164.8	12768.4
1987	19.8	846.6	2042.5	4714.2	1666.2	654.9	796.9	139.7	180.0	134.7	40.0	11235.5
1988	0.8	529.1	3697.5	2656.3	2185.6	318.3	99.9	197.6	11.0	36.0	14.0	9746.0
1989	2.6	622.7	3928.2	5034.1	1875.8	399.7	371.9	70.7	43.0	87.0	163.0	12668.7
1990	0.0	274.4	6954.4	5648.2	2191.4	1307.9	290.0	354.0	153.0	214.0	350.0	17737.3
1991	0.0	518.2	2067.6	11946.7	3727.6	1178.3	453.8	369.0	111.3	33.0	17.0	20422.5
1992	0.0	525.8	1144.9	1458.3	6741.3	1093.5	619.8	89.0	161.0	49.0	0.0	11883.6
1993	0.0	152.0	3700.4	1877.6	588.9	2889.5	292.3	79.0	27.0	0.0	0.0	9606.6
1994	0.1	74.7	2690.0	3603.4	1107.2	446.1	615.4	307.9	69.6	10.7	25.8	8950.9
1995	5.0	392.0	2102.4	3172.9	1174.5	159.5	150.0	211.5	15.5	31.2	5.0	7419.3
1996	0.0	138.9	1351.8	4474.6	1339.8	271.3	46.4	7.4	19.8	0.0	0.0	7650.1
1997	0.0	151.5	1097.5	1387.3	2662.5	342.1	42.4	29.7	4.3	11.7	2.1	5731.3
1998	0.0	147.6	999.7	1692.7	656.2	808.3	135.8	43.7	6.9	16.4	7.4	4514.7
1999	0.4	29.6	1187.7	1457.0	1047.8	335.1	570.6	78.0	0.0	58.6	0.0	4769.2
2000	0.0	325.4	1219.7	2835.7	843.7	564.7	96.7	60.1	0.0	0.0	0.0	5939.0
2001	0.0	260.3	2825.3	2189.5	1788.6	687.0	434.5	74.5	115.3	15.0	11.7	8400.2
2002	0.0	4.1	637.8	2891.3	1392.9	1198.0	542.8	408.5	96.7	100.3	8.9	7285.6
2003	0.0	31.7	285.7	1354.5	3062.8	1223.8	776.7	349.1	235.5	121.3	97.4	7537.3
2004	0.0	1.3	837.4	805.6	1493.6	1398.9	514.1	347.1	227.5	146.6	46.0	5817.0
2005	0.0	11.8	276.1	2305.7	410.0	1196.1	754.4	255.0	199.9	108.7	118.9	5635.9
2006	0.0	3.6	430.1	917.2	1685.5	157.2	535.7	365.6	175.4	131.0	137.1	4536.1
2007	0.0	16.1	391.1	2924.0	551.3	1217.0	54.4	165.1	127.4	78.5	108.1	5627.8

Total Catch Mean Weight (kg) at Age												
Year	1	2	3	4	5	6	7	8	9	10	11+	Average
1982	0.644	1.111	1.619	2.698	4.718	6.577	8.740	9.763	12.951	10.250	18.576	2.401
1983	0.446	1.062	1.610	2.440	3.751	6.025	5.775	10.391	9.951	12.855	18.125	2.375
1984	0.506	1.020	1.613	2.698	3.660	5.808	8.070	9.741	12.845	13.987	14.962	2.505
1985	0.466	0.995	1.601	2.775	4.385	5.424	7.859	11.312	12.750	12.818	13.818	2.367
1986	0.399	1.122	1.796	2.886	4.554	6.020	8.120	10.845	13.572	13.640	19.578	2.812
1987	0.206	0.952	1.546	3.131	4.811	7.161	9.521	10.053	13.195	13.132	13.333	2.568
1988	0.318	0.964	1.738	2.378	5.097	6.450	8.919	11.022	11.000	18.000	14.000	2.262
1989	0.680	1.199	1.722	2.934	3.844	4.309	9.018	11.034	14.333	17.400	23.286	2.454
1990	0.416	1.082	1.686	2.300	4.187	7.407	10.741	11.800	15.300	14.267	20.588	2.323
1991	0.416	1.182	1.542	2.433	4.006	7.421	9.689	12.300	14.003	25.672	17.000	2.596
1992	0.416	1.554	1.950	2.741	3.080	4.991	9.489	12.027	13.417	16.333	17.576	3.007
1993	0.416	1.189	1.821	2.398	4.225	6.099	10.022	13.167	13.500	14.785	17.576	2.674
1994	0.132	1.383	1.808	2.962	3.347	6.280	7.185	10.448	10.331	18.542	20.637	2.725
1995	0.274	1.415	1.797	2.662	5.051	5.578	10.760	11.492	18.893	20.064	20.347	2.512
1996	0.588	1.543	2.143	2.310	3.486	7.353	10.426	13.912	14.724	14.785	17.576	2.480
1997	0.416	1.774	2.216	3.046	3.124	4.791	8.405	11.547	14.726	15.814	21.874	2.911
1998	0.417	1.373	2.072	2.846	4.135	4.224	5.177	11.313	18.893	14.953	20.347	2.882
1999	0.334	1.341	1.835	2.565	3.843	5.773	7.201	9.915	12.870	13.402	17.576	2.872
2000	0.416	1.619	2.284	3.423	4.432	5.707	6.013	8.521	12.870	14.785	17.576	3.166
2001	0.416	1.768	2.387	3.194	4.732	6.296	7.266	8.351	8.643	12.414	24.418	3.247
2002	0.416	1.357	2.458	3.269	4.026	5.886	6.702	11.514	10.174	10.662	14.333	3.976
2003	0.416	1.929	2.409	3.058	3.998	5.289	7.522	8.760	10.834	12.269	13.074	4.289
2004	0.416	1.474	2.340	3.224	3.647	5.259	6.889	9.396	11.775	12.944	13.260	4.068
2005	0.416	1.574	2.058	2.833	4.307	4.509	6.239	7.835	10.440	13.428	14.382	3.745
2006	0.416	2.303	2.425	3.261	3.751	4.845	5.514	7.610	9.654	12.162	15.664	4.033
2007	0.416	2.027	2.526	3.222	3.927	4.794	6.362	7.075	10.106	11.721	14.314	3.695

Total

Catch
Mean
Length
(cm) at
Age

Year	1	2	3	4	5	6	7	8	9	10	11+
1982	39.2	47.2	53.0	62.8	76.4	85.6	93.9	97.3	107.4	101.0	120.7
1983	34.5	46.6	53.1	61.0	70.6	82.6	80.5	98.3	97.6	104.3	119.2
1984	35.2	45.7	53.2	63.1	69.5	81.2	91.1	96.5	106.8	110.0	112.6
1985	35.0	45.0	53.0	64.0	74.4	79.8	90.7	101.8	103.1	108.2	109.7
1986	34.0	47.0	55.3	64.6	75.0	82.4	91.6	100.7	108.4	108.7	123.0
1987	26.3	43.9	52.2	66.5	76.6	87.5	96.0	99.0	106.7	109.3	111.3
1988	32.0	44.6	54.5	60.6	78.2	83.9	96.0	101.5	113.0	114.8	125.0
1989	40.0	48.7	54.6	65.1	71.2	77.7	95.2	102.9	112.6	120.4	126.8
1990	33.6	47.5	54.5	60.1	73.2	89.0	100.9	104.0	111.8	112.6	124.6
1991	33.6	48.3	52.3	61.0	71.7	89.1	97.3	105.0	109.6	118.9	128.0
1992	33.6	53.2	56.7	63.1	65.7	76.9	96.9	103.7	109.1	117.0	119.3
1993	33.6	48.4	55.9	60.6	73.3	83.2	98.6	110.0	119.1	110.9	119.3
1994	23.6	51.0	55.6	65.1	67.4	83.0	86.9	98.3	99.9	121.2	125.5
1995	30.4	50.8	55.4	62.6	78.1	76.5	101.1	102.6	122.0	124.4	125.0
1996	38.0	52.7	58.8	60.0	68.2	88.6	100.1	110.2	112.1	110.9	119.3
1997	33.6	55.3	59.5	65.6	65.9	75.6	92.3	102.9	112.1	115.0	128.0
1998	35.0	51.1	58.2	64.1	72.6	72.6	75.5	101.6	122.0	113.0	125.0
1999	33.0	49.8	55.9	62.3	70.1	79.1	87.1	98.6	107.2	109.0	119.3
2000	33.6	53.7	59.5	68.3	74.6	81.6	82.1	93.6	107.2	110.9	119.3
2001	33.6	54.9	60.7	66.6	76.4	84.2	88.3	92.1	93.6	106.2	132.4
2002	33.6	51.3	61.3	67.5	71.9	82.1	85.4	101.3	98.6	99.9	110.0
2003	33.6	57.0	61.1	65.8	71.7	78.7	88.9	93.4	100.3	104.7	107.4
2004	33.6	52.5	60.5	67.2	69.6	78.4	86.1	96.3	103.9	107.4	107.5
2005	33.6	52.5	57.8	64.3	73.9	74.9	83.0	89.8	99.4	108.2	110.5
2006	33.6	60.7	61.5	67.6	70.6	76.3	79.6	87.9	95.9	104.0	113.7
2007	33.6	58.3	62.4	67.6	71.7	76.6	84.1	86.8	98.2	103.6	110.3

Appendix 2. Full VPA Model Output (Terminal Year 2007) for the Gulf of Maine stock of Atlantic cod.

VPA Version 2.7.1

Model ID: GoM Cod 2008 VPA Update GARMIII TY2007 11+

Input File:

C:\ALLWORK\ASSESS\GARMIIIAUG2008WG\ASSMT_MTG\GOMCOD\VPA\FINALS\GMCOD2008_GARM
III

Date of Run: 17-JUL-2008

Time of Run: 13:23

Levenburg-Marquardt Algorithm Completed 21 Iterations
Residual Sum of Squares = 279.707

Number of Residuals = 508
Number of Parameters = 9
Degrees of Freedom = 499
Mean Squared Residual = 0.560535
Standard Deviation = 0.748689

Number of Years = 26
Number of Ages = 11
First Year = 1982
Youngest Age = 1
Oldest True Age = 10

Number of Survey Indices Available = 25
Number of Survey Indices Used in Estimate = 23

VPA Classic Method - Auto Estimated Q's

Stock Numbers Predicted in Terminal Year Plus One (2008)

Age	Stock Predicted	Std. Error	CV
2	3936.752	0.173583E+04	0.440929E+00
3	16020.398	0.499998E+04	0.312101E+00
4	3542.738	0.930299E+03	0.262593E+00
5	3970.448	0.103469E+04	0.260597E+00
6	201.340	0.776978E+02	0.385903E+00
7	251.280	0.110401E+03	0.439357E+00
8	29.920	0.163265E+02	0.545679E+00
9	46.873	0.324104E+02	0.691456E+00
10	71.277	0.516470E+02	0.724592E+00

Catchability Values for Each Survey Used in Estimate

INDEX	Catchability	Std. Error	CV
1	0.639060E-04	0.988283E-05	0.154646E+00
2	0.131940E-03	0.141520E-04	0.107261E+00
3	0.225008E-03	0.228294E-04	0.101460E+00
4	0.293998E-03	0.386906E-04	0.131602E+00

5	0.382779E-03	0.641901E-04	0.167695E+00
6	0.566609E-03	0.109588E-03	0.193411E+00
7	0.511812E-03	0.139644E-03	0.272843E+00
8	0.533836E-04	0.687041E-05	0.128699E+00
9	0.113582E-03	0.128656E-04	0.113272E+00
10	0.223833E-03	0.225992E-04	0.100965E+00
11	0.370258E-03	0.463840E-04	0.125275E+00
12	0.478237E-03	0.565335E-04	0.118212E+00
13	0.451154E-03	0.836411E-04	0.185394E+00
14	0.566767E-03	0.129170E-03	0.227906E+00
15	0.710558E-03	0.107424E-03	0.151183E+00
16	0.544643E-03	0.474923E-04	0.871988E-01
17	0.453706E-03	0.562280E-04	0.123930E+00
19	0.122958E-03	0.367937E-04	0.299238E+00
21	0.245830E-05	0.690050E-06	0.280702E+00
22	0.140563E-04	0.164576E-05	0.117084E+00
23	0.231650E-04	0.128111E-05	0.553035E-01
24	0.229116E-04	0.123947E-05	0.540979E-01
25	0.218712E-04	0.246650E-05	0.112774E+00

-- Non-Linear Least Squares Fit --

Default Tolerances Used

Scaled Gradient Tolerance = 6.055454E-06
 Scaled Step Tolerance = 3.666853E-11
 Relative Function Tolerance = 3.666853E-11
 Absolute Function Tolerance = 4.930381E-32

VPA Method Options

- Catchability Values Estimated as an Analytic Function of N
- Pope Approximation Used in Cohort Solution
- Plus Group Backward Calculation Method Used
- Rivard Weights Used for JAN-1 Biomass
- Rivard Weights Used for SSB Biomass
- Rivard Weights Calculation Used 3 Years for Terminal Year Plus One
- Heincke Rule Used in F-Oldest Calculation
- F-Oldest Calculation in Years Prior to Terminal Year
 Uses Stock Sizes in Ages 5 to 9
- Calculation of Population of Age 1 In Year 2008
 = Set to Zero

Stock Estimates

Age 2
 Age 3
 Age 4
 Age 5
 Age 6
 Age 7
 Age 8
 Age 9
 Age 10

Full F in Terminal Year = 0.6492
 F in Oldest True Age in Terminal Year = 0.4888

Full F Calculated Using Classic Method

Age	Input Partial Recruitment	Calc Partial Recruitment	Fishing Mortality	Used In Full F	Comments
1	0.000	0.000	0.0000	NO	Stock Estimate in T+1
2	0.002	0.001	0.0004	NO	Stock Estimate in T+1
3	0.162	0.060	0.0388	NO	Stock Estimate in T+1
4	0.682	0.290	0.1880	NO	Stock Estimate in T+1
5	0.900	0.754	0.4892	NO	Stock Estimate in T+1
6	1.000	1.000	0.6492	YES	Stock Estimate in T+1
7	0.826	0.352	0.2288	NO	Stock Estimate in T+1
8	0.733	0.572	0.3714	NO	Stock Estimate in T+1
9	0.772	0.229	0.1484	NO	Stock Estimate in T+1
10	0.753	0.753	0.4888		Input PR * Full F

Catch At Age - Input Data

AGE	1982	1983	1984	1985	1986
1	71.4	11.3	24.7	44.3	12.8
2	1980.9	1324.4	801.5	1064.5	186.0
3	2420.3	2917.6	1581.5	2187.8	2756.8
4	1422.1	1189.0	1636.5	1137.1	929.6
5	747.1	687.2	470.1	667.5	277.0
6	77.1	452.6	207.6	133.2	199.9
7	97.7	50.0	78.4	78.5	45.7
8	65.6	65.4	19.3	32.1	30.2
9	41.0	25.2	15.0	4.0	35.6
10	4.0	11.8	11.6	11.0	8.0
11	33.0	19.4	18.4	11.0	59.5
AGE	1987	1988	1989	1990	1991
1	96.3	2.4	3.8	0.0	0.0
2	889.6	549.1	519.5	253.6	438.5
3	1321.0	2128.0	2280.6	4125.6	1341.1
4	1505.8	1117.1	1715.7	2455.9	4910.7
5	346.4	428.8	488.0	523.3	930.6
6	91.5	49.3	92.8	176.6	158.8
7	83.7	11.2	41.2	27.0	46.8
8	13.9	17.9	6.4	30.0	30.0
9	13.6	1.0	3.0	10.0	7.9
10	10.3	2.0	5.0	15.0	1.3
11	3.0	1.0	7.0	17.0	1.0
AGE	1992	1993	1994	1995	1996
1	0.0	0.0	0.9	18.1	0.0
2	338.3	127.8	54.0	277.0	90.0
3	587.1	2031.8	1488.2	1169.9	630.7
4	531.9	783.0	1216.6	1192.0	1936.7
5	2188.4	139.4	330.9	232.5	384.3
6	219.1	473.8	71.0	28.6	36.9
7	65.3	29.2	85.7	13.9	4.5
8	7.4	6.0	29.5	18.4	0.5
9	12.0	2.0	6.7	0.8	1.3
10	3.0	0.0	0.6	1.6	0.0
11	0.0	0.0	1.2	0.2	0.0

Catch At Age - Input Data

AGE	1997	1998	1999	2000	2001
1	0.0	0.0	1.2	0.0	0.0
2	85.4	107.5	22.1	201.1	147.2
3	495.2	482.4	647.2	534.0	1183.5
4	455.5	594.8	568.0	828.3	685.5
5	852.4	158.7	272.6	190.3	378.0
6	71.4	191.4	58.0	98.9	109.1
7	5.0	26.2	79.2	16.1	59.8
8	2.6	3.9	7.9	7.1	8.9
9	0.3	0.4	0.0	0.0	13.3
10	0.7	1.1	4.4	0.0	1.2
11	0.1	0.4	0.0	0.0	0.5
AGE	2002	2003	2004	2005	2006
1	0.0	0.0	0.0	0.0	0.0
2	3.0	16.4	0.9	7.5	1.6
3	259.5	118.6	357.8	134.1	177.4
4	884.3	442.9	249.9	813.8	281.3
5	346.0	766.1	409.6	95.2	449.3
6	203.5	231.4	266.0	265.3	32.5
7	81.0	103.3	74.6	120.9	97.2
8	35.5	39.9	36.9	32.5	48.0
9	9.5	21.7	19.3	19.2	18.2
10	9.4	9.9	11.3	8.1	10.8
11	0.6	7.4	3.5	8.3	8.8
AGE	2007				
1	0.0				
2	7.9				
3	154.8				
4	907.5				
5	140.4				
6	253.8				
7	8.5				
8	23.3				
9	12.6				
10	6.7				
11	7.5				

Weight At Age - Input Data

AGE	1982	1983	1984	1985	1986
1	0.6440	0.4460	0.5060	0.4660	0.3990
2	1.1110	1.0620	1.0200	0.9950	1.1220
3	1.6190	1.6100	1.6130	1.6010	1.7960
4	2.6980	2.4400	2.6980	2.7750	2.8860
5	4.7180	3.7510	3.6600	4.3850	4.5540
6	6.5770	6.0250	5.8080	5.4240	6.0200
7	8.7400	5.7750	8.0700	7.8590	8.1200
8	9.7630	10.3910	9.7410	11.3120	10.8450
9	12.9510	9.9510	12.8450	12.7500	13.5720
10	10.2500	12.8550	13.9870	12.8180	13.6400
11	18.5760	18.1250	14.9620	13.8180	19.5780
AGE	1987	1988	1989	1990	1991
1	0.2060	0.3180	0.6800	0.4160	0.4160
2	0.9520	0.9640	1.1990	1.0820	1.1820
3	1.5460	1.7380	1.7220	1.6860	1.5420
4	3.1310	2.3780	2.9340	2.3000	2.4330
5	4.8110	5.0970	3.8440	4.1870	4.0060
6	7.1610	6.4500	4.3090	7.4070	7.4210
7	9.5210	8.9190	9.0180	10.7410	9.6890
8	10.0530	11.0220	11.0340	11.8000	12.3000
9	13.1950	11.0000	14.3330	15.3000	14.0030
10	13.1320	18.0000	17.4000	14.2670	25.6720
11	13.3330	14.0000	23.2860	20.5880	17.0000
AGE	1992	1993	1994	1995	1996
1	0.4160	0.4160	0.1320	0.2740	0.5880
2	1.5540	1.1890	1.3830	1.4150	1.5430
3	1.9500	1.8210	1.8080	1.7970	2.1430
4	2.7410	2.3980	2.9620	2.6620	2.3100
5	3.0800	4.2250	3.3470	5.0510	3.4860
6	4.9910	6.0990	6.2800	5.5780	7.3530
7	9.4890	10.0220	7.1850	10.7600	10.4260
8	12.0270	13.1670	10.4480	11.4920	13.9120
9	13.4170	13.5000	10.3310	18.8930	14.7240
10	16.3330	14.7850	18.5420	20.0640	14.7850
11	17.5760	17.5760	20.6370	20.3470	17.5760

Weight At Age - Input Data

AGE	1997	1998	1999	2000	2001
1	0.4160	0.4170	0.3340	0.4160	0.4160
2	1.7740	1.3730	1.3410	1.6190	1.7680
3	2.2160	2.0720	1.8350	2.2840	2.3870
4	3.0460	2.8460	2.5650	3.4230	3.1940
5	3.1240	4.1350	3.8430	4.4320	4.7320
6	4.7910	4.2240	5.7730	5.7070	6.2960
7	8.4050	5.1770	7.2010	6.0130	7.2660
8	11.5470	11.3130	9.9150	8.5210	8.3510
9	14.7260	18.8930	12.8700	12.8700	8.6430
10	15.8140	14.9530	13.4020	14.7850	12.4140
11	21.8740	20.3470	17.5760	17.5760	24.4180
AGE	2002	2003	2004	2005	2006
1	0.4160	0.4160	0.4160	0.4160	0.4160
2	1.3570	1.9290	1.4740	1.5740	2.3030
3	2.4580	2.4090	2.3400	2.0580	2.4250
4	3.2690	3.0580	3.2240	2.8330	3.2610
5	4.0260	3.9980	3.6470	4.3070	3.7510
6	5.8860	5.2890	5.2590	4.5090	4.8450
7	6.7020	7.5220	6.8890	6.2390	5.5140
8	11.5140	8.7600	9.3960	7.8350	7.6100
9	10.1740	10.8340	11.7750	10.4400	9.6540
10	10.6620	12.2690	12.9440	13.4280	12.1620
11	14.3330	13.0740	13.2600	14.3820	15.6640
AGE	2007				
1	0.4160				
2	2.0270				
3	2.5260				
4	3.2220				
5	3.9270				
6	4.7940				
7	6.3620				
8	7.0750				
9	10.1060				
10	11.7210				
11	14.3140				

JAN-1 Weights at Age - Input Data

AGE	1982	1983	1984	1985	1986
1	0.5015	0.2949	0.3608	0.3003	0.2583
2	0.9229	0.8270	0.6745	0.7096	0.7231
3	1.3188	1.3374	1.3088	1.2779	1.3368
4	2.2882	1.9876	2.0842	2.1157	2.1495
5	4.1750	3.1812	2.9884	3.4396	3.5549
6	7.0188	5.3316	4.6675	4.4555	5.1379
7	8.0156	6.1630	6.9729	6.7561	6.6365
8	9.6703	9.5298	7.5003	9.5545	9.2321
9	12.9993	9.8566	11.5530	11.1444	12.3906
10	11.5216	12.9029	11.7977	12.8315	13.1875
11	18.5760	18.1250	14.9620	13.8180	19.5780
AGE	1987	1988	1989	1990	1991
1	0.0952	0.1638	0.5391	0.2468	0.2152
2	0.6163	0.4456	0.6175	0.8578	0.7012
3	1.3170	1.2863	1.2884	1.4218	1.2917
4	2.3713	1.9174	2.2582	1.9901	2.0253
5	3.7262	3.9948	3.0234	3.5049	3.0354
6	5.7106	5.5705	4.6865	5.3360	5.5742
7	7.5708	7.9918	7.6267	6.8032	8.4715
8	9.0350	10.2441	9.9203	10.3156	11.4941
9	11.9624	10.5159	12.5689	12.9931	12.8544
10	13.3502	15.4114	13.8347	14.3000	19.8187
11	13.3330	14.0000	23.2860	20.5880	17.0000
AGE	1992	1993	1994	1995	1996
1	0.2461	0.2282	0.0403	0.1155	0.3385
2	0.8040	0.7033	0.7585	0.4322	0.6502
3	1.5182	1.6822	1.4662	1.5765	1.7414
4	2.0559	2.1624	2.3225	2.1938	2.0374
5	2.7375	3.4030	2.8330	3.8680	3.0463
6	4.4715	4.3342	5.1510	4.3208	6.0943
7	8.3915	7.0725	6.6198	8.2203	7.6260
8	10.7949	11.1777	10.2328	9.0868	12.2349
9	12.8464	12.7422	11.6631	14.0497	13.0080
10	15.1232	14.0844	15.8214	14.3973	16.7133
11	17.5760	17.5760	20.6370	20.3470	17.5760

JAN-1 Weights at Age - Input Data

AGE	1997	1998	1999	2000	2001
1	0.2290	0.2325	0.1517	0.2018	0.2303
2	1.0213	0.7558	0.7478	0.7354	0.8576
3	1.8491	1.9172	1.5873	1.7501	1.9658
4	2.5549	2.5113	2.3054	2.5062	2.7009
5	2.6863	3.5490	3.3071	3.3717	4.0246
6	4.0867	3.6326	4.8858	4.6832	5.2824
7	7.8614	4.9803	5.5152	5.8918	6.4395
8	10.9722	9.7512	7.1645	7.8332	7.0862
9	14.3132	14.7702	12.0664	11.2963	8.5818
10	15.2593	14.8391	15.9124	13.7943	12.6399
11	21.8740	20.3470	17.5760	17.5760	24.4180
AGE	2002	2003	2004	2005	2006
1	0.1932	0.2210	0.2139	0.1768	0.1885
2	0.7513	0.8958	0.7831	0.8092	0.9788
3	2.0846	1.8080	2.1246	1.7417	1.9537
4	2.7934	2.7416	2.7869	2.5747	2.5906
5	3.5860	3.6152	3.3395	3.7264	3.2598
6	5.2776	4.6145	4.5854	4.0552	4.5681
7	6.4958	6.6539	6.0362	5.7281	4.9862
8	9.1466	7.6622	8.4069	7.3468	6.8905
9	9.2175	11.1688	10.1562	9.9043	8.6971
10	9.5996	11.1725	11.8421	12.5744	11.2682
11	14.3330	13.0740	13.2600	14.3820	15.6640
AGE	2007	2008			
1	0.1885	0.1846			
2	0.9183	0.9021			
3	2.4119	2.0358			
4	2.7952	2.6535			
5	3.5785	3.5216			
6	4.2406	4.2879			
7	5.5519	5.4221			
8	6.2459	6.8277			
9	8.7696	9.1237			
10	10.6374	11.4933			
11	14.3140	14.7867			

SSB Weight At Age - Input Data

AGE	1982	1983	1984	1985	1986
1	0.5015	0.2949	0.3608	0.3003	0.2583
2	0.9229	0.8270	0.6745	0.7096	0.7231
3	1.3188	1.3374	1.3088	1.2779	1.3368
4	2.2882	1.9876	2.0842	2.1157	2.1495
5	4.1750	3.1812	2.9884	3.4396	3.5549
6	7.0188	5.3316	4.6675	4.4555	5.1379
7	8.0156	6.1630	6.9729	6.7561	6.6365
8	9.6703	9.5298	7.5003	9.5545	9.2321
9	12.9993	9.8566	11.5530	11.1444	12.3906
10	11.5216	12.9029	11.7977	12.8315	13.1875
11	18.5760	18.1250	14.9620	13.8180	19.5780
AGE	1987	1988	1989	1990	1991
1	0.0952	0.1638	0.5391	0.2468	0.2152
2	0.6163	0.4456	0.6175	0.8578	0.7012
3	1.3170	1.2863	1.2884	1.4218	1.2917
4	2.3713	1.9174	2.2582	1.9901	2.0253
5	3.7262	3.9948	3.0234	3.5049	3.0354
6	5.7106	5.5705	4.6865	5.3360	5.5742
7	7.5708	7.9918	7.6267	6.8032	8.4715
8	9.0350	10.2441	9.9203	10.3156	11.4941
9	11.9624	10.5159	12.5689	12.9931	12.8544
10	13.3502	15.4114	13.8347	14.3000	19.8187
11	13.3330	14.0000	23.2860	20.5880	17.0000
AGE	1992	1993	1994	1995	1996
1	0.2461	0.2282	0.0403	0.1155	0.3385
2	0.8040	0.7033	0.7585	0.4322	0.6502
3	1.5182	1.6822	1.4662	1.5765	1.7414
4	2.0559	2.1624	2.3225	2.1938	2.0374
5	2.7375	3.4030	2.8330	3.8680	3.0463
6	4.4715	4.3342	5.1510	4.3208	6.0943
7	8.3915	7.0725	6.6198	8.2203	7.6260
8	10.7949	11.1777	10.2328	9.0868	12.2349
9	12.8464	12.7422	11.6631	14.0497	13.0080
10	15.1232	14.0844	15.8214	14.3973	16.7133
11	17.5760	17.5760	20.6370	20.3470	17.5760

SSB Weight At Age - Input Data

AGE	1997	1998	1999	2000	2001
1	0.2290	0.2325	0.1517	0.2018	0.2303
2	1.0213	0.7558	0.7478	0.7354	0.8576
3	1.8491	1.9172	1.5873	1.7501	1.9658
4	2.5549	2.5113	2.3054	2.5062	2.7009
5	2.6863	3.5490	3.3071	3.3717	4.0246
6	4.0867	3.6326	4.8858	4.6832	5.2824
7	7.8614	4.9803	5.5152	5.8918	6.4395
8	10.9722	9.7512	7.1645	7.8332	7.0862
9	14.3132	14.7702	12.0664	11.2963	8.5818
10	15.2593	14.8391	15.9124	13.7943	12.6399
11	21.8740	20.3470	17.5760	17.5760	24.4180
AGE	2002	2003	2004	2005	2006
1	0.1932	0.2210	0.2139	0.1768	0.1885
2	0.7513	0.8958	0.7831	0.8092	0.9788
3	2.0846	1.8080	2.1246	1.7417	1.9537
4	2.7934	2.7416	2.7869	2.5747	2.5906
5	3.5860	3.6152	3.3395	3.7264	3.2598
6	5.2776	4.6145	4.5854	4.0552	4.5681
7	6.4958	6.6539	6.0362	5.7281	4.9862
8	9.1466	7.6622	8.4069	7.3468	6.8905
9	9.2175	11.1688	10.1562	9.9043	8.6971
10	9.5996	11.1725	11.8421	12.5744	11.2682
11	14.3330	13.0740	13.2600	14.3820	15.6640
AGE	2007				
1	0.1885				
2	0.9183				
3	2.4119				
4	2.7952				
5	3.5785				
6	4.2406				
7	5.5519				
8	6.2459				
9	8.7696				
10	10.6374				
11	14.3140				

Natural Mortality - Input Data

AGE	1982	1983	1984	1985	1986
1	0.2000	0.2000	0.2000	0.2000	0.2000
2	0.2000	0.2000	0.2000	0.2000	0.2000
3	0.2000	0.2000	0.2000	0.2000	0.2000
4	0.2000	0.2000	0.2000	0.2000	0.2000
5	0.2000	0.2000	0.2000	0.2000	0.2000
6	0.2000	0.2000	0.2000	0.2000	0.2000
7	0.2000	0.2000	0.2000	0.2000	0.2000
8	0.2000	0.2000	0.2000	0.2000	0.2000
9	0.2000	0.2000	0.2000	0.2000	0.2000
10	0.2000	0.2000	0.2000	0.2000	0.2000
11	0.2000	0.2000	0.2000	0.2000	0.2000
AGE	1987	1988	1989	1990	1991
1	0.2000	0.2000	0.2000	0.2000	0.2000
2	0.2000	0.2000	0.2000	0.2000	0.2000
3	0.2000	0.2000	0.2000	0.2000	0.2000
4	0.2000	0.2000	0.2000	0.2000	0.2000
5	0.2000	0.2000	0.2000	0.2000	0.2000
6	0.2000	0.2000	0.2000	0.2000	0.2000
7	0.2000	0.2000	0.2000	0.2000	0.2000
8	0.2000	0.2000	0.2000	0.2000	0.2000
9	0.2000	0.2000	0.2000	0.2000	0.2000
10	0.2000	0.2000	0.2000	0.2000	0.2000
11	0.2000	0.2000	0.2000	0.2000	0.2000
AGE	1992	1993	1994	1995	1996
1	0.2000	0.2000	0.2000	0.2000	0.2000
2	0.2000	0.2000	0.2000	0.2000	0.2000
3	0.2000	0.2000	0.2000	0.2000	0.2000
4	0.2000	0.2000	0.2000	0.2000	0.2000
5	0.2000	0.2000	0.2000	0.2000	0.2000
6	0.2000	0.2000	0.2000	0.2000	0.2000
7	0.2000	0.2000	0.2000	0.2000	0.2000
8	0.2000	0.2000	0.2000	0.2000	0.2000
9	0.2000	0.2000	0.2000	0.2000	0.2000
10	0.2000	0.2000	0.2000	0.2000	0.2000
11	0.2000	0.2000	0.2000	0.2000	0.2000

Natural Mortality - Input Data

AGE	1997	1998	1999	2000	2001
1	0.2000	0.2000	0.2000	0.2000	0.2000
2	0.2000	0.2000	0.2000	0.2000	0.2000
3	0.2000	0.2000	0.2000	0.2000	0.2000
4	0.2000	0.2000	0.2000	0.2000	0.2000
5	0.2000	0.2000	0.2000	0.2000	0.2000
6	0.2000	0.2000	0.2000	0.2000	0.2000
7	0.2000	0.2000	0.2000	0.2000	0.2000
8	0.2000	0.2000	0.2000	0.2000	0.2000
9	0.2000	0.2000	0.2000	0.2000	0.2000
10	0.2000	0.2000	0.2000	0.2000	0.2000
11	0.2000	0.2000	0.2000	0.2000	0.2000

AGE	2002	2003	2004	2005	2006
1	0.2000	0.2000	0.2000	0.2000	0.2000
2	0.2000	0.2000	0.2000	0.2000	0.2000
3	0.2000	0.2000	0.2000	0.2000	0.2000
4	0.2000	0.2000	0.2000	0.2000	0.2000
5	0.2000	0.2000	0.2000	0.2000	0.2000
6	0.2000	0.2000	0.2000	0.2000	0.2000
7	0.2000	0.2000	0.2000	0.2000	0.2000
8	0.2000	0.2000	0.2000	0.2000	0.2000
9	0.2000	0.2000	0.2000	0.2000	0.2000
10	0.2000	0.2000	0.2000	0.2000	0.2000
11	0.2000	0.2000	0.2000	0.2000	0.2000

AGE	2007
1	0.2000
2	0.2000
3	0.2000
4	0.2000
5	0.2000
6	0.2000
7	0.2000
8	0.2000
9	0.2000
10	0.2000
11	0.2000

Proportion of Natural Mortality Before Spawning = 0.1667
Proportion of Fishing Mortality Before Spawning = 0.1667

Maturity - Input Data

AGE	1982	1983	1984	1985	1986
1	0.1100	0.0700	0.0100	0.0100	0.0700
2	0.3200	0.2600	0.2100	0.3600	0.5900
3	0.6400	0.6100	0.8500	0.9600	0.9700
4	0.8700	0.8800	0.9900	1.0000	1.0000
5	0.9600	0.9700	1.0000	1.0000	1.0000
6	0.9900	0.9900	1.0000	1.0000	1.0000
7	1.0000	1.0000	1.0000	1.0000	1.0000
8	1.0000	1.0000	1.0000	1.0000	1.0000
9	1.0000	1.0000	1.0000	1.0000	1.0000
10	1.0000	1.0000	1.0000	1.0000	1.0000
11	1.0000	1.0000	1.0000	1.0000	1.0000
AGE	1987	1988	1989	1990	1991
1	0.0300	0.0400	0.0700	0.3000	0.1000
2	0.3900	0.4200	0.3500	0.5100	0.2600
3	0.9300	0.9200	0.8100	0.7200	0.5300
4	1.0000	0.9900	0.9700	0.8600	0.7900
5	1.0000	1.0000	1.0000	0.9400	0.9200
6	1.0000	1.0000	1.0000	0.9700	0.9700
7	1.0000	1.0000	1.0000	0.9900	0.9900
8	1.0000	1.0000	1.0000	1.0000	1.0000
9	1.0000	1.0000	1.0000	1.0000	1.0000
10	1.0000	1.0000	1.0000	1.0000	1.0000
11	1.0000	1.0000	1.0000	1.0000	1.0000
AGE	1992	1993	1994	1995	1996
1	0.0600	0.0600	0.0100	0.0000	0.0300
2	0.1900	0.2200	0.1900	0.1500	0.3300
3	0.4700	0.5700	0.8200	0.9300	0.9000
4	0.7800	0.8700	0.9900	1.0000	0.9900
5	0.9300	0.9700	1.0000	1.0000	1.0000
6	0.9800	0.9900	1.0000	1.0000	1.0000
7	0.9900	1.0000	1.0000	1.0000	1.0000
8	1.0000	1.0000	1.0000	1.0000	1.0000
9	1.0000	1.0000	1.0000	1.0000	1.0000
10	1.0000	1.0000	1.0000	1.0000	1.0000
11	1.0000	1.0000	1.0000	1.0000	1.0000

Maturity - Input Data

AGE	1997	1998	1999	2000	2001
1	0.0100	0.0600	0.0900	0.1400	0.0900
2	0.1600	0.3600	0.3400	0.3900	0.2800
3	0.7900	0.8200	0.7200	0.7100	0.6100
4	0.9900	0.9700	0.9300	0.9100	0.8600
5	1.0000	1.0000	0.9800	0.9700	0.9600
6	1.0000	1.0000	1.0000	0.9900	0.9900
7	1.0000	1.0000	1.0000	1.0000	1.0000
8	1.0000	1.0000	1.0000	1.0000	1.0000
9	1.0000	1.0000	1.0000	1.0000	1.0000
10	1.0000	1.0000	1.0000	1.0000	1.0000
11	1.0000	1.0000	1.0000	1.0000	1.0000
AGE	2002	2003	2004	2005	2006
1	0.1900	0.1500	0.1300	0.0300	0.1200
2	0.4100	0.3800	0.3000	0.1100	0.3200
3	0.6800	0.6700	0.5500	0.3400	0.6300
4	0.8600	0.8700	0.7700	0.6900	0.8600
5	0.9500	0.9600	0.9000	0.9000	0.9600
6	0.9800	0.9900	0.9600	0.9800	0.9900
7	0.9900	1.0000	0.9900	0.9900	1.0000
8	1.0000	1.0000	1.0000	1.0000	1.0000
9	1.0000	1.0000	1.0000	1.0000	1.0000
10	1.0000	1.0000	1.0000	1.0000	1.0000
11	1.0000	1.0000	1.0000	1.0000	1.0000
AGE	2007				
1	0.0800				
2	0.3400				
3	0.7600				
4	0.9500				
5	0.9900				
6	1.0000				
7	1.0000				
8	1.0000				
9	1.0000				
10	1.0000				
11	1.0000				

Input Partial Recruitment

AGE

1	0.0000
2	0.0021
3	0.1618
4	0.6821
5	0.9004
6	1.0000
7	0.8264
8	0.7333
9	0.7720
10	0.7530

Input F-Plus Ratio

YEAR

1982	1.0000
1983	1.0000
1984	1.0000
1985	1.0000
1986	1.0000
1987	1.0000
1988	1.0000
1989	1.0000
1990	1.0000
1991	1.0000
1992	1.0000
1993	1.0000
1994	1.0000
1995	1.0000
1996	1.0000
1997	1.0000
1998	1.0000
1999	1.0000
2000	1.0000
2001	1.0000
2002	1.0000
2003	1.0000
2004	1.0000
2005	1.0000
2006	1.0000
2007	1.0000

SURVEY - INPUT DATA

INDEX	1	2	3	4	5
SURVEY TAG	WHSpr	WHSpr	WHSpr	WHSpr	WHSpr
AGE	2	3	4	5	6
TIME	JAN-1	JAN-1	JAN-1	JAN-1	JAN-1
TYPE	NUMBERS	NUMBERS	NUMBERS	NUMBERS	NUMBERS
RETRO FLAG	1	1	1	1	1
1982	1.0065	0.4764	0.6554	0.9877	0.0873
1983	0.9486	0.9968	0.4647	0.4042	0.2118
1984	1.3120	1.0226	0.8233	0.2118	0.0467
1985	0.2308	0.6617	0.6625	0.6617	0.1031
1986	0.2478	0.7540	0.2369	0.0912	0.0349
1987	0.4602	0.1991	0.2307	0.0744	0.0000
1988	0.9234	0.8229	0.2179	0.2535	0.0915
1989	0.6048	0.7230	0.6001	0.0908	0.0627
1990	0.2076	1.3654	0.6370	0.1020	0.0321
1991	0.0678	0.2339	1.7167	0.2993	0.0200
1992	0.2255	0.2424	0.2819	1.3281	0.2264
1993	0.4965	0.7993	0.3343	0.0906	0.4842
1994	0.3156	0.3875	0.2150	0.0942	0.0493
1995	0.1792	1.1161	0.3717	0.1454	0.0283
1996	0.0215	0.5927	1.3307	0.4032	0.0593
1997	0.1316	0.3991	0.2643	0.8756	0.2424
1998	0.2236	0.3301	0.5166	0.1415	0.4210
1999	0.3443	0.7133	0.3445	0.3150	0.1337
2000	0.7247	0.4385	0.4570	0.1071	0.1006
2001	0.3234	0.7161	0.4972	0.3539	0.0635
2002	0.0453	0.5244	1.6012	0.6142	0.3619
2003	0.8305	0.0630	0.7077	1.0889	0.3946
2004	0.0446	0.2213	0.1181	0.1908	0.2316
2005	0.7265	0.1014	0.6076	0.0154	0.1498
2006	0.2300	0.4300	0.0600	0.2000	0.0200
2007	3.4500	2.9300	4.4800	0.5000	0.8400
2008	1.0986	3.2112	1.3566	0.9393	0.0584

SURVEY - INPUT DATA

INDEX	6	7	8	9	10
SURVEY TAG	WHSpr	WHSpr	WHAut	WHAut	WHAut
AGE	7	8	2	3	4
TIME	JAN-1	JAN-1	JAN-1	JAN-1	JAN-1
TYPE	NUMBERS	NUMBERS	NUMBERS	NUMBERS	NUMBERS
RETRO FLAG	1	1	1	1	1
1982	0.1120	0.0000	0.6179	0.4188	0.5394
1983	0.0680	0.0160	0.8426	3.3527	2.2748
1984	0.1000	0.0000	0.3168	0.9155	0.8277
1985	0.0910	0.0520	0.4323	0.4258	0.6307
1986	0.0380	0.0000	0.5256	0.9567	0.6094
1987	0.0660	0.0080	0.3920	0.4010	0.6565
1988	0.0650	0.0000	0.5782	1.3796	0.5921
1989	0.0140	0.0000	1.9375	2.3134	0.9896
1990	0.0180	0.0000	0.1495	2.4065	1.5017
1991	0.0180	0.0000	0.0447	0.1868	1.8293
1992	0.0690	0.0000	0.1435	0.1390	0.2233
1993	0.0550	0.0230	0.2910	0.4458	0.1400
1994	0.1270	0.0270	0.1977	0.5678	0.3602
1995	0.0000	0.0110	0.2071	0.8831	0.8260
1996	0.0000	0.0000	0.0680	0.2845	1.2284
1997	0.1200	0.0000	0.1242	0.3826	0.1883
1998	0.0230	0.0370	0.2968	0.0855	0.1769
1999	0.2730	0.0000	0.0966	0.3203	0.1147
2000	0.0240	0.0220	0.4307	0.3672	0.5857
2001	0.0980	0.0550	0.5326	0.9837	0.3936
2002	0.1640	0.0570	0.0340	0.1410	0.7524
2003	0.3210	0.1030	0.2691	0.0805	0.3637
2004	0.0140	0.0140	0.4546	0.1976	0.1848
2005	0.1297	0.0142	0.5700	0.1700	0.5400
2006	0.1314	0.0729	0.1533	0.3806	0.0796
2007	0.0652	0.0384	1.2514	0.5802	1.0331
2008	0.0806	0.0000	0.1456	0.8310	0.3840

SURVEY - INPUT DATA

INDEX	11	12	13	14	15
SURVEY TAG	WHAut	WHAut	WHAut	WHAut	MASpr
AGE	5	6	7	8	2
TIME	JAN-1	JAN-1	JAN-1	JAN-1	JAN-1
TYPE	NUMBERS	NUMBERS	NUMBERS	NUMBERS	NUMBERS
RETRO FLAG	1	1	1	1	1
1982	0.4047	0.1205	0.0760	0.0290	7.1700
1983	1.0892	0.2092	0.0000	0.0000	14.6100
1984	0.1970	0.2270	0.2100	0.0000	5.1500
1985	0.3871	0.2140	0.1630	0.0790	2.7700
1986	0.2482	0.1820	0.0750	0.0000	11.6800
1987	0.3417	0.0727	0.0410	0.0000	4.7100
1988	0.2429	0.0751	0.0000	0.0000	6.3500
1989	0.4434	0.0990	0.0650	0.0330	20.5100
1990	0.2926	0.1605	0.0330	0.0000	5.4500
1991	0.5978	0.2589	0.0520	0.0100	2.6900
1992	0.6334	0.0811	0.0000	0.0230	5.1300
1993	0.0355	0.3498	0.1040	0.0080	6.1100
1994	0.0336	0.0000	0.0300	0.0000	4.0700
1995	0.0854	0.0511	0.0000	0.0450	1.9200
1996	0.3252	0.0821	0.0110	0.0000	0.5200
1997	0.5421	0.0616	0.0000	0.0000	0.9800
1998	0.1728	0.1402	0.0000	0.0000	0.8300
1999	0.1923	0.0387	0.0310	0.0000	2.3900
2000	0.2433	0.1320	0.0160	0.0060	7.0200
2001	0.5071	0.1343	0.0100	0.0000	4.5000
2002	0.4690	0.3368	0.1220	0.0840	0.2600
2003	2.7972	1.0958	0.6270	0.0510	12.7000
2004	0.5287	0.4498	0.0730	0.0770	1.5600
2005	0.2400	0.2500	0.1680	0.0680	7.1500
2006	0.4495	0.0221	0.0923	0.0824	3.6700
2007	0.2475	0.2857	0.0339	0.0496	3.3600
2008	0.5283	0.0226	0.0690	0.0000	0.0000

SURVEY - INPUT DATA

INDEX	16	17	18	19	20
SURVEY TAG	MASpr	MASpr	MAAut	MAAut	MAAut
AGE	3	4	1	2	3
TIME	JAN-1	JAN-1	JAN-1	JAN-1	JAN-1
TYPE	NUMBERS	NUMBERS	NUMBERS	NUMBERS	NUMBERS
RETRO FLAG	1	1	1	1	1
1982	2.4100	0.8700	1.4500	6.2000	1.2500
1983	2.8600	1.5000	4.5900	1.1400	0.3100
1984	2.0700	0.7000	1.2700	0.2800	0.1000
1985	2.2700	0.4500	10.3000	0.1600	0.0700
1986	1.2300	0.6800	2.6500	0.1900	0.0200
1987	2.9600	0.2200	1.8000	0.5500	0.3700
1988	2.4500	1.4500	311.7200	1.4000	0.0200
1989	8.7600	1.0600	5.5300	3.1000	0.2400
1990	14.7500	2.3100	3.9400	0.0200	0.1000
1991	1.5700	3.6600	7.8100	4.2200	0.3100
1992	3.6700	0.7500	5.0400	2.0000	0.3600
1993	2.5500	0.9000	26.4200	0.9900	0.0400
1994	1.7500	0.4900	49.4300	1.5300	0.3600
1995	2.7600	0.7800	40.0100	5.3600	3.4500
1996	1.0800	1.4900	2.9300	0.8000	0.4100
1997	0.9300	0.1700	6.9000	0.0800	0.0100
1998	0.7000	0.7500	1.4300	0.0300	0.0000
1999	2.3100	0.7800	3.2700	0.6400	0.3200
2000	2.8900	2.2000	7.3300	0.5900	0.0700
2001	4.9700	3.5200	0.0500	0.4000	0.1700
2002	1.2300	1.4100	49.1900	0.0100	0.1300
2003	0.2800	1.4300	0.9600	1.0900	0.1300
2004	2.5800	0.4600	120.1700	1.6000	0.1400
2005	0.5700	2.0700	44.6700	9.9400	0.9200
2006	3.3800	0.5400	39.4700	0.6100	0.2400
2007	1.8400	1.7500	2.0800	4.3500	0.4200
2008	0.0000	0.0000	7.6100	0.1600	0.1300

SURVEY - INPUT DATA

INDEX	21	22	23	24	25
SURVEY TAG	CM_CPE	CM_CPE	CM_CPE	CM_CPE	CM_CPE
AGE	2	3	4	5	6
TIME	MEAN	MEAN	MEAN	MEAN	MEAN
TYPE	NUMBERS	NUMBERS	NUMBERS	NUMBERS	NUMBERS
RETRO FLAG	0	0	0	0	0
1982	0.0743	0.0738	0.0450	0.0217	0.0027
1983	0.0477	0.1099	0.0422	0.0209	0.0123
1984	0.0331	0.0448	0.0442	0.0118	0.0055
1985	0.0137	0.0423	0.0289	0.0179	0.0036
1986	0.0041	0.0688	0.0226	0.0066	0.0043
1987	0.0074	0.0186	0.0260	0.0057	0.0018
1988	0.0146	0.0492	0.0242	0.0093	0.0015
1989	0.0170	0.0637	0.0397	0.0106	0.0023
1990	0.0110	0.1595	0.0782	0.0122	0.0051
1991	0.0194	0.0404	0.1355	0.0217	0.0039
1992	0.0149	0.0173	0.0138	0.0515	0.0052
1993	0.0027	0.0500	0.0232	0.0041	0.0140
1994	0.0000	0.0000	0.0000	0.0000	0.0000
1995	0.0000	0.0000	0.0000	0.0000	0.0000
1996	0.0000	0.0000	0.0000	0.0000	0.0000
1997	0.0000	0.0000	0.0000	0.0000	0.0000
1998	0.0000	0.0000	0.0000	0.0000	0.0000
1999	0.0000	0.0000	0.0000	0.0000	0.0000
2000	0.0000	0.0000	0.0000	0.0000	0.0000
2001	0.0000	0.0000	0.0000	0.0000	0.0000
2002	0.0000	0.0000	0.0000	0.0000	0.0000
2003	0.0000	0.0000	0.0000	0.0000	0.0000
2004	0.0000	0.0000	0.0000	0.0000	0.0000
2005	0.0000	0.0000	0.0000	0.0000	0.0000
2006	0.0000	0.0000	0.0000	0.0000	0.0000
2007	0.0000	0.0000	0.0000	0.0000	0.0000
2008	0.0000	0.0000	0.0000	0.0000	0.0000

Additional Output Files

Population File

C:\ALLWORK\ASSESS\GARMIIIAUG2008WG\ASSMT_MTG\GOMCOD\VPA\FINALS\G

Auxilliary File

C:\ALLWORK\ASSESS\GARMIIIAUG2008WG\ASSMT_MTG\GOMCOD\VPA\FINALS\G

Covariance File

C:\ALLWORK\ASSESS\GARMIIIAUG2008WG\ASSMT_MTG\GOMCOD\VPA\FINALS\G

Residuals File

C:\ALLWORK\ASSESS\GARMIIIAUG2008WG\ASSMT_MTG\GOMCOD\VPA\FINALS\G

Log File

C:\ALLWORK\ASSESS\GARMIIIAUG2008WG\ASSMT_MTG\GOMCOD\VPA\FINALS\G

Estimation Results

JAN-1 Population Numbers

AGE	1982	1983	1984	1985	1986
1	7857.	7929.	10674.	6679.	10260.
2	11123.	6368.	6481.	8717.	5428.
3	5520.	7314.	4015.	4581.	6174.
4	3128.	2329.	3348.	1856.	1771.
5	1767.	1274.	831.	1261.	491.
6	226.	771.	421.	255.	428.
7	260.	116.	222.	157.	88.
8	140.	124.	49.	111.	58.
9	71.	55.	42.	23.	62.
10	10.	21.	22.	21.	15.
11	79.	35.	36.	21.	113.
=====					
Total	30180.	26336.	26143.	23683.	24888.
=====					
AGE	1987	1988	1989	1990	1991
1	12744.	24612.	4254.	4135.	6975.
2	8388.	10347.	20148.	3480.	3386.
3	4276.	6063.	7974.	16026.	2620.
4	2560.	2306.	3038.	4465.	9388.
5	609.	734.	877.	935.	1434.
6	151.	185.	213.	276.	292.
7	170.	41.	107.	90.	66.
8	31.	63.	24.	50.	49.
9	20.	13.	35.	14.	14.
10	18.	4.	10.	26.	2.
11	5.	2.	13.	30.	2.
=====					
Total	28973.	44369.	36694.	29528.	24228.
=====					
AGE	1992	1993	1994	1995	1996
1	6340.	9123.	3180.	3805.	3545.
2	5711.	5191.	7469.	2603.	3099.
3	2375.	4369.	4134.	6066.	1880.
4	931.	1414.	1739.	2038.	3908.
5	3243.	281.	449.	323.	590.
6	332.	675.	104.	68.	54.
7	96.	73.	124.	21.	30.
8	12.	19.	34.	24.	5.
9	13.	3.	10.	1.	3.
10	4.	0.	1.	2.	0.
11	0.	0.	2.	0.	0.
=====					
Total	19057.	21148.	17245.	14951.	13113.

JAN-1 Population Numbers

AGE	1997	1998	1999	2000	2001
1	5245.	4458.	7847.	4016.	1187.
2	2902.	4294.	3650.	6424.	3288.
3	2455.	2299.	3419.	2969.	5077.
4	969.	1562.	1446.	2213.	1947.
5	1447.	381.	741.	670.	1063.
6	135.	414.	168.	360.	376.
7	11.	46.	166.	85.	205.
8	20.	4.	14.	64.	55.
9	3.	14.	0.	4.	46.
10	1.	2.	11.	0.	4.
11	0.	1.	0.	0.	2.
=====					
Total	13190.	13477.	17462.	16805.	13250.
=====					
AGE	2002	2003	2004	2005	2006
1	4953.	1681.	10966.	6713.	23910.
2	972.	4055.	1377.	8979.	5496.
3	2559.	793.	3305.	1126.	7344.
4	3086.	1860.	542.	2382.	801.
5	974.	1726.	1122.	218.	1214.
6	528.	484.	720.	548.	92.
7	209.	248.	187.	349.	209.
8	114.	98.	110.	86.	176.
9	37.	61.	44.	56.	41.
10	25.	22.	30.	19.	29.
11	2.	16.	9.	19.	23.
=====					
Total	13459.	11046.	18414.	20495.	39336.
=====					
AGE	2007	2008			
1	4808.	0.			
2	19576.	3937.			
3	4498.	16020.			
4	5852.	3543.			
5	401.	3970.			
6	587.	201.			
7	46.	251.			
8	83.	30.			
9	101.	47.			
10	17.	71.			
11	21.	19.			
=====					
Total	35992.	28090.			

Fishing Mortality Calculated

AGE	1982	1983	1984	1985	1986
1	0.0101	0.0016	0.0026	0.0074	0.0014
2	0.2192	0.2612	0.1470	0.1450	0.0386
3	0.6628	0.5814	0.5714	0.7503	0.6802
4	0.6981	0.8305	0.7769	1.1299	0.8676
5	0.6295	0.9064	0.9811	0.8800	0.9766
6	0.4723	1.0461	0.7862	0.8605	0.7259
7	0.5377	0.6505	0.4954	0.8028	0.8481
8	0.7294	0.8727	0.5657	0.3866	0.8646
9	1.0140	0.7010	0.4948	0.2139	1.0200
10	0.6088	0.9342	0.8265	0.8317	0.8523
11	0.6088	0.9342	0.8265	0.8317	0.8523
AGE	1987	1988	1989	1990	1991
1	0.0084	0.0001	0.0010	0.0000	0.0000
2	0.1247	0.0604	0.0289	0.0840	0.1545
3	0.4177	0.4909	0.3799	0.3348	0.8343
4	1.0499	0.7667	0.9783	0.9361	0.8630
5	0.9906	1.0384	0.9547	0.9634	1.2635
6	1.1023	0.3485	0.6584	1.2250	0.9179
7	0.7884	0.3576	0.5545	0.4021	1.5057
8	0.6852	0.3761	0.3568	1.0760	1.1140
9	1.4099	0.0904	0.0981	1.7050	0.9720
10	0.9568	0.7939	0.8422	0.9642	1.2033
11	0.9568	0.7939	0.8422	0.9642	1.2033
AGE	1992	1993	1994	1995	1996
1	0.0000	0.0000	0.0003	0.0053	0.0000
2	0.0677	0.0276	0.0080	0.1251	0.0326
3	0.3191	0.7214	0.5072	0.2397	0.4631
4	0.9977	0.9473	1.4838	1.0395	0.7934
5	1.3696	0.7941	1.6866	1.5888	1.2721
6	1.3085	1.4954	1.4035	0.6248	1.4090
7	1.4079	0.5791	1.4467	1.3241	0.1825
8	1.1311	0.4254	3.4380	1.9107	0.1292
9	8.8324	1.1807	1.2844	6.1427	0.6870
10	1.3641	1.1501	1.6321	1.3635	1.1851
11	1.3641	1.1501	1.6321	1.3635	1.1851

Fishing Mortality Calculated

AGE	1997	1998	1999	2000	2001
1	0.0000	0.0000	0.0002	0.0000	0.0000
2	0.0331	0.0281	0.0067	0.0352	0.0507
3	0.2522	0.2638	0.2347	0.2216	0.2979
4	0.7331	0.5461	0.5695	0.5337	0.4927
5	1.0524	0.6167	0.5220	0.3769	0.4994
6	0.8742	0.7161	0.4791	0.3620	0.3864
7	0.7168	0.9838	0.7526	0.2337	0.3888
8	0.1523	6.4333	0.9591	0.1311	0.1957
9	0.1066	0.0314	0.2164	0.0002	0.3866
10	1.0156	0.6873	0.5515	0.3465	0.4486
11	1.0156	0.6873	0.5515	0.3465	0.4486
AGE	2002	2003	2004	2005	2006
1	0.0000	0.0000	0.0000	0.0000	0.0000
2	0.0034	0.0045	0.0007	0.0009	0.0003
3	0.1189	0.1807	0.1274	0.1411	0.0271
4	0.3808	0.3053	0.7125	0.4741	0.4914
5	0.4985	0.6741	0.5164	0.6606	0.5260
6	0.5550	0.7507	0.5245	0.7653	0.4948
7	0.5582	0.6163	0.5806	0.4825	0.7225
8	0.4224	0.5975	0.4648	0.5426	0.3577
9	0.3310	0.4983	0.6597	0.4716	0.6789
10	0.5163	0.6793	0.5218	0.6406	0.5272
11	0.5163	0.6793	0.5218	0.6406	0.5272
AGE	2007				
1	0.0000				
2	0.0004				
3	0.0388				
4	0.1880				
5	0.4892				
6	0.6492				
7	0.2288				
8	0.3714				
9	0.1484				
10	0.4888				
11	0.4888				

Average Fishing Mortality For Ages 5- 7

Year Average F N Weighted Biomass Wtd Catch Wtd

1982	0.5465	0.6031	0.5896	0.6066
1983	0.8677	0.9426	0.9506	0.9488
1984	0.7543	0.8523	0.7919	0.8772
1985	0.8478	0.8698	0.8641	0.8702
1986	0.8502	0.8588	0.8383	0.8695
1987	0.9605	0.9719	0.9537	0.9778
1988	0.5815	0.8761	0.8204	0.9533
1989	0.7225	0.8662	0.8154	0.8839
1990	0.8635	0.9800	0.9711	1.0061
1991	1.2290	1.2161	1.1983	1.2252
1992	1.3620	1.3651	1.3643	1.3652
1993	0.9562	1.2385	1.2349	1.3016
1994	1.5123	1.5992	1.5540	1.6032
1995	1.1792	1.4161	1.3970	1.4752
1996	0.9545	1.2348	1.1860	1.2724
1997	0.8811	1.0350	1.0243	1.0369
1998	0.7722	0.6858	0.6925	0.6928
1999	0.5846	0.5508	0.5638	0.5605
2000	0.3242	0.3611	0.3550	0.3645
2001	0.4249	0.4598	0.4506	0.4648
2002	0.5373	0.5233	0.5298	0.5244
2003	0.6804	0.6834	0.6816	0.6848
2004	0.5405	0.5252	0.5285	0.5256
2005	0.6362	0.6564	0.6361	0.6736
2006	0.5811	0.5512	0.5613	0.5572
2007	0.4557	0.5685	0.5686	0.5845

Back Calculated Partial Recruitment

AGE	1982	1983	1984	1985	1986
1	0.0100	0.0015	0.0026	0.0065	0.0014
2	0.2162	0.2497	0.1498	0.1283	0.0378
3	0.6537	0.5557	0.5824	0.6641	0.6669
4	0.6884	0.7939	0.7918	1.0000	0.8506
5	0.6208	0.8665	1.0000	0.7789	0.9575
6	0.4658	1.0000	0.8013	0.7616	0.7116
7	0.5303	0.6218	0.5050	0.7105	0.8314
8	0.7194	0.8342	0.5766	0.3422	0.8477
9	1.0000	0.6700	0.5043	0.1893	1.0000
10	0.6004	0.8930	0.8424	0.7361	0.8356
11	0.6004	0.8930	0.8424	0.7361	0.8356
AGE	1987	1988	1989	1990	1991
1	0.0059	0.0001	0.0010	0.0000	0.0000
2	0.0884	0.0582	0.0296	0.0493	0.1026
3	0.2962	0.4727	0.3883	0.1964	0.5541
4	0.7446	0.7384	1.0000	0.5490	0.5731
5	0.7026	1.0000	0.9758	0.5650	0.8392
6	0.7818	0.3356	0.6730	0.7185	0.6096
7	0.5592	0.3444	0.5668	0.2358	1.0000
8	0.4860	0.3622	0.3647	0.6311	0.7399
9	1.0000	0.0871	0.1003	1.0000	0.6455
10	0.6786	0.7645	0.8608	0.5655	0.7992
11	0.6786	0.7645	0.8608	0.5655	0.7992
AGE	1992	1993	1994	1995	1996
1	0.0000	0.0000	0.0001	0.0009	0.0000
2	0.0077	0.0184	0.0023	0.0204	0.0232
3	0.0361	0.4824	0.1475	0.0390	0.3287
4	0.1130	0.6335	0.4316	0.1692	0.5631
5	0.1551	0.5310	0.4906	0.2587	0.9028
6	0.1481	1.0000	0.4082	0.1017	1.0000
7	0.1594	0.3872	0.4208	0.2156	0.1295
8	0.1281	0.2845	1.0000	0.3111	0.0917
9	1.0000	0.7896	0.3736	1.0000	0.4875
10	0.1544	0.7691	0.4747	0.2220	0.8411
11	0.1544	0.7691	0.4747	0.2220	0.8411

Back Calculated Partial Recruitment

AGE	1997	1998	1999	2000	2001
1	0.0000	0.0000	0.0002	0.0000	0.0000
2	0.0314	0.0044	0.0070	0.0660	0.1016
3	0.2396	0.0410	0.2448	0.4153	0.5965
4	0.6966	0.0849	0.5938	1.0000	0.9866
5	1.0000	0.0959	0.5442	0.7062	1.0000
6	0.8307	0.1113	0.4995	0.6782	0.7738
7	0.6812	0.1529	0.7847	0.4378	0.7784
8	0.1447	1.0000	1.0000	0.2457	0.3918
9	0.1013	0.0049	0.2256	0.0005	0.7741
10	0.9651	0.1068	0.5751	0.6493	0.8982
11	0.9651	0.1068	0.5751	0.6493	0.8982
AGE	2002	2003	2004	2005	2006
1	0.0000	0.0000	0.0000	0.0000	0.0000
2	0.0061	0.0060	0.0010	0.0012	0.0004
3	0.2129	0.2407	0.1788	0.1844	0.0374
4	0.6822	0.4067	1.0000	0.6195	0.6801
5	0.8931	0.8980	0.7248	0.8632	0.7280
6	0.9943	1.0000	0.7361	1.0000	0.6848
7	1.0000	0.8209	0.8148	0.6305	1.0000
8	0.7566	0.7959	0.6523	0.7090	0.4951
9	0.5929	0.6637	0.9258	0.6162	0.9396
10	0.9249	0.9049	0.7324	0.8370	0.7296
11	0.9249	0.9049	0.7324	0.8370	0.7296
AGE	2007				
1	0.0000				
2	0.0007				
3	0.0597				
4	0.2896				
5	0.7536				
6	1.0000				
7	0.3524				
8	0.5722				
9	0.2286				
10	0.7530				
11	0.7530				

JAN-1 Biomass

AGE	1982	1983	1984	1985	1986
1	3940.	2338.	3851.	2006.	2650.
2	10265.	5266.	4372.	6186.	3925.
3	7279.	9782.	5255.	5854.	8253.
4	7157.	4629.	6978.	3928.	3807.
5	7379.	4053.	2484.	4336.	1746.
6	1589.	4111.	1967.	1137.	2199.
7	2081.	712.	1546.	1062.	586.
8	1354.	1183.	370.	1057.	532.
9	924.	545.	491.	256.	762.
10	110.	273.	265.	272.	200.
11	1468.	629.	533.	293.	2210.
=====					
Total	43548.	33522.	28112.	26386.	26871.
AGE	1987	1988	1989	1990	1991
1	1213.	4031.	2294.	1021.	1501.
2	5170.	4611.	12442.	2985.	2374.
3	5631.	7799.	10274.	22786.	3384.
4	6071.	4421.	6861.	8887.	19014.
5	2269.	2931.	2651.	3278.	4352.
6	865.	1031.	997.	1475.	1629.
7	1284.	329.	816.	613.	563.
8	280.	647.	234.	519.	567.
9	238.	134.	446.	175.	181.
10	243.	61.	132.	377.	40.
11	71.	28.	312.	614.	26.
=====					
Total	23334.	26023.	37458.	42729.	33630.
AGE	1992	1993	1994	1995	1996
1	1560.	2082.	128.	439.	1200.
2	4591.	3651.	5665.	1125.	2015.
3	3606.	7350.	6061.	9564.	3274.
4	1914.	3057.	4039.	4471.	7962.
5	8877.	957.	1271.	1249.	1798.
6	1484.	2925.	536.	294.	329.
7	802.	519.	820.	172.	227.
8	130.	214.	345.	217.	56.
9	170.	41.	119.	12.	38.
10	66.	0.	13.	33.	0.
11	0.	0.	33.	6.	0.
=====					
Total	23202.	20795.	19031.	17583.	16899.

JAN-1 Biomass

AGE	1997	1998	1999	2000	2001
1	1201.	1037.	1190.	810.	273.
2	2964.	3246.	2730.	4724.	2820.
3	4540.	4408.	5426.	5195.	9981.
4	2475.	3923.	3333.	5547.	5259.
5	3888.	1352.	2450.	2258.	4277.
6	553.	1503.	823.	1686.	1987.
7	85.	230.	913.	503.	1321.
8	223.	42.	101.	500.	392.
9	47.	211.	0.	50.	393.
10	18.	36.	181.	0.	46.
11	4.	18.	0.	0.	37.
=====					
Total	15999.	16006.	17147.	21274.	26787.
AGE	2002	2003	2004	2005	2006
1	957.	372.	2346.	1187.	4507.
2	730.	3632.	1078.	7265.	5379.
3	5334.	1434.	7022.	1962.	14348.
4	8620.	5100.	1510.	6133.	2074.
5	3493.	6242.	3748.	811.	3957.
6	2787.	2235.	3303.	2223.	420.
7	1359.	1651.	1130.	1999.	1041.
8	1042.	751.	922.	630.	1215.
9	343.	683.	449.	559.	355.
10	245.	245.	360.	235.	325.
11	23.	214.	125.	276.	368.
=====					
Total	24934.	22558.	21993.	23280.	33992.
AGE	2007	2008			
1	906.	0.			
2	17977.	3551.			
3	10849.	32614.			
4	16359.	9401.			
5	1435.	13982.			
6	2491.	863.			
7	255.	1362.			
8	518.	204.			
9	886.	428.			
10	180.	819.			
11	304.	283.			
=====					
Total	52161.	63509.			

Mean Biomass

AGE	1982	1983	1984	1985	1986
1	4564.	3203.	4889.	2811.	3708.
2	10094.	5418.	5586.	7336.	5418.
3	5987.	8172.	4514.	4734.	7373.
4	5569.	3547.	5766.	2849.	3142.
5	5667.	2891.	1785.	3380.	1315.
6	1084.	2656.	1556.	853.	1681.
7	1605.	449.	1290.	780.	444.
8	890.	791.	336.	947.	385.
9	533.	363.	393.	240.	482.
10	67.	162.	196.	170.	128.
11	1007.	376.	333.	183.	1367.
Total	37067.	28028.	26644.	24281.	25443.
AGE	1987	1988	1989	1990	1991
1	2370.	7093.	2621.	1559.	2630.
2	6819.	8781.	21592.	3278.	3370.
3	4932.	7609.	10420.	20928.	2517.
4	4576.	3514.	5237.	6138.	14065.
5	1713.	2144.	1999.	2314.	3016.
6	606.	919.	615.	1091.	1306.
7	1026.	281.	677.	727.	309.
8	207.	529.	199.	335.	338.
9	130.	122.	440.	92.	116.
10	141.	45.	103.	222.	28.
11	42.	18.	194.	363.	14.
Total	22561.	31056.	44098.	37048.	27708.
AGE	1992	1993	1994	1995	1996
1	2390.	3440.	380.	942.	1889.
2	7786.	5520.	9326.	3144.	4266.
3	3613.	5199.	5358.	8820.	2946.
4	1488.	2016.	2491.	3110.	5723.
5	5039.	753.	675.	759.	1077.
6	855.	1982.	325.	258.	197.
7	451.	511.	436.	116.	258.
8	80.	187.	94.	114.	54.
9	20.	23.	55.	3.	28.
10	36.	0.	7.	24.	0.
11	0.	0.	15.	3.	0.
Total	21758.	19631.	19164.	17294.	16438.

Mean Biomass

AGE	1997	1998	1999	2000	2001
1	1978.	1685.	2375.	1514.	448.
2	4593.	5272.	4422.	9267.	5142.
3	4377.	3812.	5088.	5532.	9546.
4	1919.	3133.	2587.	5368.	4487.
5	2578.	1077.	2028.	2256.	3617.
6	398.	1144.	706.	1571.	1792.
7	59.	140.	768.	417.	1127.
8	198.	7.	83.	463.	382.
9	42.	241.	0.	52.	300.
10	11.	24.	107.	0.	33.
11	2.	12.	0.	0.	27.
=====					
Total	16154.	16548.	18164.	26440.	26901.
AGE	2002	2003	2004	2005	2006
1	1867.	634.	4135.	2531.	9015.
2	1193.	7074.	1838.	12803.	11470.
3	5386.	1589.	6595.	1964.	15933.
4	7652.	4466.	1146.	4910.	1885.
5	2822.	4602.	2922.	628.	3238.
6	2182.	1653.	2695.	1585.	321.
7	983.	1276.	895.	1578.	752.
8	976.	592.	753.	474.	1029.
9	294.	477.	349.	429.	262.
10	194.	179.	280.	170.	249.
11	17.	142.	89.	186.	261.
=====					
Total	23566.	22683.	21698.	27259.	44415.
AGE	2007				
1	1813.				
2	35957.				
3	10108.				
4	15629.				
5	1138.				
6	1898.				
7	238.				
8	447.				
9	862.				
10	144.				
11	220.				
=====					
Total	68452.				

Spawning Stock Biomass

AGE	1982	1983	1984	1985	1986
1	419.	158.	37.	19.	179.
2	3063.	1268.	866.	2102.	2226.
3	4035.	5238.	3928.	4797.	6913.
4	5361.	3431.	5870.	3147.	3186.
5	6169.	3270.	2040.	3621.	1435.
6	1406.	3307.	1669.	952.	1885.
7	1840.	618.	1377.	898.	492.
8	1160.	989.	326.	959.	446.
9	755.	469.	437.	239.	622.
10	96.	226.	223.	229.	168.
11	1283.	521.	449.	247.	1854.
Total	25587.	19494.	17223.	17211.	19406.
AGE	1987	1988	1989	1990	1991
1	35.	156.	155.	296.	145.
2	1910.	1854.	4192.	1452.	582.
3	4725.	6394.	7555.	15007.	1509.
4	4929.	3725.	5469.	6324.	12582.
5	1861.	2384.	2187.	2538.	3137.
6	696.	941.	864.	1128.	1311.
7	1089.	300.	719.	549.	420.
8	241.	587.	213.	420.	456.
9	182.	128.	424.	128.	148.
10	200.	52.	111.	310.	32.
11	58.	24.	262.	506.	21.
Total	15926.	16546.	22151.	28657.	20342.
AGE	1992	1993	1994	1995	1996
1	91.	121.	1.	0.	35.
2	834.	773.	1040.	160.	640.
3	1554.	3593.	4418.	8266.	2639.
4	1223.	2196.	3020.	3637.	6680.
5	6355.	786.	928.	927.	1406.
6	1131.	2183.	410.	256.	252.
7	607.	456.	623.	133.	213.
8	104.	193.	188.	153.	53.
9	38.	32.	93.	4.	32.
10	51.	0.	9.	26.	0.
11	0.	0.	24.	5.	0.
Total	11988.	10334.	10755.	13566.	11949.

Spawning Stock Biomass

AGE	1997	1998	1999	2000	2001
1	12.	60.	104.	110.	24.
2	456.	1125.	897.	1771.	757.
3	3326.	3345.	3634.	3438.	5603.
4	2098.	3361.	2727.	4467.	4030.
5	3155.	1180.	2129.	1990.	3654.
6	463.	1290.	735.	1519.	1784.
7	73.	189.	779.	468.	1198.
8	210.	14.	84.	473.	367.
9	45.	203.	0.	49.	357.
10	15.	31.	159.	0.	41.
11	3.	15.	0.	0.	33.
Total	9856.	10814.	11246.	14285.	17848.
AGE	2002	2003	2004	2005	2006
1	176.	54.	295.	34.	523.
2	289.	1334.	313.	773.	1665.
3	3440.	902.	3657.	630.	8704.
4	6729.	4079.	999.	3782.	1590.
5	2953.	5179.	2993.	632.	3366.
6	2408.	1889.	2810.	1855.	371.
7	1186.	1441.	982.	1767.	893.
8	939.	658.	826.	557.	1108.
9	314.	608.	389.	500.	307.
10	217.	211.	319.	204.	288.
11	21.	185.	111.	239.	326.
Total	18673.	16539.	13693.	10974.	19139.
AGE	2007				
1	70.				
2	5911.				
3	7924.				
4	14568.				
5	1267.				
6	2162.				
7	237.				
8	471.				
9	836.				
10	161.				
11	271.				
Total	33877.				

Catch Biomass

AGE	1982	1983	1984	1985	1986
1	46.	5.	12.	21.	5.
2	2201.	1407.	818.	1059.	209.
3	3918.	4697.	2551.	3503.	4951.
4	3837.	2901.	4415.	3155.	2683.
5	3525.	2578.	1721.	2927.	1261.
6	507.	2727.	1206.	722.	1203.
7	854.	289.	633.	617.	371.
8	640.	680.	188.	363.	328.
9	531.	251.	193.	51.	483.
10	41.	152.	162.	141.	109.
11	613.	352.	275.	152.	1165.
Total	16713.	16037.	12173.	12711.	12768.
AGE	1987	1988	1989	1990	1991
1	20.	1.	3.	0.	0.
2	847.	529.	623.	274.	518.
3	2042.	3698.	3927.	6956.	2068.
4	4715.	2656.	5034.	5649.	11948.
5	1667.	2186.	1876.	2191.	3728.
6	655.	318.	400.	1308.	1178.
7	797.	100.	372.	290.	453.
8	140.	197.	71.	354.	369.
9	179.	11.	43.	153.	111.
10	135.	36.	87.	214.	33.
11	40.	14.	163.	350.	17.
Total	11237.	9747.	12597.	17739.	20424.
AGE	1992	1993	1994	1995	1996
1	0.	0.	0.	5.	0.
2	526.	152.	75.	392.	139.
3	1145.	3700.	2691.	2102.	1352.
4	1458.	1878.	3604.	3173.	4474.
5	6740.	589.	1108.	1174.	1340.
6	1094.	2890.	446.	160.	271.
7	620.	293.	616.	150.	47.
8	89.	79.	308.	211.	7.
9	161.	27.	69.	15.	19.
10	49.	0.	11.	32.	0.
11	0.	0.	25.	4.	0.
Total	11881.	9607.	8952.	7419.	7648.

Catch Biomass

AGE	1997	1998	1999	2000	2001
1	0.	0.	0.	0.	0.
2	151.	148.	30.	326.	260.
3	1097.	1000.	1188.	1220.	2825.
4	1387.	1693.	1457.	2835.	2189.
5	2663.	656.	1048.	843.	1789.
6	342.	808.	335.	564.	687.
7	42.	136.	570.	97.	435.
8	30.	44.	78.	60.	74.
9	4.	8.	0.	0.	115.
10	11.	16.	59.	0.	15.
11	2.	8.	0.	0.	12.
Total	5731.	4517.	4765.	5946.	8401.
AGE	2002	2003	2004	2005	2006
1	0.	0.	0.	0.	0.
2	4.	32.	1.	12.	4.
3	638.	286.	837.	276.	430.
4	2891.	1354.	806.	2305.	917.
5	1393.	3063.	1494.	410.	1685.
6	1198.	1224.	1399.	1196.	157.
7	543.	777.	514.	754.	536.
8	409.	350.	347.	255.	365.
9	97.	235.	227.	200.	176.
10	100.	121.	146.	109.	131.
11	9.	97.	46.	119.	138.
Total	7281.	7538.	5818.	5637.	4540.
AGE	2007				
1	0.				
2	16.				
3	391.				
4	2924.				
5	551.				
6	1217.				
7	54.				
8	165.				
9	127.				
10	79.				
11	107.				
Total	5631.				

Catch Numbers

AGE	1982	1983	1984	1985	1986
1	71.4	11.3	24.7	44.3	12.8
2	1980.9	1324.4	801.5	1064.5	186.0
3	2420.3	2917.6	1581.5	2187.8	2756.8
4	1422.1	1189.0	1636.5	1137.1	929.6
5	747.1	687.2	470.1	667.5	277.0
6	77.1	452.6	207.6	133.2	199.9
7	97.7	50.0	78.4	78.5	45.7
8	65.6	65.4	19.3	32.1	30.2
9	41.0	25.2	15.0	4.0	35.6
10	4.0	11.8	11.6	11.0	8.0
11	33.0	19.4	18.4	11.0	59.5
Total	6960.2	6753.9	4864.6	5371.0	4541.1
AGE	1987	1988	1989	1990	1991
1	96.3	2.4	3.8	0.0	0.0
2	889.6	549.1	519.5	253.6	438.5
3	1321.0	2128.0	2280.6	4125.6	1341.1
4	1505.8	1117.1	1715.7	2455.9	4910.7
5	346.4	428.8	488.0	523.3	930.6
6	91.5	49.3	92.8	176.6	158.8
7	83.7	11.2	41.2	27.0	46.8
8	13.9	17.9	6.4	30.0	30.0
9	13.6	1.0	3.0	10.0	7.9
10	10.3	2.0	5.0	15.0	1.3
11	3.0	1.0	7.0	17.0	1.0
Total	4375.1	4307.8	5163.0	7634.0	7866.7
AGE	1992	1993	1994	1995	1996
1	0.0	0.0	0.9	18.1	0.0
2	338.3	127.8	54.0	277.0	90.0
3	587.1	2031.8	1488.2	1169.9	630.7
4	531.9	783.0	1216.6	1192.0	1936.7
5	2188.4	139.4	330.9	232.5	384.3
6	219.1	473.8	71.0	28.6	36.9
7	65.3	29.2	85.7	13.9	4.5
8	7.4	6.0	29.5	18.4	0.5
9	12.0	2.0	6.7	0.8	1.3
10	3.0	0.0	0.6	1.6	0.0
11	0.0	0.0	1.2	0.2	0.0
Total	3952.5	3593.0	3285.3	2953.0	3084.9

Catch Numbers

AGE	1997	1998	1999	2000	2001
1	0.0	0.0	1.2	0.0	0.0
2	85.4	107.5	22.1	201.1	147.2
3	495.2	482.4	647.2	534.0	1183.5
4	455.5	594.8	568.0	828.3	685.5
5	852.4	158.7	272.6	190.3	378.0
6	71.4	191.4	58.0	98.9	109.1
7	5.0	26.2	79.2	16.1	59.8
8	2.6	3.9	7.9	7.1	8.9
9	0.3	0.4	0.0	0.0	13.3
10	0.7	1.1	4.4	0.0	1.2
11	0.1	0.4	0.0	0.0	0.5
Total	1968.6	1566.8	1660.6	1875.8	2587.0
AGE	2002	2003	2004	2005	2006
1	0.0	0.0	0.0	0.0	0.0
2	3.0	16.4	0.9	7.5	1.6
3	259.5	118.6	357.8	134.1	177.4
4	884.3	442.9	249.9	813.8	281.3
5	346.0	766.1	409.6	95.2	449.3
6	203.5	231.4	266.0	265.3	32.5
7	81.0	103.3	74.6	120.9	97.2
8	35.5	39.9	36.9	32.5	48.0
9	9.5	21.7	19.3	19.2	18.2
10	9.4	9.9	11.3	8.1	10.8
11	0.6	7.4	3.5	8.3	8.8
Total	1832.3	1757.6	1429.8	1504.9	1125.1
AGE	2007				
1	0.0				
2	7.9				
3	154.8				
4	907.5				
5	140.4				
6	253.8				
7	8.5				
8	23.3				
9	12.6				
10	6.7				
11	7.5				
Total	1523.0				

Surplus Production

Average Adjustment Factor (Delta) = 1.0000

Year	Biomass	Delta Biomass	Catch Biomass	Surplus Production
1982	43548.026	-10025.750	16713.307	6687.557
1983	33522.276	-5409.948	16037.051	10627.104
1984	28112.328	-1726.717	12173.486	10446.769
1985	26385.612	485.726	12711.449	13197.175
1986	26871.338	-3537.308	12768.471	9231.163
1987	23334.030	2688.560	11236.780	13925.340
1988	26022.590	11435.443	9746.789	21182.231
1989	37458.032	5271.009	12597.429	17868.438
1990	42729.041	-9098.808	17738.869	8640.060
1991	33630.233	-10428.550	20423.898	9995.348
1992	23201.683	-2406.842	11880.954	9474.111
1993	20794.841	-1764.240	9606.844	7842.605
1994	19030.601	-1447.956	8951.516	7503.559
1995	17582.645	-683.721	7418.520	6734.799
1996	16898.923	-899.757	7648.280	6748.523
1997	15999.167	6.556	5731.013	5737.569
1998	16005.723	1141.654	4516.532	5658.186
1999	17147.377	4126.627	4764.652	8891.279
2000	21274.004	5513.172	5945.694	11458.866
2001	26787.176	-1853.416	8401.230	6547.813
2002	24933.760	-2375.296	7280.581	4905.285
2003	22558.464	-565.860	7538.329	6972.469
2004	21992.604	1287.872	5817.528	7105.401
2005	23280.477	10711.086	5637.061	16348.146
2006	33991.562	18168.941	4540.123	22709.064
2007	52160.503	11348.568	5631.217	16979.785
2008	63509.071			

Summary of Survey Indices Used in the Estimate

INDEX	Survey Tag	Age	Time	Type	Catchability	Std. Error	CV
1	WHSpr	2	JAN-1	NUMBER	0.6391E-04	0.9883E-05	0.1546E+00
2	WHSpr	3	JAN-1	NUMBER	0.1319E-03	0.1415E-04	0.1073E+00
3	WHSpr	4	JAN-1	NUMBER	0.2250E-03	0.2283E-04	0.1015E+00
4	WHSpr	5	JAN-1	NUMBER	0.2940E-03	0.3869E-04	0.1316E+00
5	WHSpr	6	JAN-1	NUMBER	0.3828E-03	0.6419E-04	0.1677E+00
6	WHSpr	7	JAN-1	NUMBER	0.5666E-03	0.1096E-03	0.1934E+00
7	WHSpr	8	JAN-1	NUMBER	0.5118E-03	0.1396E-03	0.2728E+00
8	WHAut	2	JAN-1	NUMBER	0.5338E-04	0.6870E-05	0.1287E+00
9	WHAut	3	JAN-1	NUMBER	0.1136E-03	0.1287E-04	0.1133E+00
10	WHAut	4	JAN-1	NUMBER	0.2238E-03	0.2260E-04	0.1010E+00
11	WHAut	5	JAN-1	NUMBER	0.3703E-03	0.4638E-04	0.1253E+00
12	WHAut	6	JAN-1	NUMBER	0.4782E-03	0.5653E-04	0.1182E+00
13	WHAut	7	JAN-1	NUMBER	0.4512E-03	0.8364E-04	0.1854E+00
14	WHAut	8	JAN-1	NUMBER	0.5668E-03	0.1292E-03	0.2279E+00
15	MASpr	2	JAN-1	NUMBER	0.7106E-03	0.1074E-03	0.1512E+00
16	MASpr	3	JAN-1	NUMBER	0.5446E-03	0.4749E-04	0.8720E-01
17	MASpr	4	JAN-1	NUMBER	0.4537E-03	0.5623E-04	0.1239E+00
19	MAAut	2	JAN-1	NUMBER	0.1230E-03	0.3679E-04	0.2992E+00
21	CM_CPE	2	MEAN	NUMBER	0.2458E-05	0.6900E-06	0.2807E+00
22	CM_CPE	3	MEAN	NUMBER	0.1406E-04	0.1646E-05	0.1171E+00
23	CM_CPE	4	MEAN	NUMBER	0.2317E-04	0.1281E-05	0.5530E-01
24	CM_CPE	5	MEAN	NUMBER	0.2291E-04	0.1239E-05	0.5410E-01
25	CM_CPE	6	MEAN	NUMBER	0.2187E-04	0.2466E-05	0.1128E+00

Survey Index: 1 Tag: WHSpr AGE = 2
Time = JAN-1 Type = NUMBER
Catchability = 0.639060E-04 % Variance Contribution = 6.0022
Residual = LN(Observed) - LN(Predicted)

Year	Observed	Predicted	Residual
1982	0.100650E+01	0.710799E+00	0.347845E+00
1983	0.948600E+00	0.406955E+00	0.846285E+00
1984	0.131200E+01	0.414194E+00	0.115297E+01
1985	0.230800E+00	0.557076E+00	-0.881151E+00
1986	0.247800E+00	0.346899E+00	-0.336413E+00
1987	0.460200E+00	0.536073E+00	-0.152610E+00
1988	0.923400E+00	0.661229E+00	0.333963E+00
1989	0.604800E+00	0.128761E+01	-0.755643E+00
1990	0.207600E+00	0.222378E+00	-0.687655E-01
1991	0.678000E-01	0.216374E+00	-0.116045E+01
1992	0.225500E+00	0.364946E+00	-0.481430E+00
1993	0.496500E+00	0.331710E+00	0.403323E+00
1994	0.315600E+00	0.477323E+00	-0.413717E+00
1995	0.179200E+00	0.166337E+00	0.744872E-01
1996	0.215000E-01	0.198014E+00	-0.222029E+01
1997	0.131600E+00	0.185482E+00	-0.343192E+00
1998	0.223600E+00	0.274436E+00	-0.204860E+00
1999	0.344300E+00	0.233272E+00	0.389310E+00
2000	0.724700E+00	0.410507E+00	0.568365E+00
2001	0.323400E+00	0.210131E+00	0.431157E+00
2002	0.453000E-01	0.621130E-01	-0.315648E+00
2003	0.830500E+00	0.259133E+00	0.116469E+01
2004	0.446000E-01	0.879742E-01	-0.679310E+00
2005	0.726500E+00	0.573787E+00	0.235981E+00
2006	0.230000E+00	0.351219E+00	-0.423332E+00
2007	0.345000E+01	0.125103E+01	0.101441E+01
2008	0.109860E+01	0.251582E+00	0.147402E+01

Survey Index: 2 Tag: WHSpr AGE = 3
Time = JAN-1 Type = NUMBER
Catchability = 0.131940E-03 % Variance Contribution = 2.8875
Residual = LN(Observed) - LN(Predicted)

Year	Observed	Predicted	Residual
1982	0.476400E+00	0.728272E+00	-0.424417E+00
1983	0.996800E+00	0.965009E+00	0.324129E-01
1984	0.102260E+01	0.529782E+00	0.657637E+00
1985	0.661700E+00	0.604445E+00	0.905019E-01
1986	0.754000E+00	0.814568E+00	-0.772658E-01
1987	0.199100E+00	0.564175E+00	-0.104156E+01
1988	0.822900E+00	0.799946E+00	0.282904E-01
1989	0.723000E+00	0.105215E+01	-0.375184E+00
1990	0.136540E+01	0.211448E+01	-0.437363E+00

1991	0.233900E+00	0.345620E+00	-0.390447E+00
1992	0.242400E+00	0.313398E+00	-0.256884E+00
1993	0.799300E+00	0.576498E+00	0.326764E+00
1994	0.387500E+00	0.545448E+00	-0.341891E+00
1995	0.111610E+01	0.800395E+00	0.332491E+00
1996	0.592700E+00	0.248098E+00	0.870866E+00
1997	0.399100E+00	0.323968E+00	0.208567E+00
1998	0.330100E+00	0.303334E+00	0.845609E-01
1999	0.713300E+00	0.451059E+00	0.458304E+00
2000	0.438500E+00	0.391672E+00	0.112936E+00
2001	0.716100E+00	0.669891E+00	0.667046E-01
2002	0.524400E+00	0.337622E+00	0.440328E+00
2003	0.630000E-01	0.104634E+00	-0.507337E+00
2004	0.221300E+00	0.436067E+00	-0.678277E+00
2005	0.101400E+00	0.148600E+00	-0.382182E+00
2006	0.430000E+00	0.969003E+00	-0.812483E+00
2007	0.293000E+01	0.593492E+00	0.159673E+01
2008	0.321120E+01	0.211373E+01	0.418189E+00

Survey Index: 3 Tag: WHSpr AGE = 4
 Time = JAN-1 Type = NUMBER
 Catchability = 0.225008E-03 % Variance Contribution = 2.5836
 Residual = LN(Observed) - LN(Predicted)

Year	Observed	Predicted	Residual
1982	0.655400E+00	0.703819E+00	-0.712760E-01
1983	0.464700E+00	0.524085E+00	-0.120261E+00
1984	0.823300E+00	0.753380E+00	0.887512E-01
1985	0.662500E+00	0.417720E+00	0.461208E+00
1986	0.236900E+00	0.398528E+00	-0.520139E+00
1987	0.230700E+00	0.576066E+00	-0.915104E+00
1988	0.217900E+00	0.518778E+00	-0.867439E+00
1989	0.600100E+00	0.683671E+00	-0.130380E+00
1990	0.637000E+00	0.100474E+01	-0.455718E+00
1991	0.171670E+01	0.211239E+01	-0.207415E+00
1992	0.281900E+00	0.209529E+00	0.296690E+00
1993	0.334300E+00	0.318050E+00	0.498311E-01
1994	0.215000E+00	0.391268E+00	-0.598755E+00
1995	0.371700E+00	0.458588E+00	-0.210066E+00
1996	0.133070E+01	0.879362E+00	0.414264E+00
1997	0.264300E+00	0.217998E+00	0.192599E+00
1998	0.516600E+00	0.351519E+00	0.385006E+00
1999	0.344500E+00	0.325315E+00	0.573012E-01
2000	0.457000E+00	0.498022E+00	-0.859616E-01
2001	0.497200E+00	0.438150E+00	0.126431E+00
2002	0.160120E+01	0.694378E+00	0.835492E+00
2003	0.707700E+00	0.418570E+00	0.525175E+00
2004	0.118100E+00	0.121949E+00	-0.320709E-01
2005	0.607600E+00	0.536011E+00	0.125362E+00
2006	0.600000E-01	0.180179E+00	-0.109961E+01
2007	0.448000E+01	0.131685E+01	0.122438E+01
2008	0.135660E+01	0.797144E+00	0.531701E+00

Survey Index: 4 Tag: WHSpr AGE = 5

Time = JAN-1 Type = NUMBER
Catchability = 0.293998E-03 % Variance Contribution = 4.3467
Residual = LN(Observed) - LN(Predicted)

Year	Observed	Predicted	Residual
1982	0.987700E+00	0.519630E+00	0.642261E+00
1983	0.404200E+00	0.374612E+00	0.760188E-01
1984	0.211800E+00	0.244348E+00	-0.142951E+00
1985	0.661700E+00	0.370595E+00	0.579702E+00
1986	0.912000E-01	0.144370E+00	-0.459325E+00
1987	0.744000E-01	0.179037E+00	-0.878139E+00
1988	0.253500E+00	0.215680E+00	0.161567E+00
1989	0.908000E-01	0.257798E+00	-0.104352E+01
1990	0.102000E+00	0.274954E+00	-0.991631E+00
1991	0.299300E+00	0.421518E+00	-0.342417E+00
1992	0.132810E+01	0.953406E+00	0.331464E+00
1993	0.906000E-01	0.826501E-01	0.918379E-01
1994	0.942000E-01	0.131944E+00	-0.336956E+00
1995	0.145400E+00	0.949236E-01	0.426416E+00
1996	0.403200E+00	0.173484E+00	0.843345E+00
1997	0.875600E+00	0.425507E+00	0.721628E+00
1998	0.141500E+00	0.112034E+00	0.233500E+00
1999	0.315000E+00	0.217813E+00	0.368937E+00
2000	0.107100E+00	0.196910E+00	-0.608983E+00
2001	0.353900E+00	0.312421E+00	0.124663E+00
2002	0.614200E+00	0.286360E+00	0.763072E+00
2003	0.108890E+01	0.507578E+00	0.763274E+00
2004	0.190800E+00	0.329950E+00	-0.547717E+00
2005	0.154000E-01	0.639780E-01	-0.142417E+01
2006	0.200000E+00	0.356917E+00	-0.579186E+00
2007	0.500000E+00	0.117918E+00	0.144462E+01
2008	0.939300E+00	0.116730E+01	-0.217316E+00

Survey Index: 5 Tag: WHSpr AGE = 6
Time = JAN-1 Type = NUMBER
Catchability = 0.382779E-03 % Variance Contribution = 6.5351
Residual = LN(Observed) - LN(Predicted)

Year	Observed	Predicted	Residual
1982	0.873000E-01	0.866418E-01	0.756783E-02
1983	0.211800E+00	0.295150E+00	-0.331842E+00
1984	0.467000E-01	0.161312E+00	-0.123959E+01
1985	0.103100E+00	0.976474E-01	0.543368E-01
1986	0.349000E-01	0.163853E+00	-0.154648E+01
1987	N/A	0.579545E-01	N/A
1988	0.915000E-01	0.708719E-01	0.255464E+00
1989	0.627000E-01	0.813926E-01	-0.260923E+00
1990	0.321000E-01	0.105784E+00	-0.119255E+01
1991	0.200000E-01	0.111846E+00	-0.172139E+01
1992	0.226400E+00	0.127010E+00	0.578037E+00
1993	0.484200E+00	0.258344E+00	0.628205E+00

1994	0.493000E-01	0.398210E-01	0.213530E+00
1995	0.283000E-01	0.260400E-01	0.832277E-01
1996	0.593000E-01	0.206587E-01	0.105447E+01
1997	0.242400E+00	0.518259E-01	0.154270E+01
1998	0.421000E+00	0.158347E+00	0.977847E+00
1999	0.133700E+00	0.644584E-01	0.729578E+00
2000	0.100600E+00	0.137766E+00	-0.314404E+00
2001	0.635000E-01	0.143989E+00	-0.818698E+00
2002	0.361900E+00	0.202110E+00	0.582556E+00
2003	0.394600E+00	0.185413E+00	0.755288E+00
2004	0.231600E+00	0.275722E+00	-0.174380E+00
2005	0.149800E+00	0.209851E+00	-0.337097E+00
2006	0.200000E-01	0.352258E-01	-0.566047E+00
2007	0.840000E+00	0.224846E+00	0.131798E+01
2008	0.584000E-01	0.770687E-01	-0.277382E+00

Survey Index: 6 Tag: WHSpr AGE = 7
Time = JAN-1 Type = NUMBER
Catchability = 0.566609E-03 % Variance Contribution = 8.0244
Residual = LN(Observed) - LN(Predicted)

Year	Observed	Predicted	Residual
1982	0.112000E+00	0.147101E+00	-0.272622E+00
1983	0.680000E-01	0.654754E-01	0.378336E-01
1984	0.100000E+00	0.125658E+00	-0.228392E+00
1985	0.910000E-01	0.890640E-01	0.215047E-01
1986	0.380000E-01	0.500514E-01	-0.275465E+00
1987	0.660000E-01	0.960915E-01	-0.375647E+00
1988	0.650000E-01	0.233256E-01	0.102484E+01
1989	0.140000E-01	0.606162E-01	-0.146550E+01
1990	0.180000E-01	0.510645E-01	-0.104272E+01
1991	0.180000E-01	0.376623E-01	-0.738287E+00
1992	0.690000E-01	0.541349E-01	0.242628E+00
1993	0.550000E-01	0.415969E-01	0.279308E+00
1994	0.127000E+00	0.701825E-01	0.593088E+00
1995	N/A	0.118593E-01	N/A
1996	N/A	0.168957E-01	N/A
1997	0.120000E+00	0.611869E-02	0.297614E+01
1998	0.230000E-01	0.262033E-01	-0.130392E+00
1999	0.273000E+00	0.937761E-01	0.106856E+01
2000	0.240000E-01	0.483830E-01	-0.701095E+00
2001	0.980000E-01	0.116258E+00	-0.170841E+00
2002	0.164000E+00	0.118570E+00	0.324362E+00
2003	0.321000E+00	0.140611E+00	0.825446E+00
2004	0.140000E-01	0.106071E+00	-0.202505E+01
2005	0.129700E+00	0.197780E+00	-0.421929E+00
2006	0.131400E+00	0.118308E+00	0.104954E+00
2007	0.652000E-01	0.260288E-01	0.918257E+00
2008	0.806000E-01	0.142377E+00	-0.568982E+00

Survey Index: 7 Tag: WHSpr AGE = 8
Time = JAN-1 Type = NUMBER
Catchability = 0.511812E-03 % Variance Contribution = 5.5891
Residual = LN(Observed) - LN(Predicted)

Year	Observed	Predicted	Residual
1982	N/A	0.716573E-01	N/A
1983	0.160000E-01	0.635433E-01	-0.137913E+01
1984	N/A	0.252670E-01	N/A
1985	0.520000E-01	0.566227E-01	-0.851666E-01
1986	N/A	0.295134E-01	N/A
1987	0.800000E-02	0.158516E-01	-0.683828E+00
1988	N/A	0.323025E-01	N/A
1989	N/A	0.120637E-01	N/A
1990	N/A	0.257487E-01	N/A
1991	N/A	0.252609E-01	N/A
1992	N/A	0.617975E-02	N/A
1993	0.230000E-01	0.979461E-02	0.853662E+00
1994	0.270000E-01	0.172403E-01	0.448589E+00
1995	0.110000E-01	0.122153E-01	-0.104793E+00
1996	N/A	0.233333E-02	N/A
1997	N/A	0.104113E-01	N/A
1998	0.370000E-01	0.220955E-02	0.281813E+01
1999	N/A	0.724529E-02	N/A
2000	0.220000E-01	0.326741E-01	-0.395540E+00
2001	0.550000E-01	0.283257E-01	0.663565E+00
2002	0.570000E-01	0.582846E-01	-0.222870E-01
2003	0.103000E+00	0.501770E-01	0.719173E+00
2004	0.140000E-01	0.561498E-01	-0.138897E+01
2005	0.142000E-01	0.438969E-01	-0.112860E+01
2006	0.729000E-01	0.902784E-01	-0.213810E+00
2007	0.384000E-01	0.424809E-01	-0.100996E+00
2008	N/A	0.153132E-01	N/A

Survey Index: 8 Tag: WHAut AGE = 2
 Time = JAN-1 Type = NUMBER
 Catchability = 0.533836E-04 % Variance Contribution = 4.1570
 Residual = LN(Observed) - LN(Predicted)

Year	Observed	Predicted	Residual
1982	0.617900E+00	0.593763E+00	0.398469E-01
1983	0.842600E+00	0.339948E+00	0.907700E+00
1984	0.316800E+00	0.345995E+00	-0.881533E-01
1985	0.432300E+00	0.465351E+00	-0.736728E-01
1986	0.525600E+00	0.289781E+00	0.595416E+00
1987	0.392000E+00	0.447806E+00	-0.133099E+00
1988	0.578200E+00	0.552354E+00	0.457300E-01
1989	0.193750E+01	0.107560E+01	0.588523E+00
1990	0.149500E+00	0.185762E+00	-0.217172E+00
1991	0.447000E-01	0.180747E+00	-0.139713E+01
1992	0.143500E+00	0.304856E+00	-0.753505E+00
1993	0.291000E+00	0.277092E+00	0.489726E-01
1994	0.197700E+00	0.398729E+00	-0.701532E+00
1995	0.207100E+00	0.138949E+00	0.399096E+00
1996	0.680000E-01	0.165410E+00	-0.888921E+00

1997	0.124200E+00	0.154942E+00	-0.221156E+00
1998	0.296800E+00	0.229249E+00	0.258249E+00
1999	0.966000E-01	0.194862E+00	-0.701715E+00
2000	0.430700E+00	0.342915E+00	0.227929E+00
2001	0.532600E+00	0.175532E+00	0.110995E+01
2002	0.340000E-01	0.518858E-01	-0.422685E+00
2003	0.269100E+00	0.216466E+00	0.217651E+00
2004	0.454600E+00	0.734888E-01	0.182228E+01
2005	0.570000E+00	0.479310E+00	0.173289E+00
2006	0.153300E+00	0.293389E+00	-0.649104E+00
2007	0.125140E+01	0.104504E+01	0.180205E+00
2008	0.145600E+00	0.210158E+00	-0.366997E+00

Survey Index: 9 Tag: WHAut AGE = 3
 Time = JAN-1 Type = NUMBER
 Catchability = 0.113582E-03 % Variance Contribution = 3.2202
 Residual = LN(Observed) - LN(Predicted)

Year	Observed	Predicted	Residual
1982	0.418800E+00	0.626938E+00	-0.403454E+00
1983	0.335270E+01	0.830735E+00	0.139521E+01
1984	0.915500E+00	0.456067E+00	0.696831E+00
1985	0.425800E+00	0.520341E+00	-0.200514E+00
1986	0.956700E+00	0.701227E+00	0.310658E+00
1987	0.401000E+00	0.485674E+00	-0.191576E+00
1988	0.137960E+01	0.688639E+00	0.694831E+00
1989	0.231340E+01	0.905753E+00	0.937707E+00
1990	0.240650E+01	0.182027E+01	0.279189E+00
1991	0.186800E+00	0.297530E+00	-0.465475E+00
1992	0.139000E+00	0.269791E+00	-0.663173E+00
1993	0.445800E+00	0.496283E+00	-0.107275E+00
1994	0.567800E+00	0.469552E+00	0.189989E+00
1995	0.883100E+00	0.689026E+00	0.248160E+00
1996	0.284500E+00	0.213577E+00	0.286737E+00
1997	0.382600E+00	0.278890E+00	0.316172E+00
1998	0.855000E-01	0.261127E+00	-0.111649E+01
1999	0.320300E+00	0.388297E+00	-0.192513E+00
2000	0.367200E+00	0.337173E+00	0.853095E-01
2001	0.983700E+00	0.576681E+00	0.534032E+00
2002	0.141000E+00	0.290644E+00	-0.723340E+00
2003	0.805000E-01	0.900753E-01	-0.112388E+00
2004	0.197600E+00	0.375392E+00	-0.641725E+00
2005	0.170000E+00	0.127923E+00	0.284370E+00
2006	0.380600E+00	0.834173E+00	-0.784692E+00
2007	0.580200E+00	0.510912E+00	0.127176E+00
2008	0.831000E+00	0.181962E+01	-0.783754E+00

Survey Index: 10 Tag: WHAut AGE = 4
 Time = JAN-1 Type = NUMBER
 Catchability = 0.223833E-03 % Variance Contribution = 2.5584
 Residual = LN(Observed) - LN(Predicted)

Year	Observed	Predicted	Residual
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1982	0.539400E+00	0.700144E+00	-0.260829E+00
1983	0.227480E+01	0.521348E+00	0.147323E+01
1984	0.827700E+00	0.749446E+00	0.993165E-01
1985	0.630700E+00	0.415539E+00	0.417253E+00
1986	0.609400E+00	0.396447E+00	0.429933E+00
1987	0.656500E+00	0.573058E+00	0.135936E+00
1988	0.592100E+00	0.516069E+00	0.137435E+00
1989	0.989600E+00	0.680101E+00	0.375060E+00
1990	0.150170E+01	0.999498E+00	0.407100E+00
1991	0.182930E+01	0.210136E+01	-0.138650E+00
1992	0.223300E+00	0.208435E+00	0.688890E-01
1993	0.140000E+00	0.316389E+00	-0.815330E+00
1994	0.360200E+00	0.389225E+00	-0.774982E-01
1995	0.826000E+00	0.456194E+00	0.593677E+00
1996	0.122840E+01	0.874770E+00	0.339506E+00
1997	0.188300E+00	0.216860E+00	-0.141214E+00
1998	0.176900E+00	0.349683E+00	-0.681443E+00
1999	0.114700E+00	0.323616E+00	-0.103724E+01
2000	0.585700E+00	0.495422E+00	0.167398E+00
2001	0.393600E+00	0.435862E+00	-0.101991E+00
2002	0.752400E+00	0.690752E+00	0.854870E-01
2003	0.363700E+00	0.416385E+00	-0.135280E+00
2004	0.184800E+00	0.121312E+00	0.420907E+00
2005	0.540000E+00	0.533212E+00	0.126500E-01
2006	0.796000E-01	0.179239E+00	-0.811704E+00
2007	0.103310E+01	0.130997E+01	-0.237443E+00
2008	0.384000E+00	0.792982E+00	-0.725158E+00

Survey Index: 11 Tag: WHAut AGE = 5
 Time = JAN-1 Type = NUMBER
 Catchability = 0.370258E-03 % Variance Contribution = 3.9388
 Residual = LN(Observed) - LN(Predicted)

Year	Observed	Predicted	Residual
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1982	0.404700E+00	0.654418E+00	-0.480600E+00
1983	0.108920E+01	0.471783E+00	0.836679E+00
1984	0.197000E+00	0.307730E+00	-0.446019E+00
1985	0.387100E+00	0.466724E+00	-0.187056E+00
1986	0.248200E+00	0.181818E+00	0.311227E+00
1987	0.341700E+00	0.225478E+00	0.415710E+00
1988	0.242900E+00	0.271626E+00	-0.111776E+00
1989	0.443400E+00	0.324668E+00	0.311669E+00
1990	0.292600E+00	0.346275E+00	-0.168426E+00
1991	0.597800E+00	0.530856E+00	0.118765E+00
1992	0.633400E+00	0.120071E+01	-0.639567E+00
1993	0.355000E-01	0.104089E+00	-0.107571E+01
1994	0.336000E-01	0.166169E+00	-0.159848E+01
1995	0.854000E-01	0.119546E+00	-0.336355E+00
1996	0.325200E+00	0.218485E+00	0.397724E+00
1997	0.542100E+00	0.535880E+00	0.115407E-01
1998	0.172800E+00	0.141094E+00	0.202706E+00

1999	0.192300E+00	0.274311E+00	-0.355207E+00
2000	0.243300E+00	0.247987E+00	-0.190795E-01
2001	0.507100E+00	0.393460E+00	0.253728E+00
2002	0.469000E+00	0.360639E+00	0.262726E+00
2003	0.279720E+01	0.639239E+00	0.147610E+01
2004	0.528700E+00	0.415537E+00	0.240850E+00
2005	0.240000E+00	0.805733E-01	0.109147E+01
2006	0.449500E+00	0.449498E+00	0.419220E-05
2007	0.247500E+00	0.148504E+00	0.510796E+00
2008	0.528300E+00	0.147009E+01	-0.102342E+01

Survey Index: 12 Tag: WHAut AGE = 6
Time = JAN-1 Type = NUMBER
Catchability = 0.478237E-03 % Variance Contribution = 3.2474
Residual = LN(Observed) - LN(Predicted)

Year	Observed	Predicted	Residual
1982	0.120500E+00	0.108249E+00	0.107218E+00
1983	0.209200E+00	0.368755E+00	-0.566843E+00
1984	0.227000E+00	0.201540E+00	0.118962E+00
1985	0.214000E+00	0.121999E+00	0.561964E+00
1986	0.182000E+00	0.204715E+00	-0.117612E+00
1987	0.727000E-01	0.724073E-01	0.403470E-02
1988	0.751000E-01	0.885462E-01	-0.164703E+00
1989	0.990000E-01	0.101691E+00	-0.268141E-01
1990	0.160500E+00	0.132165E+00	0.194241E+00
1991	0.258900E+00	0.139739E+00	0.616666E+00
1992	0.811000E-01	0.158684E+00	-0.671232E+00
1993	0.349800E+00	0.322771E+00	0.804195E-01
1994	N/A	0.497516E-01	N/A
1995	0.511000E-01	0.325339E-01	0.451501E+00
1996	0.821000E-01	0.258107E-01	0.115715E+01
1997	0.616000E-01	0.647504E-01	-0.498781E-01
1998	0.140200E+00	0.197835E+00	-0.344366E+00
1999	0.387000E-01	0.805332E-01	-0.732830E+00
2000	0.132000E+00	0.172122E+00	-0.265404E+00
2001	0.134300E+00	0.179897E+00	-0.292311E+00
2002	0.336800E+00	0.252513E+00	0.288028E+00
2003	0.109580E+01	0.231651E+00	0.155401E+01
2004	0.449800E+00	0.344482E+00	0.266762E+00
2005	0.250000E+00	0.262184E+00	-0.475867E-01
2006	0.221000E-01	0.440105E-01	-0.688851E+00
2007	0.285700E+00	0.280919E+00	0.168753E-01
2008	0.226000E-01	0.962883E-01	-0.144940E+01

Survey Index: 13 Tag: WHAut AGE = 7
Time = JAN-1 Type = NUMBER
Catchability = 0.451154E-03 % Variance Contribution = 5.1610
Residual = LN(Observed) - LN(Predicted)

Year	Observed	Predicted	Residual
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1982	0.760000E-01	0.117127E+00	-0.432526E+00
1983	N/A	0.521337E-01	N/A
1984	0.210000E+00	0.100053E+00	0.741407E+00
1985	0.163000E+00	0.709158E-01	0.832257E+00
1986	0.750000E-01	0.398527E-01	0.632299E+00
1987	0.410000E-01	0.765114E-01	-0.623868E+00
1988	N/A	0.185726E-01	N/A
1989	0.650000E-01	0.482647E-01	0.297687E+00
1990	0.330000E-01	0.406593E-01	-0.208720E+00
1991	0.520000E-01	0.299880E-01	0.550447E+00
1992	N/A	0.431041E-01	N/A
1993	0.104000E+00	0.331209E-01	0.114423E+01
1994	0.300000E-01	0.558817E-01	-0.622040E+00
1995	N/A	0.944275E-02	N/A
1996	0.110000E-01	0.134530E-01	-0.201304E+00
1997	N/A	0.487191E-02	N/A
1998	N/A	0.208640E-01	N/A
1999	0.310000E-01	0.746677E-01	-0.879061E+00
2000	0.160000E-01	0.385242E-01	-0.878698E+00
2001	0.100000E-01	0.925683E-01	-0.222536E+01
2002	0.122000E+00	0.944096E-01	0.256378E+00
2003	0.627000E+00	0.111959E+00	0.172281E+01
2004	0.730000E-01	0.844571E-01	-0.145784E+00
2005	0.168000E+00	0.157479E+00	0.646722E-01
2006	0.923000E-01	0.942010E-01	-0.203867E-01
2007	0.339000E-01	0.207250E-01	0.492075E+00
2008	0.690000E-01	0.113366E+00	-0.496513E+00

Survey Index: 14 Tag: WHAut AGE = 8
 Time = JAN-1 Type = NUMBER
 Catchability = 0.566767E-03 % Variance Contribution = 3.3797
 Residual = LN(Observed) - LN(Predicted)

Year	Observed	Predicted	Residual
1982	0.290000E-01	0.793514E-01	-0.100659E+01
1983	N/A	0.703661E-01	N/A
1984	N/A	0.279800E-01	N/A
1985	0.790000E-01	0.627025E-01	0.231047E+00
1986	N/A	0.326824E-01	N/A
1987	N/A	0.175536E-01	N/A
1988	N/A	0.357710E-01	N/A
1989	0.330000E-01	0.133590E-01	0.904319E+00
1990	N/A	0.285135E-01	N/A
1991	0.100000E-01	0.279732E-01	-0.102866E+01
1992	0.230000E-01	0.684329E-02	0.121223E+01
1993	0.800000E-02	0.108463E-01	-0.304381E+00
1994	N/A	0.190914E-01	N/A
1995	0.450000E-01	0.135269E-01	0.120198E+01
1996	N/A	0.258387E-02	N/A
1997	N/A	0.115292E-01	N/A
1998	N/A	0.244679E-02	N/A
1999	N/A	0.802324E-02	N/A
2000	0.600000E-02	0.361824E-01	-0.179681E+01
2001	N/A	0.313671E-01	N/A

2002	0.840000E-01	0.645428E-01	0.263488E+00
2003	0.510000E-01	0.555646E-01	-0.857210E-01
2004	0.770000E-01	0.621788E-01	0.213791E+00
2005	0.680000E-01	0.486102E-01	0.335674E+00
2006	0.824000E-01	0.999719E-01	-0.193304E+00
2007	0.496000E-01	0.470422E-01	0.529461E-01
2008	N/A	0.169574E-01	N/A

Survey Index: 15 Tag: MASpr AGE = 2
Time = JAN-1 Type = NUMBER
Catchability = 0.710558E-03 % Variance Contribution = 5.3115
Residual = LN(Observed) - LN(Predicted)

Year	Observed	Predicted	Residual
1982	0.717000E+01	0.790323E+01	-0.973656E-01
1983	0.146100E+02	0.452485E+01	0.117212E+01
1984	0.515000E+01	0.460534E+01	0.111781E+00
1985	0.277000E+01	0.619402E+01	-0.804737E+00
1986	0.116800E+02	0.385710E+01	0.110796E+01
1987	0.471000E+01	0.596049E+01	-0.235465E+00
1988	0.635000E+01	0.735207E+01	-0.146526E+00
1989	0.205100E+02	0.143166E+02	0.359490E+00
1990	0.545000E+01	0.247258E+01	0.790355E+00
1991	0.269000E+01	0.240582E+01	0.111650E+00
1992	0.513000E+01	0.405776E+01	0.234474E+00
1993	0.611000E+01	0.368821E+01	0.504785E+00
1994	0.407000E+01	0.530725E+01	-0.265432E+00
1995	0.192000E+01	0.184947E+01	0.374282E-01
1996	0.520000E+00	0.220168E+01	-0.144315E+01
1997	0.980000E+00	0.206234E+01	-0.744044E+00
1998	0.830000E+00	0.305140E+01	-0.130193E+01
1999	0.239000E+01	0.259370E+01	-0.817915E-01
2000	0.702000E+01	0.456434E+01	0.430489E+00
2001	0.450000E+01	0.233641E+01	0.655462E+00
2002	0.260000E+00	0.690622E+00	-0.976910E+00
2003	0.127000E+02	0.288125E+01	0.148338E+01
2004	0.156000E+01	0.978167E+00	0.466761E+00
2005	0.715000E+01	0.637981E+01	0.113973E+00
2006	0.367000E+01	0.390514E+01	-0.621009E-01
2007	0.336000E+01	0.139099E+02	-0.142066E+01
2008	N/A	0.279729E+01	N/A

Survey Index: 16 Tag: MASpr AGE = 3
Time = JAN-1 Type = NUMBER
Catchability = 0.544643E-03 % Variance Contribution = 1.7670
Residual = LN(Observed) - LN(Predicted)

Year	Observed	Predicted	Residual
1982	0.241000E+01	0.300628E+01	-0.221075E+00
1983	0.286000E+01	0.398352E+01	-0.331343E+00
1984	0.207000E+01	0.218692E+01	-0.549455E-01

1985	0.227000E+01	0.249512E+01	-0.945583E-01
1986	0.123000E+01	0.336250E+01	-0.100567E+01
1987	0.296000E+01	0.232889E+01	0.239797E+00
1988	0.245000E+01	0.330214E+01	-0.298484E+00
1989	0.876000E+01	0.434324E+01	0.701575E+00
1990	0.147500E+02	0.872850E+01	0.524649E+00
1991	0.157000E+01	0.142671E+01	0.957073E-01
1992	0.367000E+01	0.129369E+01	0.104269E+01
1993	0.255000E+01	0.237976E+01	0.690935E-01
1994	0.175000E+01	0.225159E+01	-0.252019E+00
1995	0.276000E+01	0.330400E+01	-0.179902E+00
1996	0.108000E+01	0.102414E+01	0.531105E-01
1997	0.930000E+00	0.133733E+01	-0.363243E+00
1998	0.700000E+00	0.125215E+01	-0.581537E+00
1999	0.231000E+01	0.186195E+01	0.215622E+00
2000	0.289000E+01	0.161680E+01	0.580805E+00
2001	0.497000E+01	0.276528E+01	0.586277E+00
2002	0.123000E+01	0.139369E+01	-0.124940E+00
2003	0.280000E+00	0.431926E+00	-0.433466E+00
2004	0.258000E+01	0.180007E+01	0.359965E+00
2005	0.570000E+00	0.613413E+00	-0.734015E-01
2006	0.338000E+01	0.400001E+01	-0.168420E+00
2007	0.184000E+01	0.244991E+01	-0.286285E+00
2008	N/A	0.872540E+01	N/A

Survey Index: 17 Tag: MASpr AGE = 4
 Time = JAN-1 Type = NUMBER
 Catchability = 0.453706E-03 % Variance Contribution = 3.5692
 Residual = LN(Observed) - LN(Predicted)

Year	Observed	Predicted	Residual
1982	0.870000E+00	0.141918E+01	-0.489343E+00
1983	0.150000E+01	0.105676E+01	0.350253E+00
1984	0.700000E+00	0.151912E+01	-0.774803E+00
1985	0.450000E+00	0.842292E+00	-0.626879E+00
1986	0.680000E+00	0.803591E+00	-0.166998E+00
1987	0.220000E+00	0.116158E+01	-0.166391E+01
1988	0.145000E+01	0.104606E+01	0.326529E+00
1989	0.106000E+01	0.137855E+01	-0.262766E+00
1990	0.231000E+01	0.202597E+01	0.131201E+00
1991	0.366000E+01	0.425942E+01	-0.151669E+00
1992	0.750000E+00	0.422495E+00	0.573897E+00
1993	0.900000E+00	0.641316E+00	0.338873E+00
1994	0.490000E+00	0.788953E+00	-0.476302E+00
1995	0.780000E+00	0.924698E+00	-0.170173E+00
1996	0.149000E+01	0.177315E+01	-0.173979E+00
1997	0.170000E+00	0.439571E+00	-0.950001E+00
1998	0.750000E+00	0.708803E+00	0.564961E-01
1999	0.780000E+00	0.655965E+00	0.173187E+00
2000	0.220000E+01	0.100421E+01	0.784254E+00
2001	0.352000E+01	0.883486E+00	0.138234E+01
2002	0.141000E+01	0.140014E+01	0.701462E-02
2003	0.143000E+01	0.844005E+00	0.527271E+00
2004	0.460000E+00	0.245898E+00	0.626310E+00

2005	0.207000E+01	0.108081E+01	0.649835E+00
2006	0.540000E+00	0.363314E+00	0.396302E+00
2007	0.175000E+01	0.265530E+01	-0.416941E+00
2008	N/A	0.160736E+01	N/A

Survey Index: 19 Tag: MAAut AGE = 2
Time = JAN-1 Type = NUMBER
Catchability = 0.122958E-03 % Variance Contribution = 22.4734
Residual = LN(Observed) - LN(Predicted)

Year	Observed	Predicted	Residual
1982	0.620000E+01	0.136761E+01	0.151149E+01
1983	0.114000E+01	0.782999E+00	0.375653E+00
1984	0.280000E+00	0.796927E+00	-0.104597E+01
1985	0.160000E+00	0.107184E+01	-0.190196E+01
1986	0.190000E+00	0.667449E+00	-0.125644E+01
1987	0.550000E+00	0.103143E+01	-0.628782E+00
1988	0.140000E+01	0.127223E+01	0.956991E-01
1989	0.310000E+01	0.247741E+01	0.224188E+00
1990	0.200000E-01	0.427865E+00	-0.306308E+01
1991	0.422000E+01	0.416314E+00	0.231615E+01
1992	0.200000E+01	0.702172E+00	0.104672E+01
1993	0.990000E+00	0.638224E+00	0.439016E+00
1994	0.153000E+01	0.918390E+00	0.510401E+00
1995	0.536000E+01	0.320039E+00	0.281828E+01
1996	0.800000E+00	0.380988E+00	0.741845E+00
1997	0.800000E-01	0.356876E+00	-0.149536E+01
1998	0.300000E-01	0.528027E+00	-0.286795E+01
1999	0.640000E+00	0.448825E+00	0.354836E+00
2000	0.590000E+00	0.789833E+00	-0.291699E+00
2001	0.400000E+00	0.404302E+00	-0.106976E-01
2002	0.100000E-01	0.119508E+00	-0.248080E+01
2003	0.109000E+01	0.498583E+00	0.782162E+00
2004	0.160000E+01	0.169266E+00	0.224629E+01
2005	0.994000E+01	0.110399E+01	0.219764E+01
2006	0.610000E+00	0.675761E+00	-0.102381E+00
2007	0.435000E+01	0.240704E+01	0.591780E+00
2008	0.160000E+00	0.484055E+00	-0.110702E+01

Survey Index: 21 Tag: CM_CPE AGE = 2
Time = MEAN Type = NUMBER
Catchability = 0.245830E-05 % Variance Contribution = 3.7184
Residual = LN(Observed) - LN(Predicted)

Year	Observed	Predicted	Residual
1982	0.743000E-01	0.223352E-01	0.120195E+01
1983	0.477000E-01	0.125412E-01	0.133591E+01
1984	0.331000E-01	0.134627E-01	0.899610E+00
1985	0.137000E-01	0.181238E-01	-0.279829E+00
1986	0.410000E-02	0.118717E-01	-0.106317E+01
1987	0.740000E-02	0.176086E-01	-0.866906E+00

1988	0.146000E-01	0.223933E-01	-0.427740E+00
1989	0.170000E-01	0.442708E-01	-0.957113E+00
1990	0.110000E-01	0.744697E-02	0.390088E+00
1991	0.194000E-01	0.700807E-02	0.101821E+01
1992	0.149000E-01	0.123165E-01	0.190425E+00
1993	0.270000E-02	0.114122E-01	-0.144143E+01
1994	N/A	0.165774E-01	N/A
1995	N/A	0.546252E-02	N/A
1996	N/A	0.679601E-02	N/A
1997	N/A	0.636459E-02	N/A
1998	N/A	0.943961E-02	N/A
1999	N/A	0.810664E-02	N/A
2000	N/A	0.140715E-01	N/A
2001	N/A	0.714947E-02	N/A
2002	N/A	0.216199E-02	N/A
2003	N/A	0.901510E-02	N/A
2004	N/A	0.306613E-02	N/A
2005	N/A	0.199960E-01	N/A
2006	N/A	0.122433E-01	N/A
2007	N/A	0.436076E-01	N/A
2008	N/A	0.000000E+00	N/A

Survey Index: 22 Tag: CM_CPE AGE = 3
 Time = MEAN Type = NUMBER
 Catchability = 0.140563E-04 % Variance Contribution = 0.6469
 Residual = LN(Observed) - LN(Predicted)

Year	Observed	Predicted	Residual
1982	0.738000E-01	0.519778E-01	0.350541E+00
1983	0.109900E+00	0.713423E-01	0.432082E+00
1984	0.448000E-01	0.393360E-01	0.130068E+00
1985	0.423000E-01	0.415634E-01	0.175677E-01
1986	0.688000E-01	0.577049E-01	0.175861E+00
1987	0.186000E-01	0.448396E-01	-0.879930E+00
1988	0.492000E-01	0.615373E-01	-0.223750E+00
1989	0.637000E-01	0.850584E-01	-0.289154E+00
1990	0.159500E+00	0.174475E+00	-0.897392E-01
1991	0.404000E-01	0.229452E-01	0.565723E+00
1992	0.173000E-01	0.260461E-01	-0.409160E+00
1993	0.500000E-01	0.401303E-01	0.219891E+00
1994	N/A	0.416566E-01	N/A
1995	N/A	0.689939E-01	N/A
1996	N/A	0.193218E-01	N/A
1997	N/A	0.277652E-01	N/A
1998	N/A	0.258572E-01	N/A
1999	N/A	0.389707E-01	N/A
2000	N/A	0.340461E-01	N/A
2001	N/A	0.562158E-01	N/A
2002	N/A	0.307978E-01	N/A
2003	N/A	0.927102E-02	N/A
2004	N/A	0.396172E-01	N/A
2005	N/A	0.134136E-01	N/A
2006	N/A	0.923518E-01	N/A
2007	N/A	0.562457E-01	N/A

2008 N/A 0.000000E+00 N/A

Survey Index: 23 Tag: CM_CPE AGE = 4
Time = MEAN Type = NUMBER
Catchability = 0.231650E-04 % Variance Contribution = 0.1443
Residual = LN(Observed) - LN(Predicted)

Year	Observed	Predicted	Residual
1982	0.450000E-01	0.478168E-01	-0.607149E-01
1983	0.422000E-01	0.336756E-01	0.225646E+00
1984	0.442000E-01	0.495054E-01	-0.113356E+00
1985	0.289000E-01	0.237841E-01	0.194823E+00
1986	0.226000E-01	0.252171E-01	-0.109574E+00
1987	0.260000E-01	0.338541E-01	-0.263964E+00
1988	0.242000E-01	0.342353E-01	-0.346903E+00
1989	0.397000E-01	0.413480E-01	-0.406733E-01
1990	0.782000E-01	0.618167E-01	0.235096E+00
1991	0.135500E+00	0.133920E+00	0.117317E-01
1992	0.138000E-01	0.125736E-01	0.930706E-01
1993	0.232000E-01	0.194789E-01	0.174818E+00
1994	N/A	0.194817E-01	N/A
1995	N/A	0.270618E-01	N/A
1996	N/A	0.573865E-01	N/A
1997	N/A	0.145917E-01	N/A
1998	N/A	0.255037E-01	N/A
1999	N/A	0.233620E-01	N/A
2000	N/A	0.363291E-01	N/A
2001	N/A	0.325446E-01	N/A
2002	N/A	0.542248E-01	N/A
2003	N/A	0.338284E-01	N/A
2004	N/A	0.823436E-02	N/A
2005	N/A	0.401443E-01	N/A
2006	N/A	0.133912E-01	N/A
2007	N/A	0.112368E+00	N/A
2008	N/A	0.000000E+00	N/A

Survey Index: 24 Tag: CM_CPE AGE = 5
Time = MEAN Type = NUMBER
Catchability = 0.229116E-04 % Variance Contribution = 0.1381
Residual = LN(Observed) - LN(Predicted)

Year	Observed	Predicted	Residual
1982	0.217000E-01	0.275207E-01	-0.237626E+00
1983	0.209000E-01	0.176589E-01	0.168507E+00
1984	0.118000E-01	0.111738E-01	0.545269E-01
1985	0.179000E-01	0.176601E-01	0.134932E-01
1986	0.660000E-02	0.661394E-02	-0.211032E-02
1987	0.570000E-02	0.815593E-02	-0.358279E+00
1988	0.930000E-02	0.963858E-02	-0.357593E-01
1989	0.106000E-01	0.119158E-01	-0.117011E+00
1990	0.122000E-01	0.126640E-01	-0.373282E-01

1991	0.217000E-01	0.172514E-01	0.229419E+00
1992	0.515000E-01	0.374843E-01	0.317659E+00
1993	0.410000E-02	0.408155E-02	0.450955E-02
1994	N/A	0.462407E-02	N/A
1995	N/A	0.344415E-02	N/A
1996	N/A	0.707689E-02	N/A
1997	N/A	0.189098E-01	N/A
1998	N/A	0.596659E-02	N/A
1999	N/A	0.120896E-01	N/A
2000	N/A	0.116604E-01	N/A
2001	N/A	0.175142E-01	N/A
2002	N/A	0.160594E-01	N/A
2003	N/A	0.263716E-01	N/A
2004	N/A	0.183585E-01	N/A
2005	N/A	0.334331E-02	N/A
2006	N/A	0.197757E-01	N/A
2007	N/A	0.664047E-02	N/A
2008	N/A	0.000000E+00	N/A

Survey Index: 25 Tag: CM_CPE AGE = 6
 Time = MEAN Type = NUMBER
 Catchability = 0.218712E-04 % Variance Contribution = 0.6002
 Residual = LN(Observed) - LN(Predicted)

Year	Observed	Predicted	Residual
1982	0.270000E-02	0.360420E-02	-0.288849E+00
1983	0.123000E-01	0.964092E-02	0.243583E+00
1984	0.550000E-02	0.586004E-02	-0.634079E-01
1985	0.360000E-02	0.343923E-02	0.456871E-01
1986	0.430000E-02	0.610563E-02	-0.350596E+00
1987	0.180000E-02	0.185134E-02	-0.281215E-01
1988	0.150000E-02	0.311688E-02	-0.731367E+00
1989	0.230000E-02	0.312149E-02	-0.305403E+00
1990	0.510000E-02	0.322153E-02	0.459384E+00
1991	0.390000E-02	0.384759E-02	0.135296E-01
1992	0.520000E-02	0.374652E-02	0.327830E+00
1993	0.140000E-01	0.710875E-02	0.677731E+00
1994	N/A	0.113347E-02	N/A
1995	N/A	0.101323E-02	N/A
1996	N/A	0.586834E-03	N/A
1997	N/A	0.181507E-02	N/A
1998	N/A	0.592501E-02	N/A
1999	N/A	0.267336E-02	N/A
2000	N/A	0.602197E-02	N/A
2001	N/A	0.622466E-02	N/A
2002	N/A	0.810640E-02	N/A
2003	N/A	0.683689E-02	N/A
2004	N/A	0.112083E-01	N/A
2005	N/A	0.769048E-02	N/A
2006	N/A	0.145083E-02	N/A
2007	N/A	0.865748E-02	N/A
2008	N/A	0.000000E+00	N/A

Retrospective Summary

Average Fishing Mortality
Ages = 5 - 7

	1982	1983	1984	1985	1986
2000	0.5465	0.8677	0.7543	0.8478	0.8502
2001	0.5465	0.8677	0.7543	0.8478	0.8502
2002	0.5465	0.8677	0.7543	0.8478	0.8502
2003	0.5465	0.8677	0.7543	0.8478	0.8502
2004	0.5465	0.8677	0.7543	0.8478	0.8502
2005	0.5465	0.8677	0.7543	0.8478	0.8502
2006	0.5465	0.8677	0.7543	0.8478	0.8502
2007	0.5465	0.8677	0.7543	0.8478	0.8502
	1987	1988	1989	1990	1991
2000	0.9605	0.5815	0.7225	0.8636	1.2294
2001	0.9605	0.5815	0.7225	0.8636	1.2293
2002	0.9605	0.5815	0.7225	0.8635	1.2291
2003	0.9605	0.5815	0.7225	0.8635	1.2291
2004	0.9605	0.5815	0.7225	0.8635	1.2290
2005	0.9605	0.5815	0.7225	0.8635	1.2290
2006	0.9605	0.5815	0.7225	0.8635	1.2290
2007	0.9605	0.5815	0.7225	0.8635	1.2290
	1992	1993	1994	1995	1996
2000	1.3627	0.9571	1.5425	1.2239	0.9161
2001	1.3625	0.9573	1.5339	1.2157	0.9634
2002	1.3622	0.9561	1.5204	1.1878	0.9567
2003	1.3622	0.9560	1.5177	1.1824	0.9581
2004	1.3620	0.9562	1.5125	1.1795	0.9547
2005	1.3620	0.9562	1.5129	1.1805	0.9547
2006	1.3620	0.9562	1.5126	1.1798	0.9544
2007	1.3620	0.9562	1.5123	1.1792	0.9545
	1997	1998	1999	2000	2001
2000	0.8377	0.7034	0.9794	0.6104	
2001	0.9143	0.8529	0.8262	0.4132	0.5330
2002	0.8658	0.7592	0.6060	0.3896	0.4672
2003	0.8847	0.7648	0.6037	0.3519	0.4961
2004	0.8827	0.7733	0.5875	0.3281	0.4329
2005	0.8822	0.7751	0.5902	0.3273	0.4269
2006	0.8812	0.7724	0.5870	0.3253	0.4212
2007	0.8811	0.7722	0.5846	0.3242	0.4249
	2002	2003	2004	2005	2006

2000					
2001					
2002	0.4124				
2003	0.5813	0.6681			
2004	0.5697	0.7016	0.5905		
2005	0.5559	0.7256	0.6259	0.7789	
2006	0.5399	0.6962	0.5950	0.6406	0.5204
2007	0.5373	0.6804	0.5405	0.6362	0.5811

2007

2000	
2001	
2002	
2003	
2004	
2005	
2006	
2007	0.4557

Spawning Stock Biomass

	1982	1983	1984	1985	1986
2000	25587.	19494.	17223.	17211.	19406.
2001	25587.	19494.	17223.	17211.	19406.
2002	25587.	19494.	17223.	17211.	19406.
2003	25587.	19494.	17223.	17211.	19406.
2004	25587.	19494.	17223.	17211.	19406.
2005	25587.	19494.	17223.	17211.	19406.
2006	25587.	19494.	17223.	17211.	19406.
2007	25587.	19494.	17223.	17211.	19406.

	1987	1988	1989	1990	1991
2000	15926.	16545.	22151.	28655.	20339.
2001	15926.	16545.	22151.	28655.	20340.
2002	15926.	16545.	22151.	28657.	20341.
2003	15926.	16546.	22151.	28657.	20342.
2004	15926.	16546.	22151.	28657.	20342.
2005	15926.	16546.	22151.	28657.	20342.
2006	15926.	16546.	22151.	28657.	20342.
2007	15926.	16546.	22151.	28657.	20342.

	1992	1993	1994	1995	1996
2000	11980.	10322.	10777.	13478.	11705.
2001	11981.	10317.	10715.	13398.	11662.
2002	11986.	10329.	10755.	13618.	11931.
2003	11986.	10329.	10746.	13549.	11943.

2004	11988.	10333.	10754.	13559.	11945.
2005	11988.	10333.	10754.	13560.	11938.
2006	11988.	10334.	10754.	13563.	11945.
2007	11988.	10334.	10755.	13566.	11949.

1997	1998	1999	2000	2001
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2000	9131.	9363.	9755.	14042.	
2001	9324.	10068.	10821.	15431.	21475.
2002	9657.	10652.	11773.	16946.	24018.
2003	9717.	10561.	10951.	14173.	18544.
2004	9843.	10759.	11163.	14180.	17858.
2005	9838.	10781.	11189.	14139.	17624.
2006	9848.	10813.	11253.	14254.	17787.
2007	9856.	10814.	11246.	14285.	17848.

2002	2003	2004	2005	2006
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2000					
2001					
2002	28693.				
2003	20609.	19609.			
2004	18896.	17307.	15989.		
2005	18427.	16431.	14089.	11691.	
2006	18623.	16760.	14633.	12359.	23403.
2007	18673.	16539.	13693.	10974.	19139.

2007

2000	
2001	
2002	
2003	
2004	
2005	
2006	
2007	33877.

Total Population Numbers

1982	1983	1984	1985	1986
------	------	------	------	------

2000	30180.	26336.	26143.	23683.	24887.
2001	30180.	26336.	26143.	23683.	24888.
2002	30180.	26336.	26143.	23683.	24888.
2003	30180.	26336.	26143.	23683.	24888.
2004	30180.	26336.	26143.	23683.	24888.
2005	30180.	26336.	26143.	23683.	24888.
2006	30180.	26336.	26143.	23683.	24888.
2007	30180.	26336.	26143.	23683.	24888.

	1987	1988	1989	1990	1991
2000	28973.	44369.	36693.	29511.	24213.
2001	28973.	44369.	36692.	29517.	24218.
2002	28973.	44369.	36694.	29523.	24223.
2003	28973.	44369.	36694.	29524.	24224.
2004	28973.	44369.	36694.	29528.	24228.
2005	28973.	44369.	36694.	29528.	24228.
2006	28973.	44369.	36694.	29528.	24228.
2007	28973.	44369.	36694.	29528.	24228.
	1992	1993	1994	1995	1996
2000	19138.	21034.	17098.	14371.	12093.
2001	19048.	20992.	17068.	14585.	12614.
2002	19056.	21210.	17252.	14746.	12884.
2003	19053.	21133.	17279.	14801.	12935.
2004	19057.	21141.	17245.	14946.	13064.
2005	19057.	21143.	17237.	14941.	13090.
2006	19057.	21146.	17242.	14946.	13107.
2007	19057.	21148.	17245.	14951.	13113.
	1997	1998	1999	2000	2001
2000	12119.	13858.	20971.	23393.	17455.
2001	13018.	14774.	21508.	21509.	16376.
2002	13744.	15306.	23309.	23087.	17810.
2003	13035.	13170.	18732.	18600.	14407.
2004	13154.	13306.	17668.	17029.	13255.
2005	13184.	13334.	17312.	16718.	13046.
2006	13237.	13419.	17396.	16748.	13203.
2007	13190.	13477.	17462.	16805.	13250.
	2002	2003	2004	2005	2006
2000					
2001	11067.				
2002	26285.	19865.			
2003	17077.	17114.	12418.		
2004	15583.	14068.	32769.	25539.	
2005	14224.	12041.	21034.	20889.	15743.
2006	14567.	12623.	21874.	23736.	45200.
2007	13459.	11046.	18414.	20495.	39336.
	2007	2008			
2000					
2001					
2002					
2003					
2004					
2005					

2006	35989.	
2007	35992.	28090.

Age 1 Population

	1982	1983	1984	1985	1986
2000	7857.	7929.	10674.	6679.	10260.
2001	7857.	7929.	10674.	6679.	10260.
2002	7857.	7929.	10674.	6679.	10260.
2003	7857.	7929.	10674.	6679.	10260.
2004	7857.	7929.	10674.	6679.	10260.
2005	7857.	7929.	10674.	6679.	10260.
2006	7857.	7929.	10674.	6679.	10260.
2007	7857.	7929.	10674.	6679.	10260.
	1987	1988	1989	1990	1991
2000	12744.	24612.	4253.	4119.	6975.
2001	12744.	24612.	4253.	4125.	6975.
2002	12744.	24612.	4254.	4130.	6975.
2003	12744.	24612.	4255.	4131.	6975.
2004	12744.	24612.	4254.	4135.	6975.
2005	12744.	24612.	4254.	4135.	6975.
2006	12744.	24612.	4254.	4135.	6975.
2007	12744.	24612.	4254.	4135.	6975.
	1992	1993	1994	1995	1996
2000	6432.	8943.	3126.	3345.	3000.
2001	6338.	8975.	3131.	3583.	3345.
2002	6343.	9185.	3137.	3593.	3484.
2003	6339.	9110.	3227.	3627.	3490.
2004	6340.	9116.	3185.	3800.	3500.
2005	6340.	9117.	3177.	3802.	3529.
2006	6340.	9121.	3179.	3802.	3542.
2007	6340.	9123.	3180.	3805.	3545.
	1997	1998	1999	2000	2001
2000	5009.	5716.	11044.	7729.	0.
2001	5482.	5896.	10831.	5406.	461.
2002	5987.	5834.	12196.	5510.	603.
2003	5236.	4278.	9369.	4770.	875.
2004	5249.	4317.	8193.	4071.	1008.
2005	5258.	4321.	7814.	4052.	1054.
2006	5298.	4362.	7828.	4013.	1187.
2007	5245.	4458.	7847.	4016.	1187.
	2002	2003	2004	2005	2006

2000					
2001	0.				
2002	14045.	0.			
2003	7623.	4786.	0.		
2004	7073.	2963.	22845.	0.	
2005	5884.	2050.	12772.	4959.	0.
2006	6099.	2351.	13136.	7120.	27113.
2007	4953.	1681.	10966.	6713.	23910.
	2007	2008			

2000		
2001		
2002		
2003		
2004		
2005		
2006	0.	
2007	4808.	0.

In the Retrospective Analysis
The Following Survey Indices Have Predicted
Index Value Set to Zero in Terminal Year + 1

21	CM_CPE	2
22	CM_CPE	3
23	CM_CPE	4
24	CM_CPE	5
25	CM_CPE	6

Plus Group Diagnostic Report

Calculation Method Selected = Backward

Year	Population Backward	Population Forward	F Forward	F Backward	Ratio
1982	79.	79.	0.608762	0.608767	1.000008
1983	35.	39.	0.766578	0.934198	1.218659
1984	36.	22.	2.291808	0.826495	0.360630
1985	21.	13.	2.078124	0.831755	0.400243
1986	113.	73.	2.078124	0.852354	0.410155
1987	5.	6.	0.850480	0.956793	1.125004
1988	2.	8.	0.154090	0.793893	5.152153
1989	13.	9.	2.078124	0.842203	0.405271
1990	30.	21.	2.078124	0.964334	0.464041
1991	2.	8.	0.141677	1.203395	8.493906
1992	0.	6.	0.000172	1.364201	7931.037707
1993	0.	6.	0.000179	1.151373	6429.218887
1994	2.	5.	0.302683	1.679343	5.548194
1995	0.	3.	0.072010	1.408175	19.555209
1996	0.	3.	0.000384	1.075723	2801.841399
1997	0.	2.	0.047990	1.074636	22.392985
1998	1.	2.	0.227801	0.769676	3.378726
1999	0.	2.	0.000490	0.810592	1655.235816
2000	0.	5.	0.000221	0.640350	2892.159780
2001	0.	4.	N/A	N/A	

Warning **** Infeasible Mass Balance in Plus Group

Year = 1986

Year = 1989

Year = 1990

Year = 1994

Year = 1997

Bootstrap Summary Report

Number of Bootstrap Repetitions Requested = 1000

Number of Bootstrap Repetitions Completed = 1000

Bootstrap Output Variable: Stock Estimates (2008)

	NLLS Estimate	Bootstrap Mean	Bootstrap Std Error	C.V. For NLLS Soln.
N 2	3937.	4778.	3549.	0.7428
N 3	16020.	17071.	6345.	0.3717
N 4	3543.	3648.	986.	0.2703
N 5	3970.	4078.	1050.	0.2575
N 6	201.	214.	80.	0.3741
N 7	251.	270.	126.	0.4652
N 8	30.	34.	19.	0.5717
N 9	47.	56.	45.	0.7909
N 10	71.	86.	70.	0.8079

	Bias Estimate	Bias Std. Error	Per Cent Bias	NLLS Estimate Corrected For Bias	C.V. For Corrected Estimate
N 2	841.	115.	21.3697	3095.	1.1466
N 3	1050.	203.	6.5570	14970.	0.4239
N 4	105.	31.	2.9687	3438.	0.2868
N 5	107.	33.	2.6968	3863.	0.2718
N 6	13.	3.	6.5231	188.	0.4263
N 7	19.	4.	7.4963	232.	0.5406
N 8	4.	1.	13.6268	26.	0.7521
N 9	9.	1.	20.1704	37.	1.1906
N 10	15.	2.	21.1718	56.	1.2418

	LOWER 80. % CI	UPPER 80. % CI
N 2	1677.	8603.
N 3	10069.	25149.
N 4	2521.	4978.
N 5	2832.	5454.
N 6	124.	328.
N 7	121.	439.
N 8	12.	60.
N 9	9.	110.
N 10	8.	179.

Bootstrap Output Variable: Catchability Estimates

	NLLS Estimate	Bootstrap Mean	Bootstrap Std Error	C.V. For NLLS Soln.
Q 1	0.639060E-04	0.647586E-04	0.101782E-04	0.1572
Q 2	0.131940E-03	0.133998E-03	0.145121E-04	0.1083
Q 3	0.225008E-03	0.225360E-03	0.233256E-04	0.1035
Q 4	0.293998E-03	0.295308E-03	0.383110E-04	0.1297
Q 5	0.382779E-03	0.386695E-03	0.603680E-04	0.1561
Q 6	0.566609E-03	0.571598E-03	0.110028E-03	0.1925
Q 7	0.511812E-03	0.524087E-03	0.139158E-03	0.2655
Q 8	0.533836E-04	0.535169E-04	0.726587E-05	0.1358
Q 9	0.113582E-03	0.114677E-03	0.129450E-04	0.1129
Q 10	0.223833E-03	0.223325E-03	0.225948E-04	0.1012
Q 11	0.370258E-03	0.372882E-03	0.441525E-04	0.1184
Q 12	0.478237E-03	0.480790E-03	0.575817E-04	0.1198
Q 13	0.451154E-03	0.460422E-03	0.853109E-04	0.1853
Q 14	0.566767E-03	0.586741E-03	0.137955E-03	0.2351
Q 15	0.710558E-03	0.715248E-03	0.110880E-03	0.1550
Q 16	0.544643E-03	0.546052E-03	0.476591E-04	0.0873
Q 17	0.453706E-03	0.455707E-03	0.552238E-04	0.1212
Q 19	0.122958E-03	0.128903E-03	0.390116E-04	0.3026
Q 21	0.245830E-05	0.251662E-05	0.718337E-06	0.2854
Q 22	0.140563E-04	0.141456E-04	0.162997E-05	0.1152
Q 23	0.231650E-04	0.232271E-04	0.126746E-05	0.0546
Q 24	0.229116E-04	0.229085E-04	0.120903E-05	0.0528
Q 25	0.218712E-04	0.220098E-04	0.250055E-05	0.1136

	Bias Estimate	Bias Std. Error	Per Cent Bias	NLLS Estimate Corrected For Bias	C.V. For Corrected Estimate
Q 1	0.8525E-06	0.3230E-06	1.3340	0.6305E-04	0.1614
Q 2	0.2058E-05	0.4635E-06	1.5600	0.1299E-03	0.1117
Q 3	0.3524E-06	0.7377E-06	0.1566	0.2247E-03	0.1038
Q 4	0.1310E-05	0.1212E-05	0.4455	0.2927E-03	0.1309
Q 5	0.3917E-05	0.1913E-05	1.0232	0.3789E-03	0.1593
Q 6	0.4988E-05	0.3483E-05	0.8803	0.5616E-03	0.1959
Q 7	0.1227E-04	0.4418E-05	2.3983	0.4995E-03	0.2786
Q 8	0.1332E-06	0.2298E-06	0.2496	0.5325E-04	0.1364
Q 9	0.1096E-05	0.4108E-06	0.9645	0.1125E-03	0.1151
Q 10	-0.5082E-06	0.7147E-06	-0.2270	0.2243E-03	0.1007
Q 11	0.2624E-05	0.1399E-05	0.7086	0.3676E-03	0.1201
Q 12	0.2554E-05	0.1823E-05	0.5339	0.4757E-03	0.1211
Q 13	0.9268E-05	0.2714E-05	2.0543	0.4419E-03	0.1931
Q 14	0.1997E-04	0.4408E-05	3.5242	0.5468E-03	0.2523
Q 15	0.4690E-05	0.3509E-05	0.6600	0.7059E-03	0.1571
Q 16	0.1409E-05	0.1508E-05	0.2587	0.5432E-03	0.0877
Q 17	0.2001E-05	0.1747E-05	0.4410	0.4517E-03	0.1223
Q 19	0.5945E-05	0.1248E-05	4.8350	0.1170E-03	0.3334
Q 21	0.5832E-07	0.2279E-07	2.3723	0.2400E-05	0.2993
Q 22	0.8937E-07	0.5162E-07	0.6358	0.1397E-04	0.1167
Q 23	0.6213E-07	0.4013E-07	0.2682	0.2310E-04	0.0549
Q 24	-0.3153E-08	0.3823E-07	-0.0138	0.2291E-04	0.0528
Q 25	0.1386E-06	0.7920E-07	0.6336	0.2173E-04	0.1151

	LOWER 80. % CI	UPPER 80. % CI
Q 1	0.528038E-04	0.777431E-04
Q 2	0.116065E-03	0.153541E-03
Q 3	0.195847E-03	0.256823E-03
Q 4	0.251091E-03	0.347007E-03
Q 5	0.311452E-03	0.463932E-03
Q 6	0.435944E-03	0.713003E-03
Q 7	0.363137E-03	0.705006E-03
Q 8	0.448692E-04	0.627867E-04
Q 9	0.991114E-04	0.131147E-03
Q 10	0.195500E-03	0.251712E-03
Q 11	0.317280E-03	0.430807E-03
Q 12	0.407507E-03	0.551218E-03
Q 13	0.359008E-03	0.576648E-03
Q 14	0.425972E-03	0.768331E-03
Q 15	0.581905E-03	0.849728E-03
Q 16	0.486698E-03	0.606425E-03
Q 17	0.386956E-03	0.528414E-03
Q 19	0.842248E-04	0.174946E-03
Q 21	0.167670E-05	0.346849E-05
Q 22	0.121995E-04	0.162474E-04
Q 23	0.216791E-04	0.248333E-04
Q 24	0.213895E-04	0.245191E-04
Q 25	0.190392E-04	0.252692E-04

Bootstrap Output Variable: Fishing Mortality (2007)

	NLLS Estimate	Bootstrap Mean	Bootstrap Std Error	C.V. For NLLS Soln.
AGE 1	0.0000	0.0000	0.000000	0.7193
AGE 2	0.0004	0.0005	0.000180	0.3776
AGE 3	0.0388	0.0403	0.010717	0.2657
AGE 4	0.1880	0.1940	0.047462	0.2446
AGE 5	0.4892	0.5077	0.151260	0.2979
AGE 6	0.6492	0.7011	0.268324	0.3827
AGE 7	0.2288	0.2890	0.246963	0.8546
AGE 8	0.3714	0.5913	0.645212	1.0911
AGE 9	0.1484	0.3630	0.603834	1.6637
AGE 10	0.4888	0.5279	0.202048	0.3827
AGE 11	0.4888	0.5279	0.202048	0.3827

	Bias Estimate	Bias Std. Error	Per Cent Bias	NLLS Estimate Corrected For Bias	C.V. For Corrected Estimate
AGE 1	0.000000	0.000000	25.9547	0.0000	1.2235
AGE 2	0.000031	0.000006	6.9738	0.0004	0.4343
AGE 3	0.001556	0.000342	4.0140	0.0372	0.2880
AGE 4	0.006058	0.001513	3.2227	0.1819	0.2609
AGE 5	0.018527	0.004819	3.7875	0.4706	0.3214
AGE 6	0.051977	0.008643	8.0070	0.5972	0.4493
AGE 7	0.060197	0.008039	26.3126	0.1686	1.4650
AGE 8	0.219925	0.021557	59.2126	0.1515	4.2591
AGE 9	0.214574	0.020266	144.6129	-0.0662	-9.1219
AGE 10	0.039139	0.006508	8.0070	0.4497	0.4493
AGE 11	0.039139	0.006508	8.0070	0.4497	0.4493

	LOWER 80. % CI	UPPER 80. % CI
AGE 1	0.000000	0.000001
AGE 2	0.000284	0.000710
AGE 3	0.027715	0.053995
AGE 4	0.140155	0.254509
AGE 5	0.325552	0.702242
AGE 6	0.420262	1.058058
AGE 7	0.120909	0.499303
AGE 8	0.174605	1.208743
AGE 9	0.061730	0.855144
AGE 10	0.316457	0.796718
AGE 11	0.316457	0.796718

Bootstrap Output Variable: Average F (2007) AGES 5 - 7

	NLLS Estimate	Bootstrap Mean	Bootstrap Std Error	C.V. For NLLS Soln.
AVG F	0.4557	0.4993	0.136083	0.2726
N WTD	0.5685	0.5810	0.147049	0.2531
B WTD	0.5686	0.5816	0.150324	0.2584
C WTD	0.5845	0.6250	0.178702	0.2859

	Bias Estimate	Bias Std. Error	Per Cent Bias	NLLS Estimate Corrected For Bias	C.V. For Corrected Estimate
AVG F	0.043567	0.004519	9.5605	0.4121	0.3302
N WTD	0.012503	0.004667	2.1994	0.5560	0.2645
B WTD	0.013043	0.004772	2.2939	0.5556	0.2706
C WTD	0.040489	0.005794	6.9270	0.5440	0.3285

	LOWER 80. % CI	UPPER 80. % CI
AVG F	0.355693	0.669985
N WTD	0.411017	0.781374
B WTD	0.408325	0.786745
C WTD	0.428986	0.863827

Bootstrap Output Variable: Biomass

JAN-1 Biomass (2008) Mean Biomass & SSB (2007)

	NLLS Estimate	Bootstrap Mean	Bootstrap Std Error	C.V. For NLLS Soln.	
JAN-1	64636.	68657.	14733.	0.2146	
MEAN	68452.	72310.	15634.	0.2162	
SSB	33877.	35256.	5061.	0.1435	
			NLLS Estimate Corrected For Bias	C.V. For Corrected Estimate	
JAN-1	4021.	483.	6.2205	60615.	0.2431
MEAN	3857.	509.	5.6350	64595.	0.2420
SSB	1379.	166.	4.0692	32499.	0.1557
	LOWER	UPPER			
	80. % CI	80. % CI			
JAN-1	51410.	87543.			
MEAN	54179.	91739.			
SSB	29133.	41747.			

Plus Group Diagnostic Report

Calculation Method Selected = Backward

Year	Population Backward	Population Forward	F Forward	F Backward	Ratio
1982	79.	79.	0.608762	0.608767	1.000008
1983	35.	39.	0.766578	0.934197	1.218659
1984	36.	22.	2.291801	0.826494	0.360631
1985	21.	13.	2.078124	0.831750	0.400241
1986	113.	73.	2.078124	0.852346	0.410152
1987	5.	6.	0.850463	0.956784	1.125015
1988	2.	8.	0.154087	0.793888	5.152224
1989	13.	9.	2.078124	0.842174	0.405257
1990	30.	21.	2.078124	0.964190	0.463971
1991	2.	8.	0.141642	1.203272	8.495139
1992	0.	6.	0.000172	1.364055	7932.243093
1993	0.	6.	0.000179	1.150044	6423.409462
1994	2.	5.	0.302595	1.631834	5.392807
1995	0.	3.	0.071812	1.363187	18.982625
1996	0.	3.	0.000379	1.184958	3124.512926
1997	0.	2.	0.047392	1.015233	21.422228
1998	1.	2.	0.221488	0.685785	3.096259
1999	0.	2.	0.000451	0.550581	1221.900183
2000	0.	7.	0.000150	0.346290	2312.462606
2001	2.	6.	0.095719	0.448343	4.683963
2002	2.	6.	0.109135	0.513022	4.700795
2003	17.	17.	0.631774	0.663032	1.049475
2004	9.	17.	0.257924	0.519155	2.012819
2005	19.	26.	0.439374	0.648994	1.477087
2006	24.	21.	0.595954	0.524603	0.880275
2007	22.	24.	0.426115	0.470989	1.105310
2008	21.	23.	N/A	N/A	

Warning **** Infeasible Mass Balance in Plus Group

Year = 1986

Year = 1989

Year = 1990

Year = 1994

Year = 1997

Year = 2001

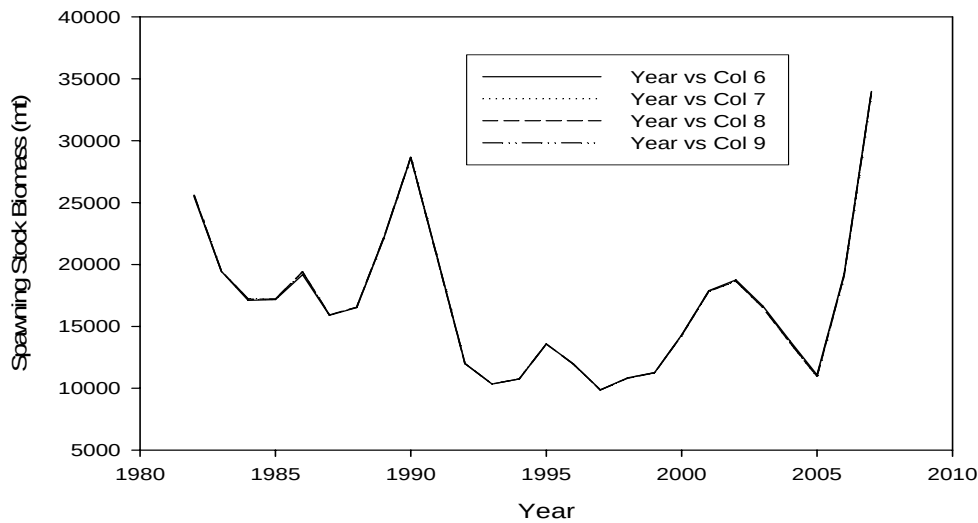
Appendix 3. F on Oldest True Age Explorations for the Gulf of Maine stock of Atlantic cod.

In the 11 plus VPA formulation, F on the oldest true age (age 10) was estimated in a series of trial VPAs using ages 5-6, 5-7, 5-8, and 5-9 as a basis for computing F on age 10. An additional exploration was conducted using ages 8-9. The following graphics show the impact on the average F (ages 5-7), spawning stock biomass, and F on age 10.

2D Graph 2

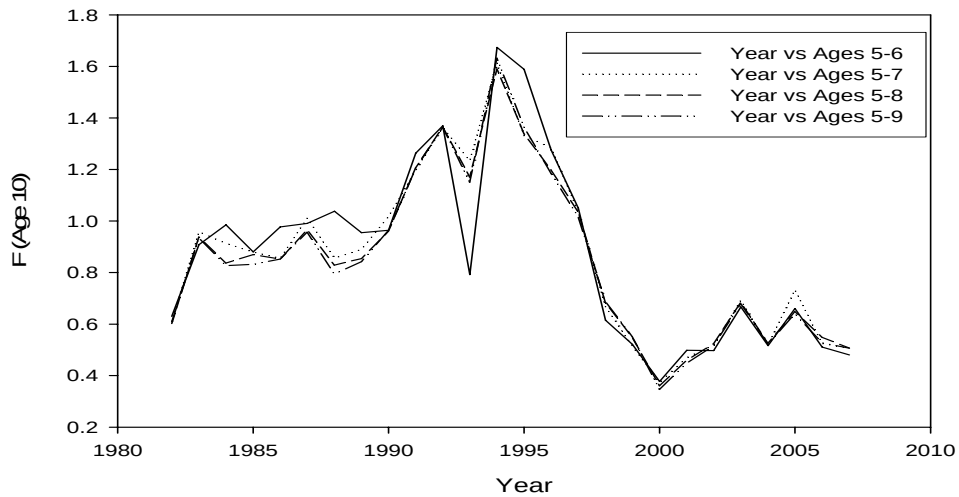


2D Graph 4



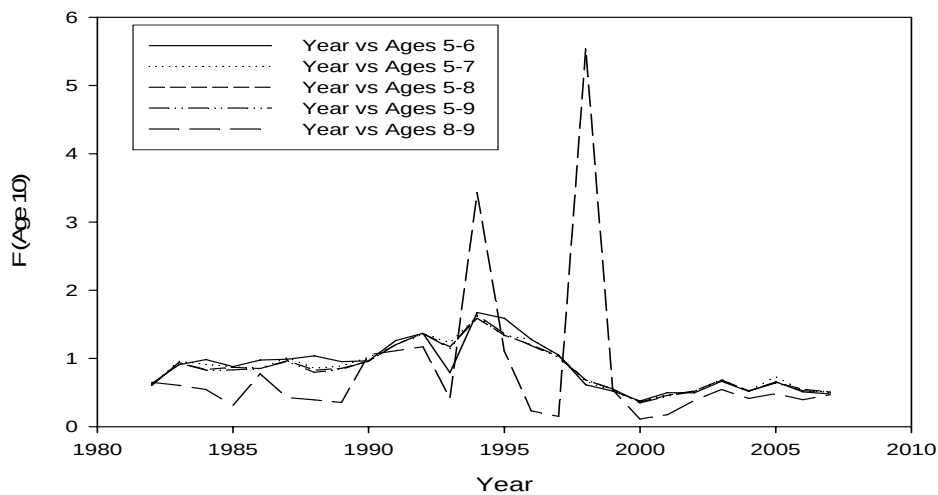
In each trial, the average F on the fully recruited ages (5-7) and the spawning stock biomass were not appreciably affected by the choice of age range.

2D Graph 3



The F on the oldest (age 10), however, was directly affected by the choice of age range. The age 5-6 range caused F to deviate from the other ranges, especially in 1993. Overall, the age range did not substantially affect the estimate of F on the oldest true age.

2D Graph 5



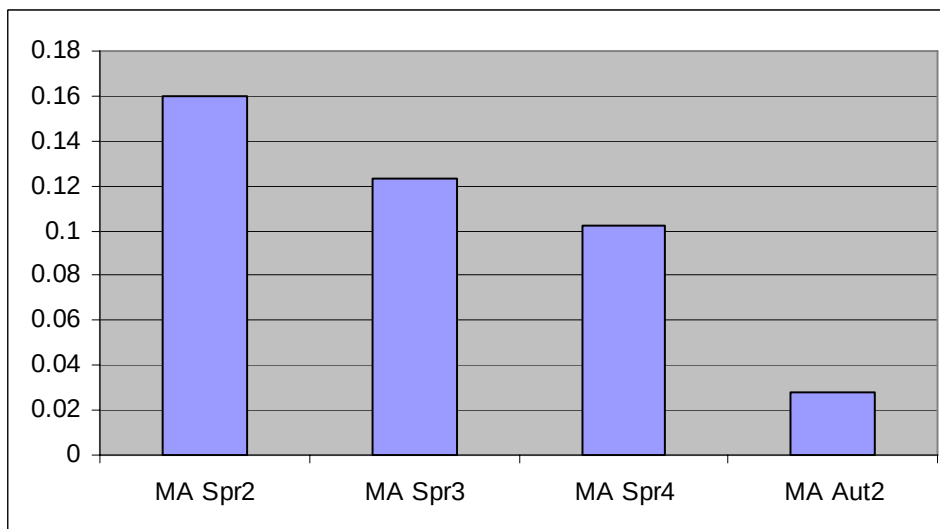
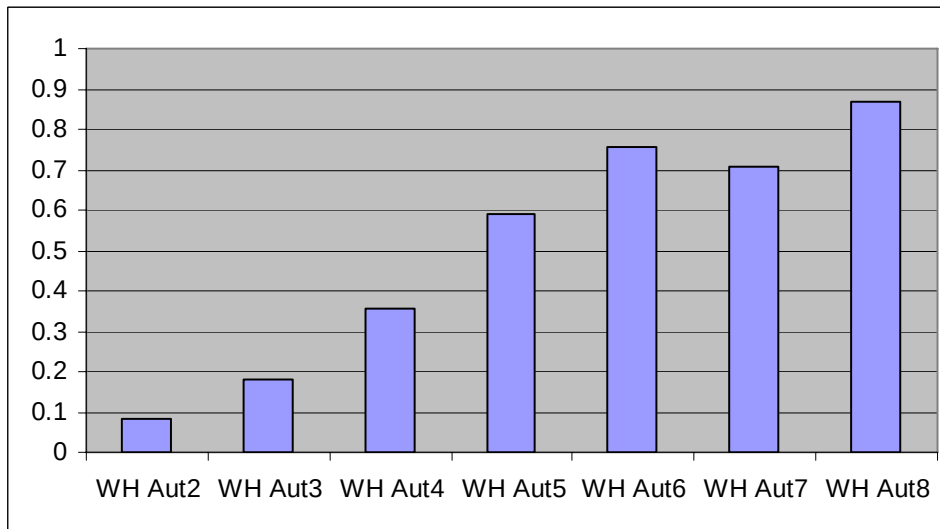
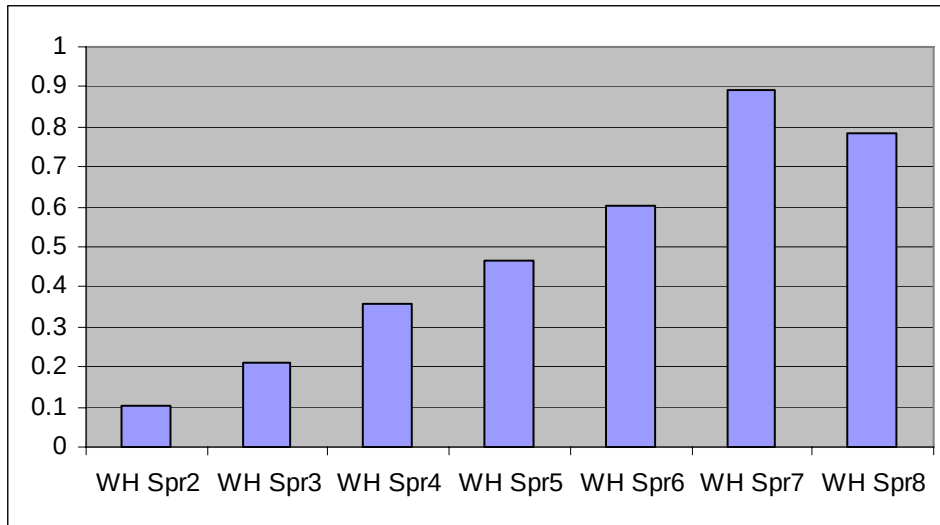
When ages 8-9 were included in the analysis, the estimate of F on age 10 was generally lower than the estimates obtained from the other age ranges, sometimes as much as 80-90% lower (1996 and 1997). In other cases (1994 and 1998), the estimates are as much as 2-6 times higher (1994 and 1998). The estimates of F on ages 8 and 9 are highly variable, especially during the 1990s.

Appendix 4. Swept area survey Q analyses for the Gulf of Maine stock of Atlantic cod.

Index	Index #	q	se	Q	CV	2 Std	NEFSC	
WH Spr2	1	0.000064	0.1547	0.10224	0.1547	0.031633	Area (sq mi) A	17892
WH Spr3	2	0.000132	0.1065	0.21087	0.1065	0.044915	Area Swept a	0.0112
							Exp Fact	1597500
WH Spr4	3	0.000225	0.1026	0.359438	0.1026	0.073757	Exp Fact	
WH Spr5	4	0.000293	0.1308	0.468068	0.1308	0.122446	(1000s)	1597.5
WH Spr6	5	0.000378	0.1666	0.603855	0.1666	0.201204	MADMF	
WH Spr7	6	0.000557	0.1964	0.889808	0.1964	0.349516	Area (sq mi) A	869
WH Spr8	7	0.000491	0.2765	0.784373	0.2765	0.433758	Area Swept a	0.00385
WH Aut2	8	0.000053	0.1286	0.084668	0.1286	0.021776	Exp Fact	225714.3
							Exp Fact	
WH Aut3	9	0.000113	0.1128	0.180518	0.1128	0.040725	(1000s)	225.7143
WH Aut4	10	0.000224	0.1012	0.35784	0.1012	0.072427		
WH Aut5	11	0.000369	0.1239	0.589478	0.1239	0.146073		
WH Aut6	12	0.000473	0.1185	0.755618	0.1185	0.179081		
WH Aut7	13	0.000442	0.1875	0.706095	0.1875	0.264786		
WH Aut8	14	0.000545	0.2305	0.870638	0.2305	0.401364		
MA Spr2	15	0.00071	0.1511	0.160257	0.1511	0.04843		
MA Spr3	16	0.000544	0.0868	0.122789	0.0868	0.021316		
MA Spr4	17	0.000453	0.1231	0.102249	0.1231	0.025174		
MA Aut2	19	0.000123	0.2996	0.027763	0.2996	0.016636		

Survey catchabilities (qs) obtained from the VPA (calibrated with number/per tow at age) were expanded on the basis of minimum swept area population numbers using the area of the strata used in the assessment ($A = 17,892$ sq mi) and the footprint of a standard tow ($a = 0.0112$ sq mi) for the NEFSC survey and the strata used in the assessment ($A = 869$ sq mi) and the footprint of a standard tow ($a = 0.00385$ sq mi) for the MA DMF survey. The expansion factor: $(A/a * 1/1000)$ converts survey qs from a kg/tow basis to a swept area basis (Q).

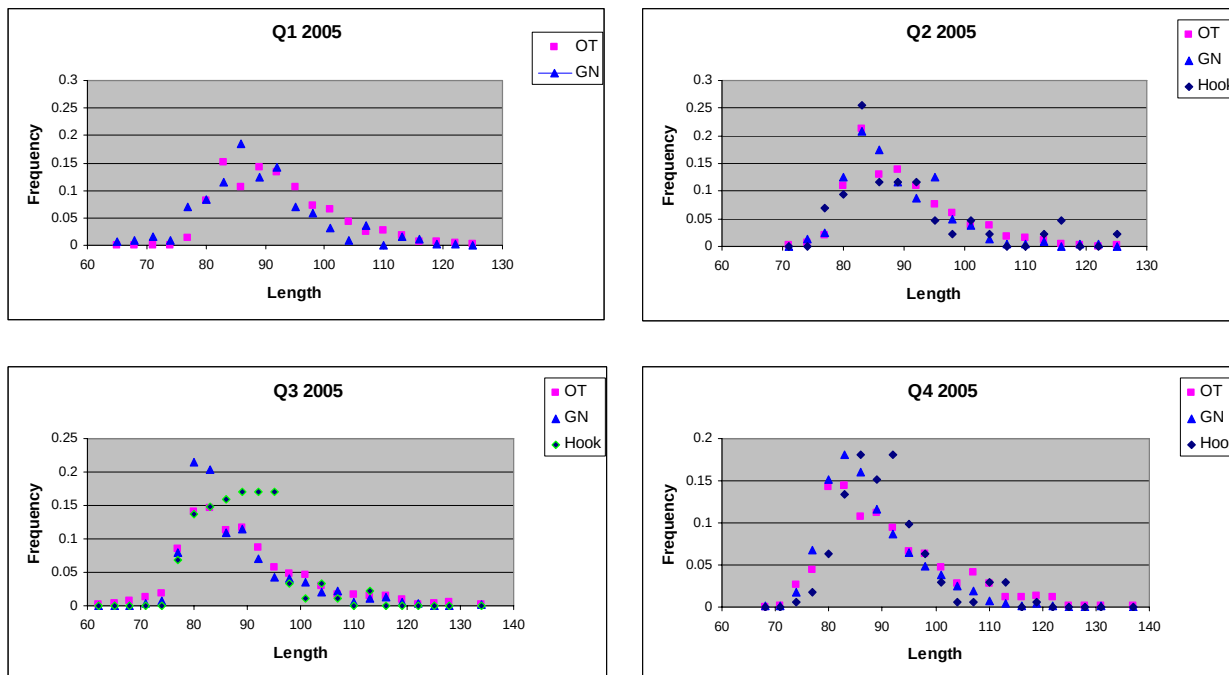
As the figures below show, the NEFSC survey Qs start at about 10% at age 2, increase through age 5 or 6 and then level off at about 70-90%. The MA DMF spring Qs show a continuously declining trend from age 2 to age 4, reflecting the movement of fish out of the survey area as they grow older



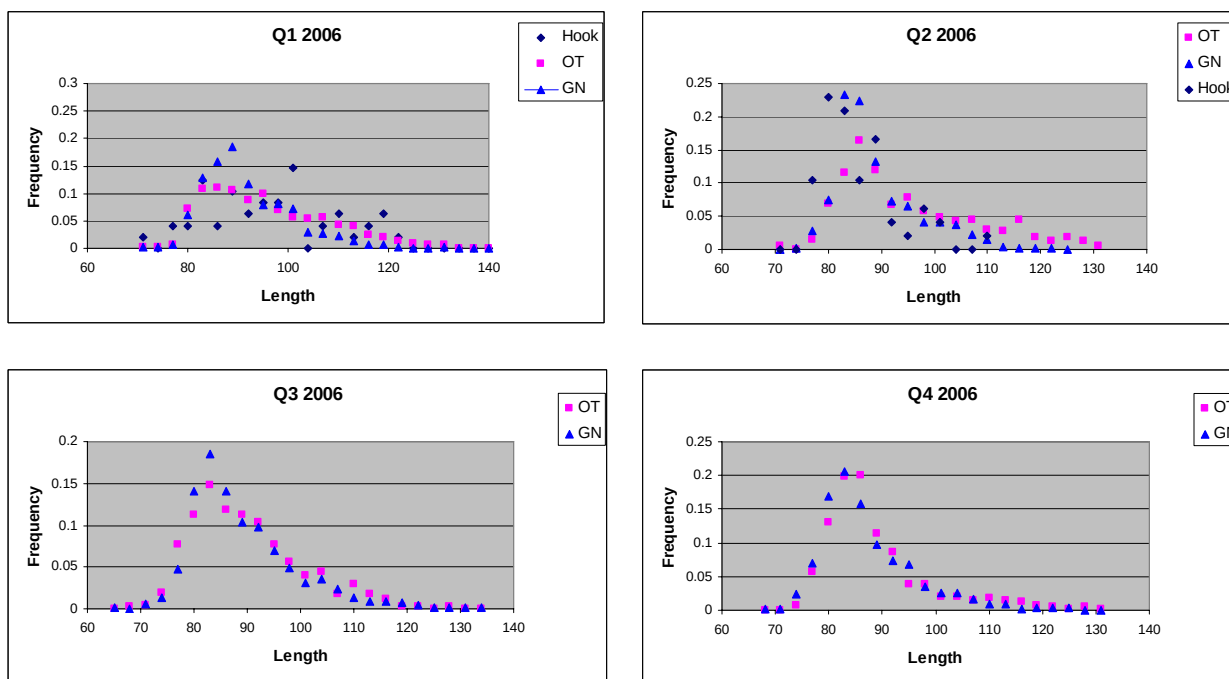
Appendix 5. Length frequency of landed large cod by major gear and quarter, 2005-2007 for the Gulf of Maine stock of Atlantic cod.

Commercial port samples collected in 2005, 2006 and 2007 were used to construct length frequency plots of landed large cod by major gear type (hooks, trawls and gillnets) and quarter. The dominant length modes coincide for all 3 gear types. Although the proportions are low for the largest fish, trawls and gillnets are capable of capturing fish as large as 135+ cm (51+ in). Hook gear tends to take somewhat smaller cod, although some catches out to 125 cm have been recorded.

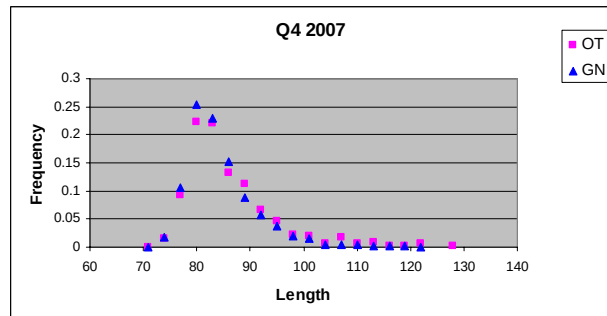
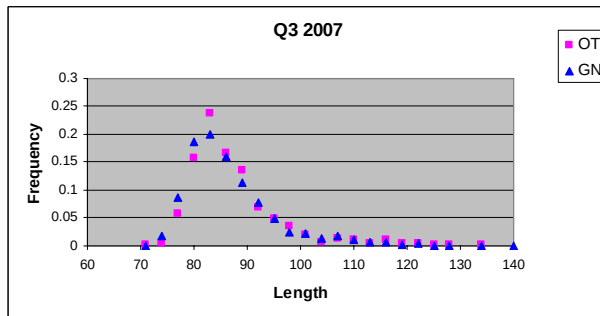
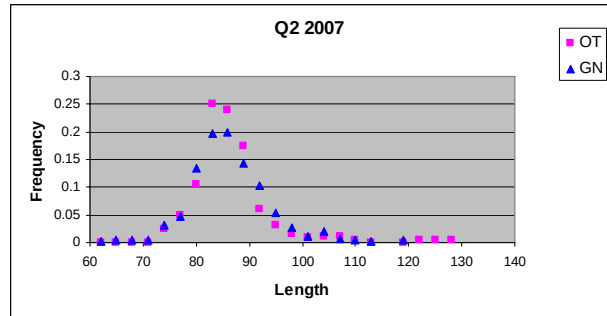
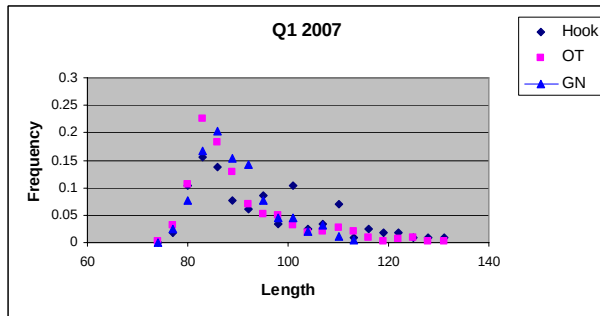
2005



2006



2007



Appendix G. Witch flounder

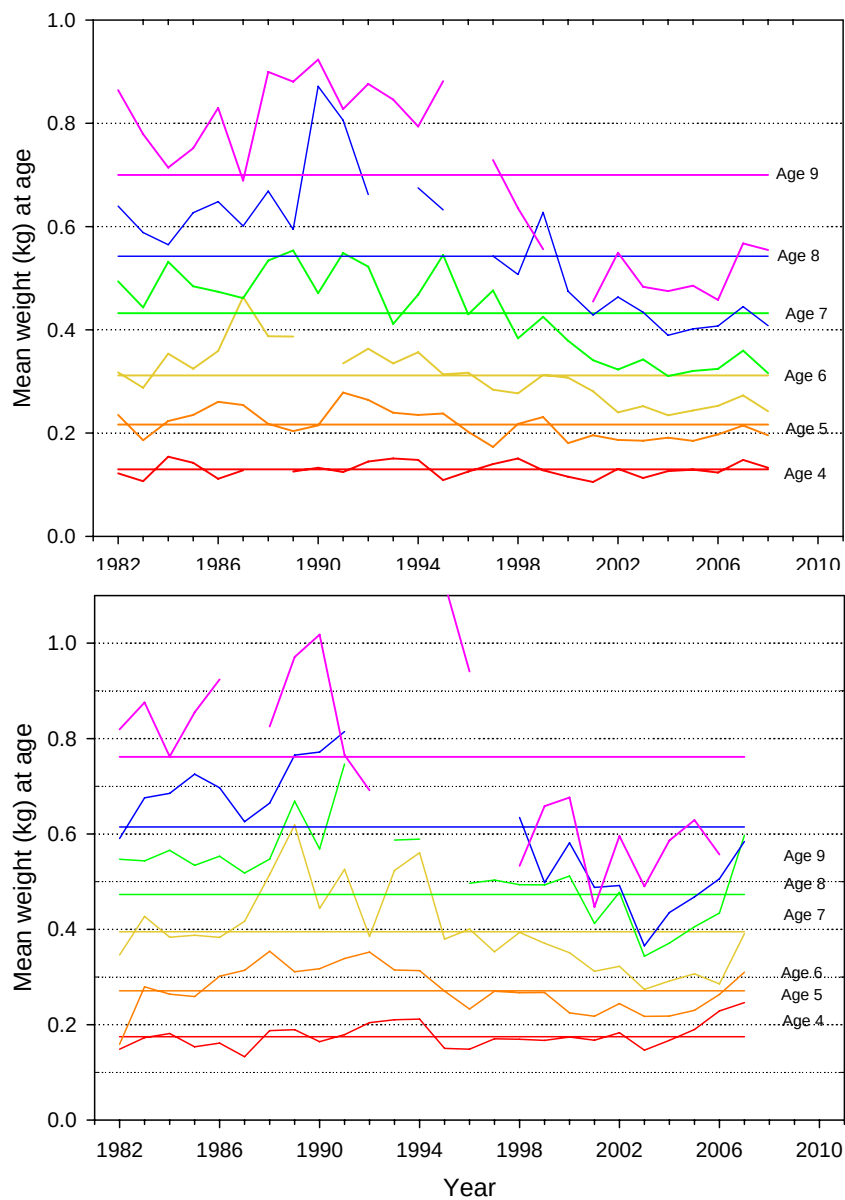
Appendix Tables and Figures by S.E. Wigley and L. Col

Appendix Table G1. Stratified mean number, weight (kg), length (cm), and individual weight (kg) per tow of witch flounder in **Massachusetts Division of Marine Fisheries inshore spring and autumn surveys** in the Cape Cod Bay and Mass. Bay region (Regions 4 and 5), 1978-2007.

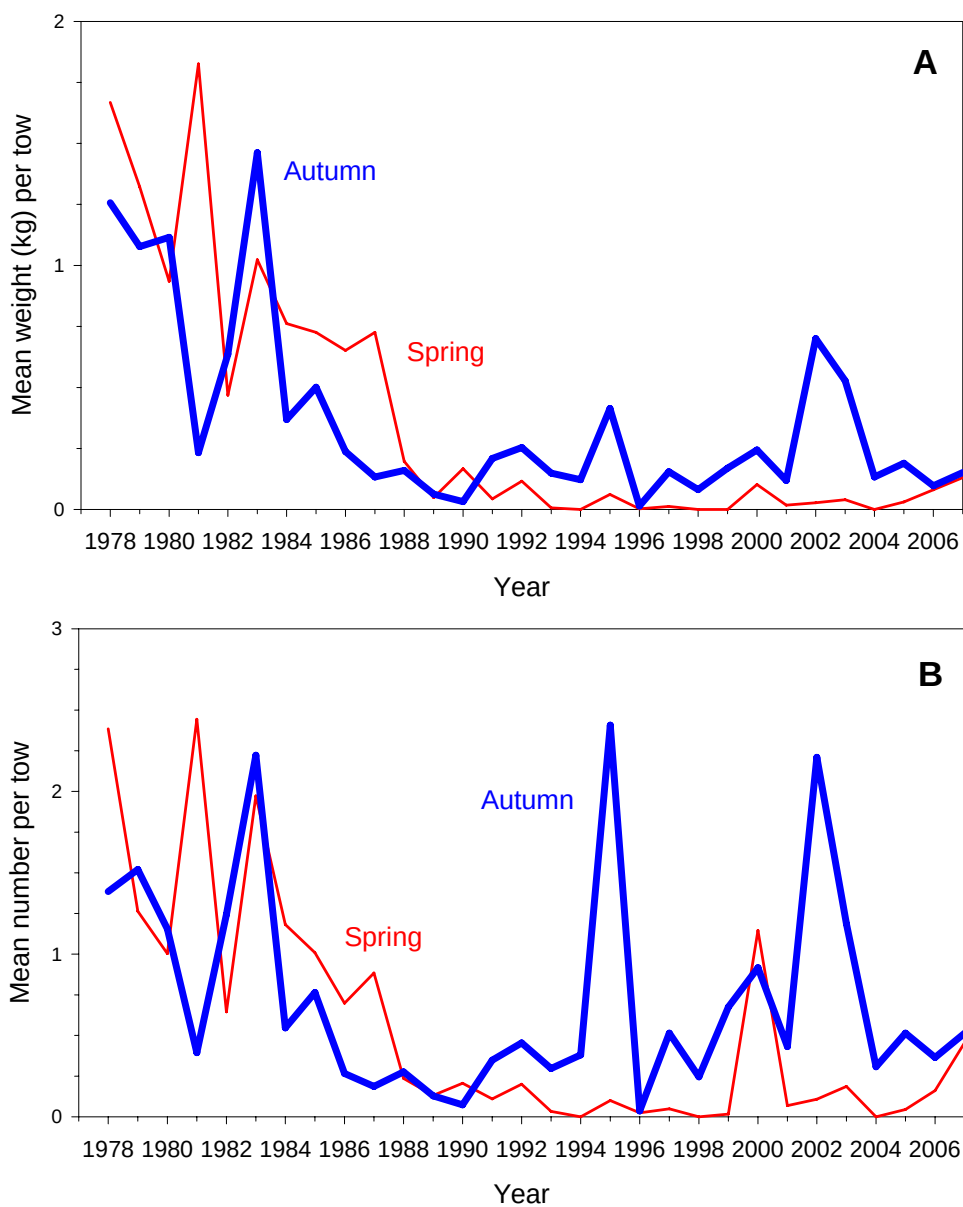
Year	SPRING				AUTUMN			
	Number per tow	Weight per tow	Length per tow	Avg. wt. per tow	Number per tow	Weight per tow	Length per tow	Avg. wt. per tow
1978	2.38	1.67	44.6	0.699	1.38	1.26	46.4	0.908
1979	1.26	1.32	48.3	1.046	1.52	1.08	42.9	0.708
1980	1.00	0.93	44.0	0.932	1.15	1.12	46.5	0.966
1981	2.44	1.83	40.2	0.747	0.39	0.23	41.2	0.589
1982	0.65	0.47	44.2	0.726	1.24	0.64	37.7	0.511
1983	1.97	1.02	36.8	0.519	2.22	1.46	44.6	0.658
1984	1.18	0.76	40.8	0.645	0.55	0.37	43.6	0.674
1985	1.01	0.73	43.4	0.720	0.76	0.50	43.6	0.655
1986	0.70	0.65	47.6	0.934	0.27	0.24	46.4	0.893
1987	0.88	0.73	45.1	0.821	0.19	0.13	44.6	0.713
1988	0.24	0.20	45.6	0.837	0.28	0.16	39.5	0.579
1989	0.13	0.05	34.9	0.369	0.13	0.06	38.1	0.491
1990	0.21	0.17	44.2	0.809	0.07	0.03	36.8	0.436
1991	0.11	0.04	34.1	0.393	0.35	0.21	41.1	0.602
1992	0.20	0.12	40.2	0.583	0.45	0.25	40.7	0.557
1993	0.03	0.01	33.0	0.200	0.30	0.15	40.9	0.500
1994	0.00	0.00	-	-	0.38	0.12	31.0	0.321
1995	0.10	0.06	36.0	0.613	2.41	0.41	26.7	0.172
1996	0.02	<0.01	21.0	0.100	0.04	0.01	40.0	0.400
1997	0.05	0.01	31.5	0.250	0.51	0.15	36.0	0.300
1998	0.00	0.00	-	-	0.25	0.08	35.2	0.332
1999	0.02	<0.01	11.0	0.000	0.67	0.17	33.7	0.251
2000	1.15	0.10	23.5	0.089	0.92	0.24	31.6	0.266
2001	0.07	0.02	33.0	0.250	0.43	0.12	33.2	0.275
2002	0.11	0.03	33.4	0.253	2.21	0.70	36.5	0.317
2003	0.19	0.04	30.2	0.217	1.19	0.53	39.8	0.445
2004	0.00	0.00	-	-	0.31	0.13	40.5	0.432
2005	0.05	0.03	45.5	0.675	0.51	0.19	37.8	0.369
2006	0.16	0.08	40.9	0.500	0.37	0.10	33.0	0.265
2007	0.46	0.13	34.6	0.286	0.51	0.15	36.8	0.295

Appendix Table G2. Stratified mean number, weight (kg), length (cm), and individual weight (kg) per tow of witch flounder in the **ASMFC summer shrimp surveys** in the Gulf of Maine (strata set 1,3,6,8), 1984 - 2007.

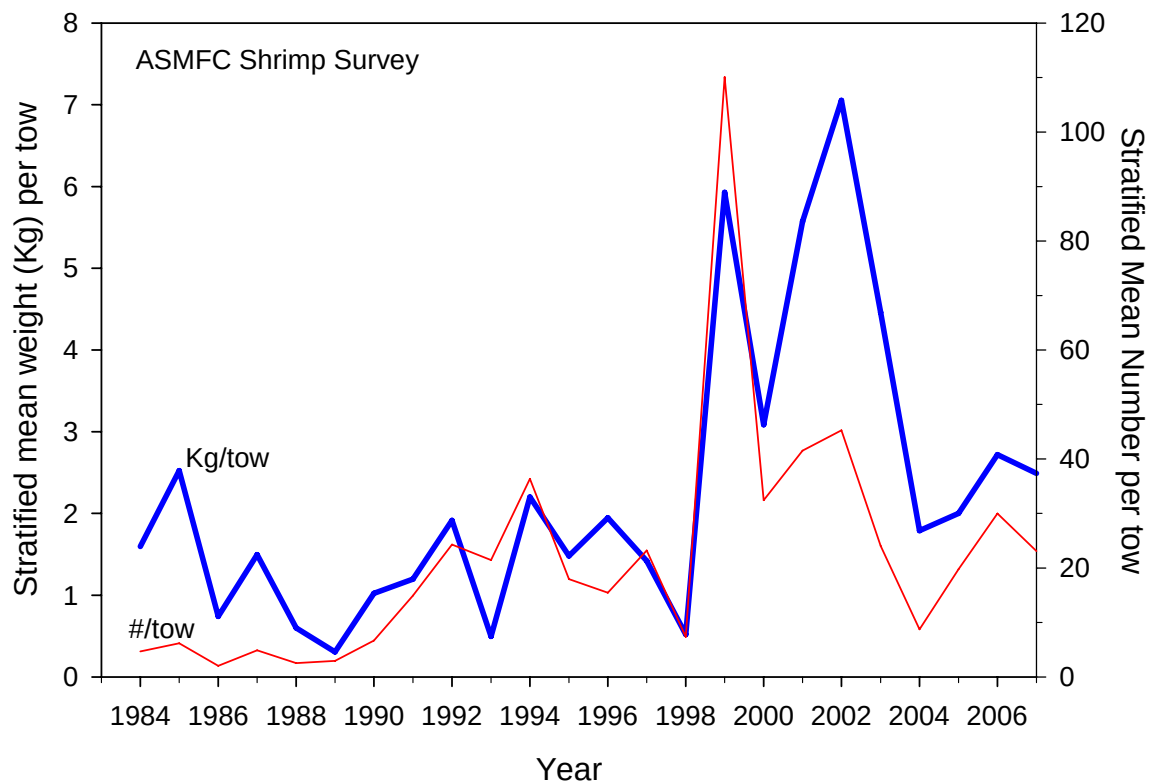
Year	Number per tow	Weight per tow	Length per tow	Ave. wt. per tow
1984	4.68	1.60	33.9	0.341
1985	6.19	2.52	36.0	0.408
1986	2.05	0.74	35.9	0.362
1987	4.87	1.50	26.5	0.307
1988	2.53	0.60	25.8	0.238
1989	2.92	0.31	22.8	0.105
1990	6.66	1.02	24.5	0.154
1991	14.94	1.20	19.6	0.080
1992	24.28	1.91	20.5	0.079
1993	21.42	0.50	12.8	0.023
1994	36.36	2.20	19.1	0.061
1995	17.95	1.48	22.6	0.082
1996	15.45	1.95	25.2	0.126
1997	23.19	1.42	19.1	0.061
1998	7.35	0.52	21.9	0.071
1999	110.07	5.93	18.7	0.054
2000	32.43	3.09	24.2	0.095
2001	41.52	5.57	27.2	0.134
2002	45.25	7.05	28.8	0.156
2003	24.06	4.46	30.6	0.185
2004	8.75	1.79	31.3	0.205
2005	19.77	2.00	21.6	0.101
2006	29.98	2.72	22.6	0.091
2007	23.10	2.49	25.1	0.108



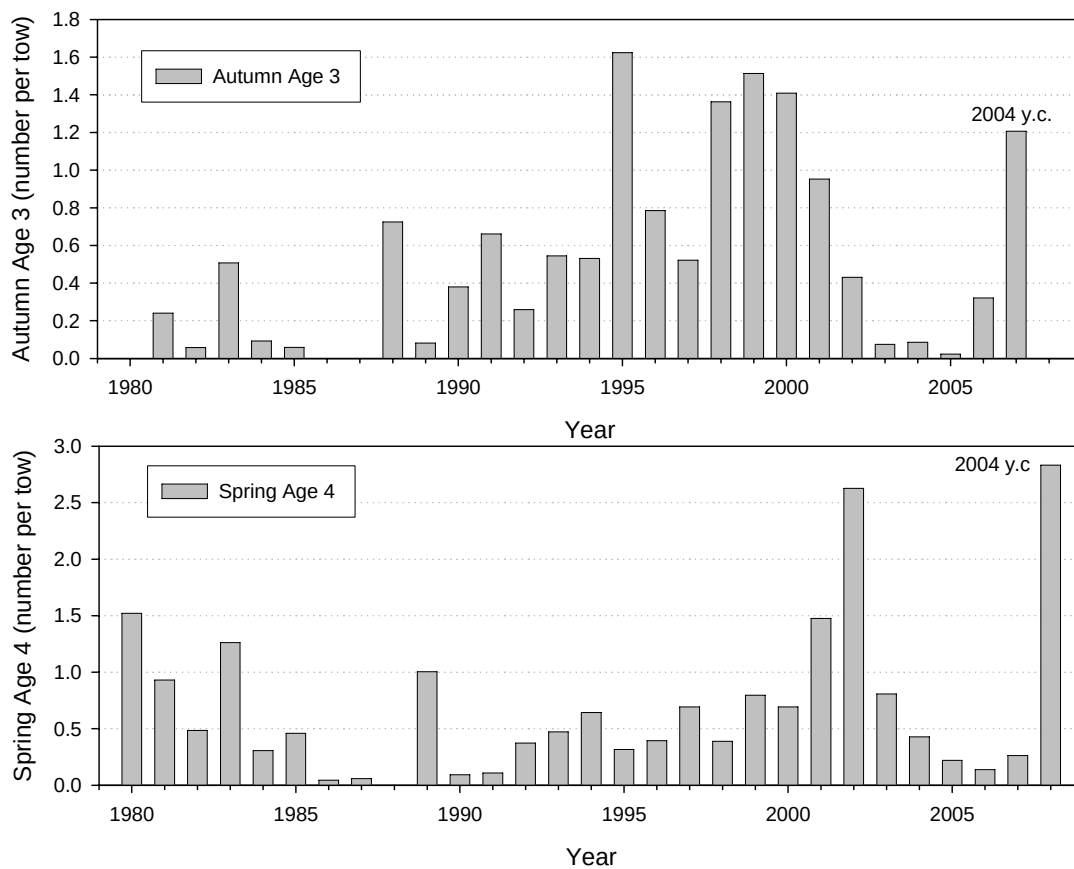
Appendix Figure G1. Mean weight at age of witch flounder (age groups 4 – 9) in the NEFSC spring (top) and autumn (bottom) survey, 1980-2007.



Appendix Figure G2 Stratified mean catch per tow, in weight (A) and number (B), of witch flounder in the Massachusetts Division of Marine Fisheries spring and autumn bottom trawl surveys in Cape Cod Bay – Mass Bay region, 1978 – 2007.



Appendix Figure G3. Stratified mean catch per tow, in weight (kg) and numbers, of witch flounder in the Atlantic States Marine Fisheries Commission summer northern shrimp survey, 1984-2007.



Appendix Figure G4. Stratified mean number per tow of age 3 witch flounder in the NEFSC autumn survey, 1980- 2007 (top), and age 4 witch flounder in the NEFSC spring survey, 1980 - 2008 (bottom).

Appendix H. Gulf of Maine – Georges Bank American plaice by Loretta O'Brien, Jay Burnett , and Michele Traver

Appendix H. Table H1. Bootstrapped estimates of mean landings in numbers, with standard deviation (Stdev) and coefficient of variation (CV), and average length and weight with 5% confidence intervals (5% CI, 95% CI) at age

YEAR	Gulf of Maine										Georges Bank									
	Age	Mean Catch (numbers)	Stdev	CV	Length			Weight			Age	Mean Catc (numbers)	Stdev	CV	Length			Weight		
					Average	5% CI	95% CI	Average	5% CI	95% CI					Average	5% CI	95% CI	Average	5% CI	95% CI
2003	4	121373	61040.49	0.50	35.935	35.192	36.798	0.395	0.369	0.427	4	18324	20691.28	1.13	36.763	0	38	0.424	0	0.472
	5	641249	59791.17	0.09	37.209	36.855	37.636	0.446	0.431	0.464	5	95926	45619.39	0.48	37.112	36.25	38.867	0.44	0.405	0.524
	6	724331	53850.96	0.07	39.264	38.903	39.652	0.536	0.521	0.554	6	318260	74368.41	0.23	41.076	40.163	42.034	0.623	0.572	0.677
	7	380708	40874.67	0.11	42.01	41.396	42.71	0.675	0.644	0.711	7	288011	46336.09	0.16	43.184	42.58	43.783	0.735	0.7	0.77
	8	275690	27778.66	0.10	44.97	44.172	45.769	0.846	0.801	0.89	8	209754	44891.03	0.21	45.621	44.814	46.823	0.89	0.837	0.976
	9	122912	12307	0.10	47.639	46.561	48.505	1.027	0.962	1.083	9	119416	29827.97	0.25	46.264	44.52	48.63	0.956	0.84	1.122
	10	88951	12092.29	0.14	47.993	46.897	49.036	1.059	0.992	1.133	10	52166	23966.4	0.46	49.596	46.576	54.747	1.21	0.986	1.61
	11	46010	8141.45	0.18	49.486	47.62	51.042	1.176	1.07	1.294	11	19747	10464.62	0.53	51.556	47.925	57.123	1.356	1.063	1.865
	12	13087	3331.84	0.25	52.212	50.354	54.114	1.401	1.25	1.572	12	10070	7117	0.71	54.375	52.929	59	1.586	1.444	2.058
	13	5403	3727.05	0.69	53.254	49.221	58	1.513	1.226	1.95	13	1616	1787.39	1.11	54	0	54	1.531	0	1.531
	14	2163	993.67	0.46	52.853	51.474	55.727	1.445	1.313	1.733	14	1871	1860.87	0.99	55.385	0	62	1.672	0	2.43
	15	605	420.95	0.70	57	0	66	1.896	0	2.995	15	1244	882.28	0.71	59.372	0	62	2.109	0	2.43
2004	3										3	8676	7026.83	0.81	34.4	32.742	35	0.34	0.288	0.359
	4	63995	16941.22	0.26	36.961	36.106	37.793	0.433	0.4	0.466	4	77740	26973.58	0.35	37.365	36.265	38.249	0.449	0.406	0.489
	5	312148	38419.34	0.12	37.515	37.13	37.859	0.456	0.441	0.471	5	157236	23926.21	0.15	38.688	37.867	39.451	0.512	0.474	0.548
	6	539603	32973.76	0.06	39.501	39.113	40.072	0.548	0.531	0.576	6	269574	39632.04	0.15	39.956	39.172	40.788	0.574	0.537	0.614
	7	273875	34504.72	0.13	41.719	41.205	42.34	0.661	0.634	0.693	7	146571	18649.88	0.13	43.56	42.408	44.758	0.766	0.699	0.84
	8	206459	27493.88	0.13	44.173	43.558	45.564	0.802	0.767	0.883	8	116892	22875.12	0.20	44.437	43.224	46.124	0.839	0.764	0.951
	9	109896	13118.82	0.12	46.79	45.914	47.751	0.971	0.915	1.033	9	57978	12151.3	0.21	48.857	47.59	50.728	1.142	1.043	1.285
	10	44927	9013.48	0.20	47.124	45.686	48.912	1.002	0.907	1.123	10	33243	13130.16	0.40	47.467	45.171	51.179	1.033	0.866	1.33
	11	26445	4645.92	0.18	48.78	46.766	50.84	1.148	1.009	1.293	11	21298	8875.66	0.42	49.45	46.929	54.633	1.204	0.987	1.649
	12	6113	1745.55	0.29	52.374	50.921	53.89	1.401	1.275	1.535	12	10408	8710.93	0.84	48.177	0	57	1.083	0	1.852
	13	4385	1772.16	0.40	52.575	50.651	54.711	1.424	1.261	1.617										
	14	1683	957.72	0.57	54.348	51.706	56.824	1.582	1.365	1.828	14	577	995.45	1.72						
	15	235	156.49	0.67	55.389	52	59.31	1.684	1.349	2.095										
2005	3										3	2760	2391.39	0.87	37	0	37	0.432	0	0.432
	4	55806	20451.62	0.37	36.289	35.602	36.974	0.408	0.383	0.434	4	130609	17945.66	0.14	36.411	35.906	36.809	0.413	0.393	0.429
	5	337958	35010.32	0.10	38.137	37.861	38.389	0.483	0.471	0.494	5	250463	31662.41	0.13	38.265	37.725	38.877	0.491	0.469	0.516
	6	349848	32468.56	0.09	39.754	39.349	40.228	0.561	0.542	0.582	6	204810	21103.92	0.10	40.108	39.444	40.875	0.582	0.55	0.618
	7	212722	22920.28	0.11	42.096	41.465	42.747	0.684	0.653	0.719	7	154143	26025.59	0.17	42.725	41.689	44.044	0.722	0.665	0.793
	8	96617	13459.16	0.14	44.783	44.085	45.645	0.835	0.793	0.887	8	63540	10143.65	0.16	46.092	45.343	47.016	0.918	0.867	0.98
	9	56631	9150.59	0.16	46.844	45.418	48.088	0.975	0.889	1.055	9	36807	8431.68	0.23	46.41	44.456	48.94	0.956	0.833	1.115
	10	31525	7026.8	0.22	47.158	45.569	49.044	1.004	0.899	1.13	10	9804	2914.52	0.30	51.113	50.144	52.221	1.303	1.224	1.391
	11	18296	4313.46	0.24	50.301	49.361	51.396	1.219	1.149	1.311	11	5806	1646.54	0.28	52.676	50.285	55.113	1.438	1.233	1.658
	12	7425	3516.19	0.47	47.159	44.475	52.678	1.021	0.828	1.426	12	6978	2315.46	0.33	51.058	48.998	52.862	1.289	1.126	1.434
	13	3627	1629.78	0.45	52.346	50.838	54.022	1.387	1.254	1.548	13	2649	1191.04	0.45	51.74	49.373	55.338	1.352	1.156	1.662
	14	1726	1165.54	0.68	53.764	51.684	55.97	1.517	1.328	1.734	14	567	433.41	0.76	56.831	0	59	1.819	0	2.058
	15	776	1029.15	1.33	53	0	53	1.438	0	1.438	15	399	410.71	1.03	53	0	53	1.438	0	1.438

Appendix H. Table H1 continued. Bootstrapped estimates of mean landings in numbers, with standard deviation (Stdev) and coefficient of variation (CV), and average length and weight with confidence intervals (5% CI, 95% CI) , at age, for American plaice, 2003-2007

2006	3										3	2245	2277.92	1.01	34	0	34	0.326	0	0.326
	4	71243	16414.63	0.23	36.724	36.159	37.275	0.424	0.402	0.446	4	85354	13899.22	0.16	37.062	36.675	37.469	0.438	0.421	0.456
	5	257796	31417.66	0.12	37.652	37.319	38.061	0.463	0.449	0.481	5	230286	24587.07	0.11	38.567	38.106	38.956	0.504	0.484	0.52
	6	214990	29231.96	0.14	39.389	38.957	39.838	0.541	0.522	0.563	6	176564	24138.32	0.14	41.226	40.618	41.985	0.637	0.607	0.675
	7	169875	33267.54	0.20	40.963	40.134	42.414	0.623	0.581	0.695	7	110260	18343.21	0.17	43.607	43.025	44.278	0.766	0.733	0.807
	8	99224	11534.42	0.12	44.564	43.78	45.276	0.82	0.776	0.863	8	69859	9452.87	0.14	45.456	44.533	46.303	0.891	0.836	0.946
	9	57051	10638.29	0.19	45.294	43.935	46.697	0.873	0.795	0.96	9	32295	4884.53	0.15	47.742	46.688	48.916	1.052	0.974	1.139
	10	41034	8842.36	0.22	46.686	45.493	48.189	0.962	0.885	1.062	10	10804	2363.07	0.22	50.963	49.869	52.152	1.287	1.19	1.393
	11	15437	5075.82	0.33	48.746	46.396	51.251	1.114	0.953	1.3	11	9489	2366.06	0.25	51.758	49.492	53.948	1.37	1.18	1.559
	12	7427	3635.37	0.49	51.835	50.449	53.689	1.349	1.235	1.517	12	2435	1214.19	0.50	54.873	51.455	60.208	1.67	1.324	2.24
	13	2115	1232.96	0.58	52.624	50.943	55.97	1.42	1.267	1.755	13	1415	657.83	0.46	54.657	51.294	58.351	1.623	1.302	2.012
	14	1185	606.09	0.51	54.461	53.18	55.375	1.577	1.455	1.665	14	308	234.67	0.76	54.631	0	56	1.595	0	1.729
	15	1989	2080.71	1.05	53.723	52	57.571	1.515	1.349	1.897	15	147	200.46	1.36						
2007	3										3	18293	13455.03	0.74	35.637	0	36.165	0.382	0	0.401
	4	73360	27600.5	0.38	37.192	36.63	38.324	0.444	0.421	0.492	4	182533	27657.49	0.15	35.672	35.436	35.992	0.385	0.376	0.397
	5	372751	57933.98	0.16	37.876	37.168	38.341	0.473	0.445	0.492	5	212803	34719.88	0.16	37.691	37.236	38.239	0.466	0.447	0.489
	6	282839	43098.41	0.15	39.315	38.537	40.15	0.543	0.508	0.582	6	125986	16895.72	0.13	40.225	39.447	41.152	0.586	0.55	0.633
	7	137063	24917.26	0.18	41.992	40.667	43.253	0.679	0.615	0.745	7	55387	14026.68	0.25	41.37	40.248	43.731	0.649	0.591	0.77
	8	80369	21578.32	0.27	44.114	41.481	46.185	0.803	0.664	0.917	8	27632	7709.54	0.28	46.448	44.885	48.447	0.949	0.849	1.082
	9	53043	14383.79	0.27	45.787	42.303	47.785	0.921	0.724	1.038	9	13474	3491.69	0.26	51.897	49.407	54.074	1.368	1.153	1.565
	10	20473	3930.33	0.19	49.334	48.17	50.71	1.15	1.065	1.257	10	9638	4832.51	0.50	46.441	42.171	52.138	0.973	0.718	1.369
	11	10467	2530.08	0.24	50.483	49.382	51.683	1.241	1.15	1.337	11	3546	1241.23	0.35	52.964	52.1	54.586	1.449	1.364	1.608
	12	2665	1054.52	0.40	51.743	50.123	54.159	1.342	1.201	1.559	12	3182	1559.82	0.49	54.495	51.814	56.699	1.592	1.357	1.809
	13	1258	661.55	0.53	53.578	51.185	57.148	1.511	1.29	1.865	13	5371	2798.47	0.52	56.667	54	62	1.83	1.531	2.43
	14	1155	925.83	0.80	51.733	49	56	1.342	1.106	1.729	14	955	565.83	0.59	58.906	57.211	60	2.051	1.857	2.177
	15										15	1019	668.75	0.66	58.198	53	61.9	1.998	1.438	2.417

Appendix H. Table H2. VPA output and diagnostics for GB-GB American plaice.

VPA Version 2.7.1

Model ID: American Plaice Gulf of Maine-Georges Bank 2007 Base Run

Input File: C:\LOB\AP\ASSESS_2008\VPA\B_11P_F69_SV+_9-11\B11P_SV+_BOOT.DAT
Date of Run: 20-JUL-2008 Time of Run: 13:47

Levenburg-Marquardt Algorithm Completed 9 Iterations
Residual Sum of Squares = 300.043

Number of Residuals = 743
Number of Parameters = 10
Degrees of Freedom = 733
Mean Squared Residual = 0.409336
Standard Deviation = 0.639793

Number of Years = 28
Number of Ages = 11
First Year = 1980
Youngest Age = 1
Oldest True Age = 10

Number of Survey Indices Available = 30
Number of Survey Indices Used in Estimate = 27

VPA Classic Method - Auto Estimated Q's

Stock Numbers Predicted in Terminal Year Plus One (2008)

Age	Stock Predicted	Std. Error	CV
1	42084.333	0.274534E+05	0.652342E+00
2	19084.898	0.559295E+04	0.293056E+00
3	34216.404	0.749229E+04	0.218968E+00
4	23147.560	0.423645E+04	0.183019E+00
5	15758.500	0.259021E+04	0.164369E+00
6	7052.158	0.113337E+04	0.160712E+00
7	6866.112	0.105831E+04	0.154136E+00
8	1632.210	0.330953E+03	0.202763E+00
9	1801.068	0.358493E+03	0.199044E+00
10	2375.051	0.443839E+03	0.186875E+00

Catchability Values for Each Survey Used in Estimate

INDEX	Catchability	Std. Error	CV
1	0.756315E-02	0.142550E-02	0.188479E+00
2	0.117776E+00	0.131015E-01	0.111241E+00
3	0.237083E+00	0.226727E-01	0.956320E-01
4	0.345291E+00	0.278629E-01	0.806939E-01
5	0.332013E+00	0.234096E-01	0.705080E-01
6	0.270544E+00	0.198359E-01	0.733185E-01

7	0.239287E+00	0.222962E-01	0.931778E-01
8	0.178071E+00	0.243164E-01	0.136554E+00
9	0.183208E+00	0.279889E-01	0.152771E+00
11	0.106649E+00	0.124861E-01	0.117077E+00
12	0.299685E+00	0.259527E-01	0.865999E-01
13	0.454693E+00	0.396251E-01	0.871469E-01
14	0.545345E+00	0.407639E-01	0.747489E-01
15	0.521424E+00	0.446796E-01	0.856877E-01
16	0.460618E+00	0.447785E-01	0.972141E-01
17	0.328359E+00	0.416616E-01	0.126878E+00
18	0.310350E+00	0.441360E-01	0.142214E+00
20	0.421847E-01	0.102605E-01	0.243227E+00
21	0.234209E+00	0.370230E-01	0.158077E+00
22	0.318789E+00	0.249546E-01	0.782794E-01
23	0.228953E+00	0.182832E-01	0.798555E-01
24	0.128202E+00	0.126938E-01	0.990135E-01
26	0.265599E+00	0.400073E-01	0.150631E+00
27	0.341196E+00	0.393301E-01	0.115271E+00
28	0.271214E+00	0.304525E-01	0.112282E+00
29	0.140295E+00	0.194801E-01	0.138851E+00
30	0.542392E-01	0.102775E-01	0.189484E+00

-- Non-Linear Least Squares Fit --

Default Tolerances Used

Scaled Gradient Tolerance	=	6.055454E-06
Scaled Step Tolerance	=	3.666853E-11
Relative Function Tolerance	=	3.666853E-11
Absolute Function Tolerance	=	4.930381E-32

VPA Method Options

- Catchability Values Estimated as an Analytic Function of N
- Catch Equation Used in Cohort Solution
- Plus Group Backward Calculation Method Used
- Rivard Weights Used for JAN-1 Biomass
- Rivard Weights Used for SSB Biomass
- Rivard Weights Calculation Used 5 Years for Terminal Year Plus One
- Heincke Rule Used in F-Oldest Calculation
- F-Oldest Calculation in Years Prior to Terminal Year
Uses Stock Sizes in Ages 6 to 9
- Calculation of Population of Age 1 In Year 2008
= Stock Estimate

Stock Estimates

Age	1
Age	2
Age	3
Age	4
Age	5
Age	6
Age	7

Age 8
 Age 9
 Age 10

Full F in Terminal Year = 0.0646

F in Oldest True Age in Terminal Year = 0.0646

Full F Calculated Using Classic Method

Age	Input Partial Recruitment	Calc Partial Recruitment	Fishing Mortality	Used In Full F	Comments
1	0.000	0.067	0.0075	NO	Stock Estimate in T+1
2	0.050	0.055	0.0063	NO	Stock Estimate in T+1
3	0.050	0.077	0.0087	NO	Stock Estimate in T+1
4	0.250	0.298	0.0336	NO	Stock Estimate in T+1
5	0.760	0.869	0.0981	NO	Stock Estimate in T+1
6	1.000	0.576	0.0650	YES	Stock Estimate in T+1
7	1.000	1.000	0.1129	YES	Stock Estimate in T+1
8	1.000	0.486	0.0548	YES	Stock Estimate in T+1
9	1.000	0.227	0.0256	YES	Stock Estimate in T+1
10	1.000	0.572	0.0646		Input PR * Full F

Catch At Age - Input Data

AGE	1980	1981	1982	1983	1984
1	5.2	5.1	9.6	14.5	2.5
2	98.9	981.8	603.2	662.8	370.5
3	1071.7	2191.8	3348.1	1478.2	990.6
4	2671.5	5055.3	4574.0	5176.8	2422.1
5	3938.7	5337.2	4503.1	4917.9	6031.2
6	3933.3	3648.1	3598.6	3913.0	3244.4
7	3632.0	2400.8	3297.0	2270.2	1935.6
8	1185.4	1581.6	2037.6	1272.1	580.3
9	1138.6	645.1	1256.1	701.2	273.8
10	849.9	439.8	736.7	449.6	307.2
11	1380.4	620.9	717.4	911.4	768.9
AGE	1985	1986	1987	1988	1989
1	64.8	59.3	38.5	313.5	15.5
2	157.8	638.7	589.6	785.5	2275.0
3	1217.4	738.0	1840.5	1839.5	2605.8
4	1336.4	2284.0	1439.2	1833.4	2517.3
5	2404.6	1700.0	2282.3	1597.4	1521.9
6	2872.0	1476.5	1336.9	1444.4	827.2
7	2228.2	1307.1	895.0	552.8	835.5
8	1081.3	631.5	542.9	270.3	534.5
9	438.1	254.9	187.2	177.1	195.6
10	267.1	104.8	61.6	88.2	103.6
11	181.9	99.9	59.9	55.3	118.0

AGE	1990	1991	1992	1993	1994
1	0.0	0.4	9.6	21.8	58.2
2	1094.4	255.2	244.5	280.6	885.8
3	4725.5	1030.8	861.7	421.6	406.9
4	3606.7	5997.5	1604.6	1774.5	1710.6
5	1971.8	4865.9	5810.5	2382.2	2840.7
6	696.0	1260.9	2649.2	2578.6	1341.7
7	367.2	326.5	848.7	1384.1	1158.2
8	404.1	165.8	190.7	264.9	597.0
9	193.0	201.6	131.2	286.6	234.7
10	96.1	97.0	117.6	151.2	149.7
11	161.0	104.1	93.5	124.8	290.5

Catch At Age - Input Data

AGE	1995	1996	1997	1998	1999
1	45.3	12.5	14.7	37.2	4.2
2	2433.7	1149.7	636.1	85.5	216.3
3	1572.9	1257.3	336.9	348.7	169.0
4	2359.5	3732.1	2317.2	866.1	1136.2
5	3294.4	2712.5	3615.0	2859.4	1674.7
6	1854.2	1506.3	1716.5	2603.7	2352.1
7	654.6	566.3	633.9	1071.4	1388.6
8	588.5	242.6	182.1	317.9	488.4
9	210.3	126.4	84.9	59.5	149.7
10	52.6	36.8	66.3	56.8	42.3
11	49.6	68.3	116.2	154.5	79.0

AGE	2000	2001	2002	2003	2004
1	2.7	0.0	1.1	11.9	6.1
2	303.0	91.7	12.9	689.2	140.0
3	442.2	413.8	108.7	45.5	226.2
4	797.2	958.8	771.8	297.1	440.3
5	1650.5	2296.8	1449.5	1238.0	923.9
6	2223.8	2198.0	1810.7	1275.1	1195.3
7	1755.2	1579.0	1191.3	743.8	508.0
8	567.3	911.8	516.1	557.3	364.4
9	138.2	293.4	283.1	278.7	195.3
10	69.8	56.3	161.4	153.9	77.3
11	19.8	51.8	177.2	119.0	73.8

AGE	2005	2006	2007
1	34.3	28.4	160.0
2	283.5	83.4	237.7
3	106.5	114.0	223.7
4	434.2	477.6	596.4

5	989.7	768.1	806.2
6	766.8	535.7	511.0
7	442.2	353.5	216.3
8	177.3	191.2	112.5
9	97.2	99.4	68.3
10	42.3	59.9	33.4
11	48.8	43.5	30.8

Weight At Age - Input Data

AGE	1980	1981	1982	1983	1984
1	0.0300	0.0320	0.0180	0.0130	0.0040
2	0.0760	0.1080	0.1150	0.0330	0.0450
3	0.1540	0.1680	0.2300	0.1850	0.1610
4	0.2670	0.3160	0.2900	0.3780	0.3030
5	0.4090	0.4420	0.4180	0.5300	0.5240
6	0.6530	0.7780	0.5640	0.6700	0.6300
7	0.8290	0.8850	0.9600	0.8230	0.8880
8	1.0390	0.9780	1.1380	1.0420	1.1870
9	1.1830	1.1300	1.1960	1.2380	1.1330
10	1.3740	1.2540	1.5520	1.4460	1.3690
11	1.8950	1.5510	1.9010	1.6800	1.9580
AGE	1985	1986	1987	1988	1989
1	0.0180	0.0160	0.0130	0.0160	0.0090
2	0.0580	0.0420	0.0460	0.0460	0.0350
3	0.0840	0.1380	0.1310	0.1590	0.1050
4	0.2090	0.2290	0.2340	0.2840	0.2410
5	0.3310	0.3840	0.4090	0.4490	0.3620
6	0.5340	0.5870	0.6090	0.6410	0.4540
7	0.8470	0.8420	0.8920	0.8800	0.6970
8	1.1670	1.1740	1.1730	1.2310	0.8010
9	1.3770	1.4910	1.4830	1.3960	1.3270
10	1.6650	1.7470	1.7320	1.7170	1.4620
11	2.1280	2.1940	2.2840	2.2380	1.9260
AGE	1990	1991	1992	1993	1994
1	0.0110	0.0040	0.0060	0.0030	0.0040
2	0.0380	0.0270	0.0320	0.0310	0.0260
3	0.1200	0.1100	0.1140	0.2280	0.1890
4	0.2540	0.3030	0.3200	0.3680	0.3600
5	0.4010	0.4450	0.5010	0.4890	0.4600
6	0.5540	0.6780	0.7270	0.6340	0.6080
7	0.7170	0.9580	0.9250	0.9440	0.7940
8	0.8760	1.1570	1.2400	1.2340	1.0830
9	1.0880	1.2740	1.3190	1.3940	1.2890
10	1.3050	1.5410	1.6400	1.5770	1.4240
11	1.6960	1.8130	2.0070	2.3130	2.4240

Weight At Age - Input Data

AGE	1995	1996	1997	1998	1999
1	0.0060	0.0030	0.0060	0.0130	0.0080
2	0.0270	0.0370	0.0210	0.0300	0.0190
3	0.1280	0.0990	0.1460	0.1010	0.0830
4	0.3050	0.3170	0.3470	0.2450	0.2510
5	0.4890	0.4950	0.4200	0.3480	0.3970
6	0.6650	0.6350	0.6010	0.4980	0.5130
7	0.9050	0.8840	0.8070	0.7860	0.6850
8	1.1550	1.2030	1.1270	1.0310	0.8720
9	1.0990	1.3900	1.3360	1.3500	1.1090
10	2.1040	1.5810	1.5700	1.4630	1.4580
11	1.9200	2.2270	2.4250	3.2930	1.9080
AGE	2000	2001	2002	2003	2004
1	0.0130	0.0110	0.0020	0.0270	0.0050
2	0.0190	0.0190	0.0350	0.0240	0.0190
3	0.1850	0.0750	0.1360	0.0950	0.0750
4	0.3240	0.3170	0.2960	0.2820	0.2420
5	0.4640	0.4300	0.4150	0.3830	0.3740
6	0.5720	0.5220	0.5060	0.5300	0.4860
7	0.7630	0.6960	0.6690	0.6830	0.6470
8	1.0070	0.8350	0.8840	0.8200	0.7820
9	1.0940	1.0450	1.0430	0.9500	0.9720
10	1.4110	1.4540	1.2240	1.1060	1.0090
11	1.8640	1.5290	1.4460	1.2430	1.2070
AGE	2005	2006	2007		
1	0.0090	0.0100	0.0080		
2	0.0170	0.0330	0.0330		
3	0.0700	0.1100	0.1720		
4	0.2910	0.2930	0.3160		
5	0.3990	0.4160	0.4300		
6	0.5070	0.5220	0.5150		
7	0.6410	0.6210	0.6440		
8	0.8480	0.8230	0.8250		
9	0.9460	0.9220	0.9810		
10	1.0730	0.9830	1.0230		
11	1.2800	1.2960	1.5110		

JAN-1 Weights at Age - Input Data

AGE	1980	1981	1982	1983	1984
1	0.0158	0.0169	0.0133	0.0070	0.0011

2	0.0511	0.0569	0.0607	0.0244	0.0242
3	0.1075	0.1130	0.1576	0.1459	0.0729
4	0.2075	0.2206	0.2207	0.2949	0.2368
5	0.2965	0.3435	0.3634	0.3920	0.4451
6	0.5609	0.5641	0.4993	0.5292	0.5778
7	0.7632	0.7602	0.8642	0.6813	0.7713
8	0.9963	0.9004	1.0036	1.0002	0.9884
9	1.1490	1.0835	1.0815	1.1869	1.0865
10	1.2749	1.2180	1.3243	1.3151	1.3019
11	1.8950	1.5510	1.9010	1.6800	1.9580
AGE	1985	1986	1987	1988	1989
1	0.0118	0.0094	0.0069	0.0108	0.0044
2	0.0152	0.0275	0.0271	0.0245	0.0237
3	0.0615	0.0895	0.0742	0.0855	0.0695
4	0.1834	0.1387	0.1797	0.1929	0.1958
5	0.3167	0.2833	0.3060	0.3241	0.3206
6	0.5290	0.4408	0.4836	0.5120	0.4515
7	0.7305	0.6705	0.7236	0.7321	0.6684
8	1.0180	0.9972	0.9938	1.0479	0.8396
9	1.2785	1.3191	1.3195	1.2797	1.2781
10	1.3735	1.5510	1.6070	1.5957	1.4286
11	2.1280	2.1940	2.2840	2.2380	1.9260
AGE	1990	1991	1992	1993	1994
1	0.0070	0.0014	0.0026	0.0010	0.0015
2	0.0185	0.0172	0.0113	0.0136	0.0088
3	0.0648	0.0647	0.0555	0.0854	0.0765
4	0.1633	0.1907	0.1876	0.2048	0.2865
5	0.3109	0.3362	0.3896	0.3956	0.4114
6	0.4478	0.5214	0.5688	0.5636	0.5453
7	0.5705	0.7285	0.7919	0.8284	0.7095
8	0.7814	0.9108	1.0899	1.0684	1.0111
9	0.9335	1.0564	1.2353	1.3147	1.2612
10	1.3160	1.2948	1.4455	1.4422	1.4089
11	1.6960	1.8130	2.0070	2.3130	2.4240

JAN-1 Weights at Age - Input Data

AGE	1995	1996	1997	1998	1999
1	0.0024	0.0011	0.0027	0.0108	0.0052
2	0.0104	0.0149	0.0079	0.0134	0.0157
3	0.0577	0.0517	0.0735	0.0461	0.0499
4	0.2401	0.2014	0.1853	0.1891	0.1592
5	0.4196	0.3886	0.3649	0.3475	0.3119
6	0.5531	0.5572	0.5454	0.4573	0.4225
7	0.7418	0.7667	0.7159	0.6873	0.5841
8	0.9576	1.0434	0.9981	0.9121	0.8279
9	1.0910	1.2671	1.2678	1.2335	1.0693
10	1.6468	1.3182	1.4773	1.3981	1.4030
11	1.9200	2.2270	2.4250	3.2930	1.9080
AGE	2000	2001	2002	2003	2004
1	0.0108	0.0062	0.0006	0.0322	0.0027
2	0.0123	0.0157	0.0196	0.0069	0.0226
3	0.0593	0.0377	0.0508	0.0577	0.0424
4	0.1640	0.2422	0.1490	0.1958	0.1516
5	0.3413	0.3733	0.3627	0.3367	0.3248
6	0.4765	0.4921	0.4665	0.4690	0.4314
7	0.6256	0.6310	0.5909	0.5879	0.5856
8	0.8305	0.7982	0.7844	0.7407	0.7308
9	0.9767	1.0258	0.9332	0.9164	0.8928
10	1.2509	1.2612	1.1310	1.0740	0.9791
11	1.8640	1.5290	1.4460	1.2430	1.2070
AGE	2005	2006	2007	2008	
1	0.0047	0.0055	0.0035	0.0097	
2	0.0092	0.0172	0.0182	0.0148	
3	0.0365	0.0432	0.0753	0.0510	
4	0.1477	0.1432	0.1864	0.1650	
5	0.3107	0.3479	0.3550	0.3350	
6	0.4355	0.4564	0.4629	0.4510	
7	0.5581	0.5611	0.5798	0.5745	
8	0.7407	0.7263	0.7158	0.7309	
9	0.8601	0.8842	0.8985	0.8904	
10	1.0213	0.9643	0.9712	1.0020	
11	1.2800	1.2960	1.5110	1.3074	

SSB Weight At Age - Input Data

AGE	1980	1981	1982	1983	1984
1	0.0158	0.0169	0.0133	0.0070	0.0011
2	0.0511	0.0569	0.0607	0.0244	0.0242
3	0.1075	0.1130	0.1576	0.1459	0.0729
4	0.2075	0.2206	0.2207	0.2949	0.2368
5	0.2965	0.3435	0.3634	0.3920	0.4451
6	0.5609	0.5641	0.4993	0.5292	0.5778
7	0.7632	0.7602	0.8642	0.6813	0.7713
8	0.9963	0.9004	1.0036	1.0002	0.9884
9	1.1490	1.0835	1.0815	1.1869	1.0865
10	1.2749	1.2180	1.3243	1.3151	1.3019
11	1.8950	1.5510	1.9010	1.6800	1.9580
AGE	1985	1986	1987	1988	1989
1	0.0118	0.0094	0.0069	0.0108	0.0044
2	0.0152	0.0275	0.0271	0.0245	0.0237
3	0.0615	0.0895	0.0742	0.0855	0.0695
4	0.1834	0.1387	0.1797	0.1929	0.1958
5	0.3167	0.2833	0.3060	0.3241	0.3206
6	0.5290	0.4408	0.4836	0.5120	0.4515
7	0.7305	0.6705	0.7236	0.7321	0.6684
8	1.0180	0.9972	0.9938	1.0479	0.8396
9	1.2785	1.3191	1.3195	1.2797	1.2781
10	1.3735	1.5510	1.6070	1.5957	1.4286
11	2.1280	2.1940	2.2840	2.2380	1.9260
AGE	1990	1991	1992	1993	1994
1	0.0070	0.0014	0.0026	0.0010	0.0015
2	0.0185	0.0172	0.0113	0.0136	0.0088
3	0.0648	0.0647	0.0555	0.0854	0.0765
4	0.1633	0.1907	0.1876	0.2048	0.2865
5	0.3109	0.3362	0.3896	0.3956	0.4114
6	0.4478	0.5214	0.5688	0.5636	0.5453
7	0.5705	0.7285	0.7919	0.8284	0.7095
8	0.7814	0.9108	1.0899	1.0684	1.0111
9	0.9335	1.0564	1.2353	1.3147	1.2612
10	1.3160	1.2948	1.4455	1.4422	1.4089
11	1.6960	1.8130	2.0070	2.3130	2.4240

SSB Weight At Age - Input Data

AGE	1995	1996	1997	1998	1999
1	0.0024	0.0011	0.0027	0.0108	0.0052
2	0.0104	0.0149	0.0079	0.0134	0.0157
3	0.0577	0.0517	0.0735	0.0461	0.0499
4	0.2401	0.2014	0.1853	0.1891	0.1592
5	0.4196	0.3886	0.3649	0.3475	0.3119
6	0.5531	0.5572	0.5454	0.4573	0.4225
7	0.7418	0.7667	0.7159	0.6873	0.5841
8	0.9576	1.0434	0.9981	0.9121	0.8279
9	1.0910	1.2671	1.2678	1.2335	1.0693
10	1.6468	1.3182	1.4773	1.3981	1.4030
11	1.9200	2.2270	2.4250	3.2930	1.9080
AGE	2000	2001	2002	2003	2004
1	0.0108	0.0062	0.0006	0.0322	0.0027
2	0.0123	0.0157	0.0196	0.0069	0.0226
3	0.0593	0.0377	0.0508	0.0577	0.0424
4	0.1640	0.2422	0.1490	0.1958	0.1516
5	0.3413	0.3733	0.3627	0.3367	0.3248
6	0.4765	0.4921	0.4665	0.4690	0.4314
7	0.6256	0.6310	0.5909	0.5879	0.5856
8	0.8305	0.7982	0.7844	0.7407	0.7308
9	0.9767	1.0258	0.9332	0.9164	0.8928
10	1.2509	1.2612	1.1310	1.0740	0.9791
11	1.8640	1.5290	1.4460	1.2430	1.2070
AGE	2005	2006	2007		
1	0.0047	0.0055	0.0035		
2	0.0092	0.0172	0.0182		
3	0.0365	0.0432	0.0753		
4	0.1477	0.1432	0.1864		
5	0.3107	0.3479	0.3550		
6	0.4355	0.4564	0.4629		
7	0.5581	0.5611	0.5798		
8	0.7407	0.7263	0.7158		
9	0.8601	0.8842	0.8985		
10	1.0213	0.9643	0.9712		
11	1.2800	1.2960	1.5110		

Natural Mortality - Input Data

AGE	1980	1981	1982	1983	1984
1	0.2000	0.2000	0.2000	0.2000	0.2000
2	0.2000	0.2000	0.2000	0.2000	0.2000
3	0.2000	0.2000	0.2000	0.2000	0.2000
4	0.2000	0.2000	0.2000	0.2000	0.2000
5	0.2000	0.2000	0.2000	0.2000	0.2000
6	0.2000	0.2000	0.2000	0.2000	0.2000
7	0.2000	0.2000	0.2000	0.2000	0.2000
8	0.2000	0.2000	0.2000	0.2000	0.2000
9	0.2000	0.2000	0.2000	0.2000	0.2000
10	0.2000	0.2000	0.2000	0.2000	0.2000
11	0.2000	0.2000	0.2000	0.2000	0.2000
AGE	1985	1986	1987	1988	1989
1	0.2000	0.2000	0.2000	0.2000	0.2000
2	0.2000	0.2000	0.2000	0.2000	0.2000
3	0.2000	0.2000	0.2000	0.2000	0.2000
4	0.2000	0.2000	0.2000	0.2000	0.2000
5	0.2000	0.2000	0.2000	0.2000	0.2000
6	0.2000	0.2000	0.2000	0.2000	0.2000
7	0.2000	0.2000	0.2000	0.2000	0.2000
8	0.2000	0.2000	0.2000	0.2000	0.2000
9	0.2000	0.2000	0.2000	0.2000	0.2000
10	0.2000	0.2000	0.2000	0.2000	0.2000
11	0.2000	0.2000	0.2000	0.2000	0.2000
AGE	1990	1991	1992	1993	1994
1	0.2000	0.2000	0.2000	0.2000	0.2000
2	0.2000	0.2000	0.2000	0.2000	0.2000
3	0.2000	0.2000	0.2000	0.2000	0.2000
4	0.2000	0.2000	0.2000	0.2000	0.2000
5	0.2000	0.2000	0.2000	0.2000	0.2000
6	0.2000	0.2000	0.2000	0.2000	0.2000
7	0.2000	0.2000	0.2000	0.2000	0.2000
8	0.2000	0.2000	0.2000	0.2000	0.2000
9	0.2000	0.2000	0.2000	0.2000	0.2000
10	0.2000	0.2000	0.2000	0.2000	0.2000
11	0.2000	0.2000	0.2000	0.2000	0.2000

Natural Mortality - Input Data

AGE	1995	1996	1997	1998	1999
1	0.2000	0.2000	0.2000	0.2000	0.2000
2	0.2000	0.2000	0.2000	0.2000	0.2000
3	0.2000	0.2000	0.2000	0.2000	0.2000
4	0.2000	0.2000	0.2000	0.2000	0.2000
5	0.2000	0.2000	0.2000	0.2000	0.2000
6	0.2000	0.2000	0.2000	0.2000	0.2000
7	0.2000	0.2000	0.2000	0.2000	0.2000
8	0.2000	0.2000	0.2000	0.2000	0.2000
9	0.2000	0.2000	0.2000	0.2000	0.2000
10	0.2000	0.2000	0.2000	0.2000	0.2000
11	0.2000	0.2000	0.2000	0.2000	0.2000

AGE	2000	2001	2002	2003	2004
1	0.2000	0.2000	0.2000	0.2000	0.2000
2	0.2000	0.2000	0.2000	0.2000	0.2000
3	0.2000	0.2000	0.2000	0.2000	0.2000
4	0.2000	0.2000	0.2000	0.2000	0.2000
5	0.2000	0.2000	0.2000	0.2000	0.2000
6	0.2000	0.2000	0.2000	0.2000	0.2000
7	0.2000	0.2000	0.2000	0.2000	0.2000
8	0.2000	0.2000	0.2000	0.2000	0.2000
9	0.2000	0.2000	0.2000	0.2000	0.2000
10	0.2000	0.2000	0.2000	0.2000	0.2000
11	0.2000	0.2000	0.2000	0.2000	0.2000

AGE	2005	2006	2007
1	0.2000	0.2000	0.2000
2	0.2000	0.2000	0.2000
3	0.2000	0.2000	0.2000
4	0.2000	0.2000	0.2000
5	0.2000	0.2000	0.2000
6	0.2000	0.2000	0.2000
7	0.2000	0.2000	0.2000
8	0.2000	0.2000	0.2000
9	0.2000	0.2000	0.2000
10	0.2000	0.2000	0.2000
11	0.2000	0.2000	0.2000

Proportion of Natural Mortality Before Spawning = 0.2500
Proportion of Fishing Mortality Before Spawning = 0.2500

Maturity - Input Data

AGE	1980	1981	1982	1983	1984
1	0.0100	0.0100	0.0100	0.0100	0.0200
2	0.0400	0.0500	0.0500	0.0500	0.0700
3	0.1500	0.1800	0.1700	0.1700	0.2100
4	0.4500	0.4600	0.4300	0.4400	0.5000
5	0.8000	0.7700	0.7400	0.7600	0.7900
6	0.9500	0.9300	0.9100	0.9300	0.9300
7	0.9900	0.9800	0.9700	0.9800	0.9800
8	1.0000	1.0000	0.9900	1.0000	0.9900
9	1.0000	1.0000	1.0000	1.0000	1.0000
10	1.0000	1.0000	1.0000	1.0000	1.0000
11	1.0000	1.0000	1.0000	1.0000	1.0000
AGE	1985	1986	1987	1988	1989
1	0.0300	0.0200	0.0100	0.0100	0.0100
2	0.1000	0.0700	0.0500	0.0500	0.0400
3	0.2600	0.2400	0.2400	0.2500	0.2200
4	0.5500	0.5600	0.6500	0.6900	0.6600
5	0.8000	0.8400	0.9200	0.9400	0.9300
6	0.9300	0.9600	0.9900	0.9900	0.9900
7	0.9800	0.9900	1.0000	1.0000	1.0000
8	0.9900	1.0000	1.0000	1.0000	1.0000
9	1.0000	1.0000	1.0000	1.0000	1.0000
10	1.0000	1.0000	1.0000	1.0000	1.0000
11	1.0000	1.0000	1.0000	1.0000	1.0000
AGE	1990	1991	1992	1993	1994
1	0.0000	0.0000	0.0000	0.0000	0.0000
2	0.0200	0.0200	0.0200	0.0200	0.0200
3	0.1500	0.1500	0.1500	0.1300	0.1300
4	0.6200	0.6000	0.6000	0.5700	0.5700
5	0.9400	0.9300	0.9200	0.9200	0.9200
6	0.9900	0.9900	0.9900	0.9900	0.9900
7	1.0000	1.0000	1.0000	1.0000	1.0000
8	1.0000	1.0000	1.0000	1.0000	1.0000
9	1.0000	1.0000	1.0000	1.0000	1.0000
10	1.0000	1.0000	1.0000	1.0000	1.0000
11	1.0000	1.0000	1.0000	1.0000	1.0000

Maturity - Input Data

AGE	1995	1996	1997	1998	1999
1	0.0000	0.0000	0.0000	0.0000	0.0000
2	0.0200	0.0200	0.0200	0.0200	0.0200
3	0.1300	0.1400	0.1200	0.1400	0.1500
4	0.5600	0.5600	0.5600	0.5800	0.5500
5	0.9200	0.9100	0.9200	0.9200	0.9000
6	0.9900	0.9900	0.9900	0.9900	0.9800
7	1.0000	1.0000	1.0000	1.0000	1.0000
8	1.0000	1.0000	1.0000	1.0000	1.0000
9	1.0000	1.0000	1.0000	1.0000	1.0000
10	1.0000	1.0000	1.0000	1.0000	1.0000
11	1.0000	1.0000	1.0000	1.0000	1.0000
AGE	2000	2001	2002	2003	2004
1	0.0000	0.0000	0.0000	0.0000	0.0000
2	0.0200	0.0200	0.0200	0.0300	0.0200
3	0.1600	0.1600	0.1500	0.1500	0.1300
4	0.5900	0.6200	0.5900	0.5400	0.5400
5	0.9200	0.9400	0.9200	0.8800	0.9000
6	0.9900	0.9900	0.9900	0.9800	0.9900
7	1.0000	1.0000	1.0000	1.0000	1.0000
8	1.0000	1.0000	1.0000	1.0000	1.0000
9	1.0000	1.0000	1.0000	1.0000	1.0000
10	1.0000	1.0000	1.0000	1.0000	1.0000
11	1.0000	1.0000	1.0000	1.0000	1.0000
AGE	2005	2006	2007		
1	0.0100	0.0100	0.0100		
2	0.0300	0.0300	0.0400		
3	0.1800	0.1800	0.2000		
4	0.5700	0.5700	0.5900		
5	0.8900	0.8900	0.9000		
6	0.9800	0.9800	0.9800		
7	1.0000	1.0000	1.0000		
8	1.0000	1.0000	1.0000		
9	1.0000	1.0000	1.0000		
10	1.0000	1.0000	1.0000		
11	1.0000	1.0000	1.0000		

Input Partial Recruitment

AGE

1	0.0000
2	0.0500
3	0.0500
4	0.2500
5	0.7600
6	1.0000
7	1.0000
8	1.0000
9	1.0000
10	1.0000

Input F-Plus Ratio

YEAR

1980	1.0000
1981	1.0000
1982	1.0000
1983	1.0000
1984	1.0000
1985	1.0000
1986	1.0000
1987	1.0000
1988	1.0000
1989	1.0000
1990	1.0000
1991	1.0000
1992	1.0000
1993	1.0000
1994	1.0000
1995	1.0000
1996	1.0000
1997	1.0000
1998	1.0000
1999	1.0000
2000	1.0000
2001	1.0000
2002	1.0000
2003	1.0000
2004	1.0000
2005	1.0000
2006	1.0000
2007	1.0000

SURVEY - INPUT DATA

INDEX	1	2	3	4	5
SURVEY TAG	spr_us	spr_us	spr_us	spr_us	spr_us
AGE	1	2	3	4	5
TIME	JAN-1	JAN-1	JAN-1	JAN-1	JAN-1
TYPE	NUMBERS	NUMBERS	NUMBERS	NUMBERS	NUMBERS
RETRO FLAG	1	1	1	1	1
1980	1333.6100	10935.5800	13484.2500	9038.8900	8683.2600
1981	385.2600	10165.0500	12476.6400	10253.9600	7734.9200
1982	88.9100	3111.7500	5304.7900	9394.5200	6312.4100
1983	592.7100	10905.9400	9868.6900	13276.8000	7823.8300
1984	29.6400	1037.2500	1659.6000	2667.2100	3823.0100
1985	88.9100	948.3400	2904.3000	2548.6700	2163.4100
1986	29.6400	1363.2400	1007.6100	2993.2100	1748.5100
1987	266.7200	1807.7800	2933.9400	2044.8600	1511.4200
1988	592.7100	2933.9400	2489.4000	2252.3100	918.7100
1989	148.1800	4712.0800	3763.7400	2548.6700	1452.1500
1990	0.0000	1689.2400	7853.4600	3022.8400	1600.3300
1991	88.9100	2104.1400	4830.6200	6905.1200	2726.4900
1992	177.8100	1007.6100	3408.1100	2607.9400	3171.0200
1993	977.9800	2489.4000	3437.7400	4682.4400	1807.7800
1994	88.9100	4237.9100	3378.4700	3319.2000	2222.6800
1995	88.9100	5838.2400	9513.0600	6816.2100	3289.5600
1996	59.2700	1392.8800	5749.3300	9779.7900	3882.2800
1997	29.6400	2519.0400	4919.5300	7468.2000	6075.3200
1998	177.8100	563.0800	3022.8400	3319.2000	3615.5600
1999	237.0900	1215.0600	1541.0600	3348.8400	2341.2200
2000	88.9100	5660.4200	7349.6600	6579.1300	4741.7100
2001	0.0000	2098.2100	10876.3100	9987.2400	4297.1800
2002	297.8400	1024.5100	2911.1200	6964.3900	4931.6800
2003	132.7700	2247.2800	798.9800	2088.7300	3676.0100
2004	1074.2900	2567.6400	6001.8200	5303.0100	3930.2900
2005	578.7900	2303.2900	3087.4500	3647.8600	2707.8200
2006	2258.2400	4799.8000	5080.7500	5042.5200	2480.5100
2007	726.0800	11092.0600	8227.7600	4780.5400	3017.2100
2008	318.2900	1728.9500	6066.1300	8426.0300	4146.9300

SURVEY - INPUT DATA

INDEX	6	7	8	9	10
SURVEY TAG	spr_us	spr_us	spr_us	spr_us	us0aut
AGE	6	7	8	9 - 11	1
TIME	JAN-1	JAN-1	JAN-1	JAN-1	JAN-1
TYPE	NUMBERS	NUMBERS	NUMBERS	NUMBERS	NUMBERS
RETRO FLAG	1	1	1	1	1
1980	4771.3500	3378.4700	770.5300	1944.1029	0.0000
1981	5008.4400	4178.6400	2281.9500	3082.1143	0.0000
1982	3941.5500	2726.4900	1481.7900	2044.8643	8.8900
1983	3497.0100	1718.8700	948.3400	1541.0571	0.0000
1984	1718.8700	651.9900	296.3600	266.7214	177.8100
1985	2548.6700	1363.2400	1244.7000	859.4357	59.2700
1986	859.4400	622.3500	296.3600	237.0857	59.2700
1987	740.8900	503.8100	207.4500	296.3571	296.3600
1988	681.6200	355.6300	29.6400	325.9929	29.6400
1989	859.4400	474.1700	88.9100	266.7214	0.0000
1990	503.8100	177.8100	118.5400	148.1786	148.1800
1991	444.5400	207.4500	118.5400	148.1786	29.6400
1992	1274.3400	325.9900	118.5400	118.5429	29.6400
1993	1333.6100	503.8100	237.0900	237.0857	59.2700
1994	681.6200	296.3600	88.9100	148.1786	29.6400
1995	1303.9700	651.9900	88.9100	355.6286	118.5400
1996	1570.6900	592.7100	148.1800	59.2714	29.6400
1997	1155.7900	266.7200	29.6400	88.9071	29.6400
1998	2015.2300	474.1700	177.8100	88.9071	29.6400
1999	1896.6900	1215.0600	503.8100	118.5429	29.6400
2000	2548.6700	1778.1400	444.5400	296.3571	59.2700
2001	2222.6800	1096.5200	503.8100	474.1714	88.9100
2002	1515.5700	988.6500	579.9700	645.4659	59.2700
2003	1892.2400	653.4700	303.7700	554.7806	144.0300
2004	3370.1700	1020.0600	290.4300	611.0884	98.9800
2005	1470.2300	702.9600	342.8900	48.8989	28.7500
2006	958.4200	881.9600	317.9900	170.7017	0.0000
2007	966.4200	406.9000	207.7500	120.0246	77.6500
2008	1886.3100	642.2100	253.0900	362.1484	56.3100

SURVEY - INPUT DATA

INDEX	11	12	13	14	15
SURVEY TAG	us1aut	us2aut	us3aut	us4aut	us5aut
AGE	2	3	4	5	6
TIME	JAN-1	JAN-1	JAN-1	JAN-1	JAN-1
TYPE	NUMBERS	NUMBERS	NUMBERS	NUMBERS	NUMBERS
RETRO FLAG	1	1	1	1	1
1980	0.0000	0.0000	0.0000	0.0000	0.0000
1981	4682.4400	6608.7600	8060.9100	8416.5400	4534.2600
1982	1303.9700	7823.8300	6401.3100	7349.6600	6401.3100
1983	592.7100	2696.8500	4889.8900	3763.7400	1689.2400
1984	1481.7900	2993.2100	5986.4100	8653.6300	4030.4600
1985	651.9900	6638.4000	4623.1700	3585.9200	3171.0200
1986	2696.8500	2459.7600	7823.8300	3111.7500	2341.2200
1987	1511.4200	4326.8100	2578.3100	4237.9100	1392.8800
1988	1570.6900	3763.7400	2933.9400	1274.3400	2044.8600
1989	8416.5400	8801.8100	7082.9400	2311.5900	1392.8800
1990	1422.5100	13187.8900	8475.8100	2904.3000	563.0800
1991	5067.7100	6697.6700	22197.1500	8564.7200	1748.5100
1992	1392.8800	7320.0200	5986.4100	4712.0800	2163.4100
1993	1926.3200	3645.1900	5482.6100	3793.3700	2311.5900
1994	5038.0700	6934.7600	10283.5900	6756.9400	3111.7500
1995	11350.4800	22315.6900	8327.6400	5067.7100	3852.6400
1996	1481.7900	11261.5700	11320.8400	7408.9300	2667.2100
1997	1600.3300	2400.4900	5927.1400	8120.1900	2756.1200
1998	1066.8900	3141.3900	4593.5400	5512.2400	3082.1100
1999	5126.9800	1778.1400	5571.5100	5956.7800	5275.1600
2000	5927.1400	6519.8600	6075.3200	6312.4100	4741.7100
2001	1392.8800	8594.3600	11587.5600	6756.9400	4000.8200
2002	1185.4300	3615.5600	9809.4200	7823.8300	4326.8100
2003	2955.8700	2270.6900	3864.2000	9955.8200	5120.1600
2004	2077.7600	6697.3800	3726.6900	5206.4000	5147.7200
2005	2081.6100	2845.9200	3533.7600	2917.0400	2172.8900
2006	2041.0100	4876.8500	2141.1800	3464.1200	2209.9400
2007	6052.8000	7517.9900	7742.3300	7619.6400	4186.9300
2008	3187.0200	10214.2500	8386.3100	6491.4100	2508.9600

SURVEY - INPUT DATA

INDEX	16	17	18	19	20
SURVEY TAG	us6aut	us7aut	us8paut	us8aut	spr_ma
AGE	7	8	9 - 11	9	1
TIME	JAN-1	JAN-1	JAN-1	JAN-1	JAN-1
TYPE	NUMBERS	NUMBERS	NUMBERS	NUMBERS	NUMBERS
RETRO FLAG	1	1	1	1	1
1980	0.0000	0.0000	0.0000	0.0000	0.0000
1981	3022.8400	2756.1200	4119.3643	1689.2400	0.0000
1982	4267.5400	1748.5100	3259.9286	1570.6900	1622.2300
1983	1422.5100	889.0700	1452.1500	503.8100	436.0600
1984	2015.2300	1007.6100	1333.6071	503.8100	485.7600
1985	1511.4200	355.6300	503.8071	296.3600	4871.2000
1986	1215.0600	563.0800	325.9929	148.1800	6113.8500
1987	1244.7000	474.1700	563.0786	325.9900	7763.1900
1988	740.8900	296.3600	325.9929	118.5400	18407.0700
1989	296.3600	207.4500	148.1786	0.0000	1823.3100
1990	296.3600	59.2700	266.7214	59.2700	1746.4900
1991	740.8900	355.6300	414.9000	207.4500	474.4700
1992	859.4400	118.5400	237.0857	177.8100	1852.2800
1993	889.0700	207.4500	355.6286	148.1800	2619.9000
1994	2370.8600	325.9900	355.6286	118.5400	2621.0000
1995	1185.4300	740.8900	563.0786	385.2600	122.1900
1996	651.9900	118.5400	148.1786	88.9100	516.7600
1997	1155.7900	207.4500	325.9929	118.5400	349.8200
1998	948.3400	118.5400	118.5429	29.6400	639.4000
1999	3200.6600	355.6300	237.0857	148.1800	305.0100
2000	2400.4900	592.7100	88.9071	88.9100	779.2800
2001	2222.6800	977.9800	592.7143	414.9000	15.8200
2002	1570.6900	1215.0600	1185.4286	592.7100	1414.3600
2003	1573.0600	1170.3100	1655.4510	853.8000	1163.5700
2004	2621.2800	1033.9900	923.7452	395.3400	3727.9600
2005	1472.9000	566.9300	430.6069	271.7600	1504.7400
2006	1259.5200	432.9800	678.6579	298.7300	1070.9400
2007	1677.0900	1305.7500	734.6694	487.8000	571.6200
2008	1239.3700	442.1600	120.0246	65.7900	0.0000

SURVEY - INPUT DATA

INDEX	21	22	23	24	25
SURVEY TAG	spr_ma	spr_ma	spr_ma	spr_ma	ma0aut
AGE	2	3	4	5	1
TIME	JAN-1	JAN-1	JAN-1	JAN-1	JAN-1
TYPE	NUMBERS	NUMBERS	NUMBERS	NUMBERS	NUMBERS
RETRO FLAG	1	1	1	1	1
1980	0.0000	0.0000	0.0000	0.0000	0.0000
1981	0.0000	0.0000	0.0000	0.0000	0.0000
1982	11127.3900	7534.9900	3872.5600	1129.6800	0.0000
1983	4238.5700	5065.5000	4848.6000	2309.0700	38.4100
1984	6199.7100	4816.9700	2388.1500	1048.3500	291.4600
1985	3877.0800	5472.1900	2146.4000	851.7800	24.8500
1986	24914.0500	6079.9600	3260.2700	641.6600	0.0000
1987	3899.6700	3567.5400	881.1500	397.6500	51.9700
1988	14362.8000	4032.9700	1970.1700	347.9400	54.2200
1989	28752.7200	10160.3800	2708.9800	684.5900	0.0000
1990	5732.0200	12812.8800	3723.4400	774.9600	6.7800
1991	4514.2200	7855.8200	4288.2800	732.0400	18.0700
1992	2498.2700	7677.1300	3387.2900	1676.9500	9.0400
1993	4288.4400	3633.7000	2069.4000	779.1000	0.0000
1994	11876.5300	4998.7200	1611.3600	876.3600	0.0000
1995	7828.7800	11216.3800	2332.7500	712.9400	0.0000
1996	935.9700	3371.2500	7092.5200	1429.3200	0.0000
1997	1799.0700	3151.8400	3894.1300	2758.4900	20.7900
1998	978.3100	2586.9800	1701.3000	2017.6200	0.0000
1999	2632.1600	2632.1600	3413.9100	1710.3400	36.1500
2000	12768.4400	7875.5900	4513.7200	3002.8800	0.0000
2001	1073.2000	5356.9600	3847.7000	1070.9400	6.7800
2002	937.6400	2433.3400	4200.1700	1339.8100	0.0000
2003	10140.0400	2797.1000	4127.8700	4026.1900	38.4100
2004	2675.0900	7661.5200	2952.9900	1281.0600	0.0000
2005	4753.7100	5180.7300	1861.7200	1084.5000	0.0000
2006	12252.5500	7907.7900	3210.5600	1116.1300	0.0000
2007	11021.2000	9688.1700	3563.0200	1683.2300	0.0000
2008	0.0000	0.0000	0.0000	0.0000	15.8200

SURVEY - INPUT DATA

INDEX	26	27	28	29	30
SURVEY TAG	ma1aut	ma2aut	ma3aut	ma4aut	ma5aut
AGE	2	3	4	5	6
TIME	JAN-1	JAN-1	JAN-1	JAN-1	JAN-1
TYPE	NUMBERS	NUMBERS	NUMBERS	NUMBERS	NUMBERS
RETRO FLAG	1	1	1	1	1
1980	0.0000	0.0000	0.0000	0.0000	0.0000
1981	0.0000	0.0000	0.0000	0.0000	0.0000
1982	0.0000	0.0000	0.0000	0.0000	0.0000
1983	2991.4000	3492.9800	2309.0700	1154.5400	257.5700
1984	11787.1200	4288.2800	2263.8900	1875.2800	314.0500
1985	709.4400	2991.4000	964.7500	413.4600	173.9700
1986	13775.3700	2135.1000	3210.5600	352.4600	31.6300
1987	9324.4100	9055.5500	2727.0600	1197.4700	88.1200
1988	10474.4300	3298.6800	677.8100	117.4900	51.9700
1989	19346.9700	9326.6700	3158.6000	302.7600	101.6700
1990	13004.9200	27620.7800	7010.8200	526.4300	29.3700
1991	7227.7200	3208.3000	4545.8500	887.9300	47.4500
1992	5438.3000	20415.6500	9048.7700	2600.5300	264.3500
1993	10467.3800	2935.9800	6731.6300	2495.1300	311.2300
1994	17217.8500	8314.0200	3973.6900	1547.9600	386.2600
1995	8294.1200	17919.8900	2431.8500	656.6200	351.7600
1996	2675.3900	9990.4700	5632.1500	952.1700	204.5200
1997	3672.1500	4348.6300	6225.6400	3155.1900	313.4000
1998	3075.2900	6345.1200	4045.9200	2325.4500	329.7300
1999	7808.3800	1382.7300	3117.9300	1604.1500	849.5200
2000	6604.1300	7358.7600	4656.5600	2390.4100	643.9200
2001	1414.3600	5799.8000	4387.6900	1357.8800	675.5500
2002	680.0700	3323.5300	6961.1100	2049.2500	603.2500
2003	8881.5800	2117.0300	2661.5400	3361.9400	840.4800
2004	5417.9600	7473.9900	3217.3400	1712.6000	903.7500
2005	13560.7300	4315.3900	2250.3300	1425.6600	619.0700
2006	9358.3000	12318.0800	3330.3100	2632.1600	953.4500
2007	3278.3400	10198.7900	4699.4900	2458.1900	933.1200
2008	1796.2000	5542.2300	4347.0200	2444.6400	630.3600

Additional Output Files

Population File C:\LOB\AP\ASSESS_2008\VPA\B_11P_F69_SV+_9-11\B11P_SV+_BOOT.PP2
 Auxilliary File C:\LOB\AP\ASSESS_2008\VPA\B_11P_F69_SV+_9-11\B11P_SV+_BOOT.AUX
 Covariance File C:\LOB\AP\ASSESS_2008\VPA\B_11P_F69_SV+_9-11\B11P_SV+_BOOT.CV
 Residuals File C:\LOB\AP\ASSESS_2008\VPA\B_11P_F69_SV+_9-11\B11P_SV+_BOOT.RSD
 Log File C:\LOB\AP\ASSESS_2008\VPA\B_11P_F69_SV+_9-11\B11P_SV+_BOOT.LOG

Bootstrap Files

Bootstrap Stock Numbers C:\LOB\AP\ASSESS_2008\VPA\B_11P_F69_SV+_9-11\B11P_SV+_B00T.BSN
 Bootstrap Fishing Mortality C:\LOB\AP\ASSESS_2008\VPA\B_11P_F69_SV+_9-11\B11P_SV+_B00T.BSF
 Bootstrap Biomass C:\LOB\AP\ASSESS_2008\VPA\B_11P_F69_SV+_9-11\B11P_SV+_B00T.BSB
 Bootstrap Catchability C:\LOB\AP\ASSESS_2008\VPA\B_11P_F69_SV+_9-11\B11P_SV+_B00T.BSQ

Estimation Results

JAN-1 Population Numbers

AGE	1980	1981	1982	1983	1984
1	50300.	26027.	20849.	24666.	15520.
2	39477.	41178.	21304.	17061.	20182.
3	32635.	32231.	32827.	16898.	13370.
4	24065.	25752.	24412.	23858.	12502.
5	19254.	17295.	16536.	15870.	14878.
6	13955.	12221.	9371.	9494.	8582.
7	9947.	7894.	6732.	4451.	4273.
8	4678.	4891.	4309.	2570.	1621.
9	3006.	2765.	2586.	1709.	970.
10	2776.	1441.	1684.	996.	772.
11	4509.	2035.	1640.	2019.	1932.
=====					
Total	204602.	173729.	142248.	119593.	94601.
=====					
AGE	1985	1986	1987	1988	1989
1	19012.	23602.	41613.	53494.	20981.
2	12704.	15507.	19270.	34035.	43514.
3	16189.	10259.	12120.	15245.	27156.
4	10053.	12156.	7733.	8265.	10824.
5	8056.	7027.	7897.	5037.	5118.
6	6785.	4438.	4225.	4417.	2691.
7	4121.	2987.	2310.	2260.	2321.
8	1770.	1390.	1278.	1090.	1354.
9	807.	489.	574.	561.	649.
10	548.	271.	173.	302.	300.
11	373.	258.	169.	189.	342.
=====					
Total	80418.	78384.	97362.	124895.	115250.
=====					
AGE	1990	1991	1992	1993	1994
1	21648.	22668.	25137.	39653.	38756.
2	17164.	17722.	18557.	20571.	32445.
3	33573.	13065.	14279.	14973.	16589.
4	19884.	23231.	9767.	10913.	11878.

5	6599.	13034.	13632.	6552.	7337.
6	2825.	3633.	6314.	5966.	3230.
7	1461.	1687.	1844.	2800.	2580.
8	1152.	866.	1088.	752.	1058.
9	630.	581.	560.	719.	379.
10	356.	342.	295.	340.	332.
11	597.	368.	235.	281.	644.
=====					
Total	105888.	97197.	91707.	103521.	115228.

JAN-1 Population Numbers

AGE	1995	1996	1997	1998	1999
1	26619.	24201.	21348.	16743.	26464.
2	31678.	21753.	19803.	17465.	13674.
3	25764.	23741.	16772.	15639.	14222.
4	13215.	19675.	18303.	13428.	12489.
5	8184.	8695.	12750.	12897.	10212.
6	3464.	3753.	4686.	7193.	7988.
7	1445.	1185.	1725.	2299.	3557.
8	1077.	598.	465.	844.	926.
9	335.	358.	273.	218.	407.
10	102.	88.	180.	147.	125.
11	96.	163.	315.	400.	233.
=====					
Total	111979.	104210.	96620.	87273.	90296.

AGE	2000	2001	2002	2003	2004
1	16173.	12409.	28387.	22483.	36846.
2	21663.	13239.	10159.	23239.	18396.
3	11000.	17462.	10756.	8306.	18404.
4	11491.	8607.	13923.	8708.	6759.
5	9201.	8689.	6182.	10703.	6862.
6	6853.	6047.	5051.	3759.	7647.
7	4429.	3617.	2982.	2513.	1934.
8	1669.	2056.	1550.	1376.	1390.
9	323.	858.	868.	806.	628.
10	199.	141.	440.	457.	410.
11	56.	129.	483.	353.	392.
=====					
Total	83058.	73255.	80782.	82703.	99669.

AGE	2005	2006	2007	2008
1	42696.	51397.	23487.	42084.
2	30161.	34926.	42054.	19085.
3	14935.	24438.	28519.	34216.
4	14864.	12132.	19905.	23148.
5	5137.	11777.	9502.	15758.
6	4785.	3315.	8949.	7052.
7	5185.	3228.	2232.	6866.
8	1128.	3846.	2324.	1632.
9	811.	763.	2976.	1801.

10	339.	576.	536.	2375.
11	391.	418.	543.	828.
=====				
Total	120431.	146816.	141027.	154846.

Fishing Mortality Calculated

AGE	1980	1981	1982	1983	1984
1	0.0001	0.0002	0.0005	0.0006	0.0002
2	0.0028	0.0266	0.0317	0.0438	0.0205
3	0.0369	0.0779	0.1191	0.1013	0.0852
4	0.1304	0.2430	0.2306	0.2722	0.2394
5	0.2546	0.4127	0.3548	0.4148	0.5851
6	0.3697	0.3963	0.5445	0.5983	0.5335
7	0.5100	0.4054	0.7628	0.8104	0.6816
8	0.3258	0.4373	0.7247	0.7748	0.4973
9	0.5349	0.2959	0.7537	0.5946	0.3705
10	0.4087	0.4071	0.6493	0.6781	0.5707
11	0.4087	0.4071	0.6493	0.6781	0.5707
AGE	1985	1986	1987	1988	1989
1	0.0038	0.0028	0.0010	0.0065	0.0008
2	0.0138	0.0465	0.0343	0.0258	0.0594
3	0.0865	0.0826	0.1828	0.1425	0.1117
4	0.1582	0.2313	0.2288	0.2792	0.2948
5	0.3962	0.3087	0.3810	0.4269	0.3944
6	0.6204	0.4531	0.4257	0.4434	0.4108
7	0.8867	0.6494	0.5510	0.3126	0.5007
8	1.0857	0.6844	0.6237	0.3177	0.5650
9	0.8925	0.8369	0.4418	0.4248	0.4006
10	0.7573	0.5506	0.4920	0.3857	0.4745
11	0.7573	0.5506	0.4920	0.3857	0.4745
AGE	1990	1991	1992	1993	1994
1	0.0001	0.0001	0.0004	0.0006	0.0017
2	0.0729	0.0160	0.0146	0.0152	0.0306
3	0.1683	0.0909	0.0688	0.0315	0.0274
4	0.2224	0.3331	0.1993	0.1970	0.1725
5	0.3968	0.5248	0.6263	0.5072	0.5504
6	0.3153	0.4779	0.6130	0.6384	0.6046
7	0.3228	0.2391	0.6969	0.7732	0.6732
8	0.4845	0.2362	0.2141	0.4868	0.9492
9	0.4092	0.4778	0.2974	0.5723	1.1144
10	0.3509	0.3719	0.5723	0.6629	0.6770
11	0.3509	0.3719	0.5723	0.6629	0.6770

Fishing Mortality Calculated

AGE	1995	1996	1997	1998	1999
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1	0.0019	0.0006	0.0008	0.0025	0.0002
2	0.0884	0.0600	0.0361	0.0054	0.0176
3	0.0697	0.0601	0.0224	0.0249	0.0132
4	0.2185	0.2338	0.1501	0.0737	0.1056
5	0.5797	0.4182	0.3724	0.2790	0.1989
6	0.8726	0.5774	0.5121	0.5042	0.3898
7	0.6819	0.7357	0.5143	0.7097	0.5565
8	0.9011	0.5856	0.5589	0.5306	0.8535
9	1.1376	0.4881	0.4173	0.3564	0.5153
10	0.8280	0.6102	0.5157	0.5487	0.4638
11	0.8280	0.6102	0.5157	0.5487	0.4638
AGE	2000	2001	2002	2003	2004

1	0.0002	0.0001	0.0001	0.0006	0.0002
2	0.0155	0.0077	0.0014	0.0333	0.0084
3	0.0453	0.0265	0.0112	0.0061	0.0137
4	0.0795	0.1308	0.0630	0.0383	0.0745
5	0.2197	0.3425	0.2976	0.1362	0.1604
6	0.4392	0.5070	0.4980	0.4643	0.1886
7	0.5677	0.6474	0.5737	0.3922	0.3398
8	0.4653	0.6619	0.4536	0.5846	0.3391
9	0.6301	0.4688	0.4419	0.4755	0.4169
10	0.4848	0.5748	0.5135	0.4601	0.2320
11	0.4848	0.5748	0.5135	0.4601	0.2320
AGE	2005	2006	2007		

1	0.0009	0.0006	0.0075		
2	0.0104	0.0026	0.0063		
3	0.0079	0.0052	0.0087		
4	0.0327	0.0444	0.0336		
5	0.2379	0.0746	0.0981		
6	0.1939	0.1957	0.0650		
7	0.0987	0.1285	0.1129		
8	0.1899	0.0564	0.0548		
9	0.1415	0.1546	0.0256		
10	0.1479	0.1216	0.0646		
11	0.1479	0.1216	0.0646		

Average Fishing Mortality For Ages 4- 9

Year	Average F	N Weighted	Biomass Wtd	Catch Wtd
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1980	0.3542	0.2857	0.3574	0.3426
1981	0.3651	0.3445	0.3700	0.3607
1982	0.5619	0.4192	0.5377	0.4957
1983	0.5775	0.4378	0.5078	0.4949
1984	0.4846	0.4753	0.5203	0.5211
1985	0.6733	0.4839	0.6563	0.6261
1986	0.5273	0.3613	0.4841	0.4202

1987	0.4420	0.3706	0.4353	0.4014
1988	0.3674	0.3563	0.3699	0.3690
1989	0.4277	0.3704	0.4148	0.3857
1990	0.3585	0.2832	0.3242	0.3035
1991	0.3815	0.3997	0.4089	0.4187
1992	0.4412	0.4831	0.5238	0.5567
1993	0.5292	0.4413	0.5407	0.5267
1994	0.6774	0.4234	0.5271	0.5427
1995	0.7319	0.4687	0.5852	0.5869
1996	0.5065	0.3444	0.4206	0.3936
1997	0.4208	0.2920	0.3629	0.3551
1998	0.4090	0.2813	0.3652	0.4018
1999	0.4366	0.2654	0.3545	0.3667
2000	0.4002	0.2779	0.3675	0.3856
2001	0.4597	0.3773	0.4477	0.4600
2002	0.3880	0.2628	0.3720	0.4026
2003	0.3485	0.2049	0.2815	0.3467
2004	0.2532	0.1759	0.2180	0.2162
2005	0.1491	0.1090	0.1357	0.1683
2006	0.1090	0.0803	0.0929	0.1051
2007	0.0650	0.0575	0.0611	0.0713

Average Fishing Mortality For Ages 5- 9

Year	Average F	N Weighted	Biomass Wtd	Catch Wtd
1980	0.3990	0.3593	0.3962	0.3836
1981	0.3896	0.4025	0.3975	0.4044
1982	0.6281	0.5357	0.6078	0.5783
1983	0.6386	0.5537	0.5955	0.5831
1984	0.5336	0.5726	0.5677	0.5776
1985	0.7763	0.6359	0.7329	0.6954
1986	0.5865	0.4580	0.5375	0.5006
1987	0.4847	0.4379	0.4705	0.4487
1988	0.3851	0.4040	0.3894	0.4098
1989	0.4543	0.4377	0.4546	0.4442
1990	0.3857	0.3787	0.3829	0.3841
1991	0.3912	0.4779	0.4466	0.4941
1992	0.4896	0.6013	0.5723	0.6163
1993	0.5956	0.6001	0.6173	0.6116
1994	0.7784	0.6277	0.6750	0.6453
1995	0.8346	0.6966	0.7340	0.7185
1996	0.5610	0.4935	0.5198	0.5092
1997	0.4750	0.4225	0.4409	0.4313
1998	0.4760	0.4001	0.4365	0.4429
1999	0.5028	0.3518	0.4048	0.4157
2000	0.4644	0.3793	0.4174	0.4241
2001	0.5255	0.4771	0.5076	0.5034
2002	0.4530	0.4300	0.4485	0.4525
2003	0.4106	0.2806	0.3297	0.3691
2004	0.2890	0.2131	0.2359	0.2357
2005	0.1724	0.1754	0.1636	0.1921
2006	0.1219	0.0993	0.1007	0.1200
2007	0.0713	0.0758	0.0689	0.0844

Average Fishing Mortality For Ages 6- 9

Year	Average F	N Weighted	Biomass Wtd	Catch Wtd
1980	0.4351	0.4231	0.4305	0.4350
1981	0.3838	0.3961	0.3931	0.3990
1982	0.6965	0.6657	0.6941	0.6770
1983	0.6945	0.6746	0.6844	0.6845
1984	0.5207	0.5605	0.5572	0.5701
1985	0.8713	0.7791	0.8240	0.8040
1986	0.6559	0.5708	0.6136	0.5894
1987	0.5106	0.4915	0.5081	0.5009
1988	0.3746	0.3902	0.3788	0.3986
1989	0.4693	0.4694	0.4755	0.4758
1990	0.3829	0.3590	0.3749	0.3690
1991	0.3577	0.3874	0.3709	0.4175
1992	0.4554	0.5665	0.5310	0.6009
1993	0.6177	0.6595	0.6557	0.6667
1994	0.8354	0.7060	0.7481	0.7261
1995	0.8983	0.8479	0.8548	0.8568
1996	0.5967	0.6046	0.6040	0.6103
1997	0.5006	0.5120	0.5103	0.5128
1998	0.5252	0.5481	0.5559	0.5585
1999	0.5788	0.4731	0.5034	0.4986
2000	0.5256	0.4900	0.4976	0.4961
2001	0.5713	0.5700	0.5765	0.5776
2002	0.4918	0.5084	0.5035	0.5115
2003	0.4791	0.4635	0.4692	0.4701
2004	0.3211	0.2442	0.2639	0.2665
2005	0.1560	0.1485	0.1454	0.1616
2006	0.1338	0.1254	0.1164	0.1495
2007	0.0646	0.0629	0.0588	0.0722

Back Calculated Partial Recruitment

AGE	1980	1981	1982	1983	1984
1	0.0002	0.0005	0.0007	0.0008	0.0003
2	0.0052	0.0609	0.0416	0.0540	0.0300
3	0.0689	0.1781	0.1562	0.1250	0.1249
4	0.2437	0.5556	0.3023	0.3359	0.3513
5	0.4759	0.9438	0.4651	0.5119	0.8585
6	0.6911	0.9062	0.7138	0.7383	0.7828
7	0.9533	0.9270	1.0000	1.0000	1.0000
8	0.6091	1.0000	0.9500	0.9561	0.7297
9	1.0000	0.6767	0.9881	0.7338	0.5437
10	0.7640	0.9309	0.8512	0.8367	0.8374
11	0.7640	0.9309	0.8512	0.8367	0.8374
AGE	1985	1986	1987	1988	1989
1	0.0035	0.0033	0.0016	0.0146	0.0014
2	0.0127	0.0555	0.0550	0.0581	0.1050
3	0.0797	0.0987	0.2931	0.3214	0.1977
4	0.1457	0.2764	0.3669	0.6297	0.5218
5	0.3650	0.3688	0.6110	0.9628	0.6981
6	0.5714	0.5413	0.6825	1.0000	0.7271
7	0.8167	0.7759	0.8836	0.7051	0.8861
8	1.0000	0.8177	1.0000	0.7165	1.0000
9	0.8221	1.0000	0.7084	0.9579	0.7091
10	0.6975	0.6579	0.7889	0.8698	0.8398
11	0.6975	0.6579	0.7889	0.8698	0.8398
AGE	1990	1991	1992	1993	1994
1	0.0002	0.0002	0.0006	0.0008	0.0015
2	0.1504	0.0305	0.0210	0.0196	0.0274
3	0.3473	0.1733	0.0988	0.0408	0.0246
4	0.4590	0.6346	0.2859	0.2548	0.1548
5	0.8190	1.0000	0.8987	0.6559	0.4939
6	0.6508	0.9105	0.8796	0.8257	0.5426
7	0.6662	0.4556	1.0000	1.0000	0.6041
8	1.0000	0.4501	0.3073	0.6296	0.8518
9	0.8446	0.9104	0.4268	0.7401	1.0000
10	0.7243	0.7086	0.8211	0.8573	0.6075
11	0.7243	0.7086	0.8211	0.8573	0.6075

Back Calculated Partial Recruitment

AGE	1995	1996	1997	1998	1999
1	0.0017	0.0008	0.0014	0.0035	0.0002
2	0.0777	0.0816	0.0645	0.0076	0.0206
3	0.0612	0.0818	0.0401	0.0351	0.0155
4	0.1921	0.3178	0.2685	0.1039	0.1237
5	0.5096	0.5685	0.6663	0.3932	0.2330
6	0.7671	0.7848	0.9163	0.7105	0.4567
7	0.5994	1.0000	0.9202	1.0000	0.6520
8	0.7922	0.7959	1.0000	0.7476	1.0000
9	1.0000	0.6634	0.7467	0.5021	0.6038
10	0.7279	0.8293	0.9228	0.7731	0.5434
11	0.7279	0.8293	0.9228	0.7731	0.5434
AGE	2000	2001	2002	2003	2004
1	0.0003	0.0002	0.0002	0.0010	0.0004
2	0.0247	0.0116	0.0024	0.0569	0.0202
3	0.0719	0.0400	0.0195	0.0104	0.0327
4	0.1262	0.1977	0.1099	0.0656	0.1787
5	0.3486	0.5174	0.5187	0.2330	0.3846
6	0.6969	0.7659	0.8680	0.7941	0.4525
7	0.9009	0.9781	1.0000	0.6708	0.8151
8	0.7385	1.0000	0.7905	1.0000	0.8134
9	1.0000	0.7084	0.7701	0.8133	1.0000
10	0.7693	0.8685	0.8950	0.7870	0.5565
11	0.7693	0.8685	0.8950	0.7870	0.5565
AGE	2005	2006	2007		
1	0.0037	0.0031	0.0668		
2	0.0438	0.0135	0.0554		
3	0.0332	0.0264	0.0770		
4	0.1376	0.2268	0.2977		
5	1.0000	0.3812	0.8694		
6	0.8148	1.0000	0.5759		
7	0.4147	0.6567	1.0000		
8	0.7981	0.2880	0.4859		
9	0.5948	0.7903	0.2271		
10	0.6215	0.6213	0.5722		
11	0.6215	0.6213	0.5722		

JAN-1 Biomass

AGE	1980	1981	1982	1983	1984
1	795.	440.	277.	173.	17.
2	2017.	2343.	1293.	416.	488.
3	3508.	3642.	5174.	2465.	975.
4	4993.	5681.	5388.	7036.	2960.
5	5709.	5941.	6009.	6221.	6622.
6	7827.	6894.	4679.	5024.	4958.
7	7591.	6001.	5817.	3032.	3296.
8	4661.	4403.	4325.	2571.	1602.
9	3453.	2996.	2796.	2029.	1054.
10	3540.	1755.	2230.	1310.	1005.
11	8545.	3156.	3117.	3393.	3784.
=====					
Total	52640.	43252.	41105.	33670.	26761.
=====					
AGE	1985	1986	1987	1988	1989
1	224.	222.	287.	578.	92.
2	193.	426.	522.	834.	1031.
3	996.	918.	899.	1303.	1887.
4	1844.	1686.	1390.	1594.	2119.
5	2551.	1991.	2417.	1632.	1641.
6	3589.	1956.	2043.	2262.	1215.
7	3010.	2003.	1671.	1655.	1551.
8	1802.	1386.	1270.	1142.	1136.
9	1032.	645.	758.	717.	830.
10	753.	420.	279.	482.	429.
11	794.	566.	385.	424.	658.
=====					
Total	16788.	12220.	11921.	12623.	12591.
=====					
AGE	1990	1991	1992	1993	1994
1	152.	32.	65.	40.	58.
2	318.	305.	210.	280.	286.
3	2176.	845.	792.	1279.	1269.
4	3247.	4430.	1832.	2235.	3403.
5	2052.	4382.	5311.	2592.	3019.
6	1265.	1894.	3591.	3362.	1761.
7	833.	1229.	1461.	2320.	1830.
8	900.	789.	1185.	804.	1070.
9	588.	614.	692.	945.	477.
10	469.	443.	426.	491.	468.
11	1012.	666.	471.	650.	1562.
=====					
Total	13010.	15630.	16037.	14997.	15203.

JAN-1 Biomass

AGE	1995	1996	1997	1998	1999
1	64.	27.	58.	181.	138.
2	329.	324.	156.	234.	215.
3	1487.	1227.	1233.	721.	710.
4	3173.	3962.	3391.	2539.	1988.
5	3434.	3379.	4653.	4482.	3185.
6	1916.	2091.	2556.	3290.	3375.
7	1072.	909.	1235.	1580.	2078.
8	1032.	624.	464.	770.	766.
9	366.	454.	346.	269.	435.
10	167.	116.	266.	206.	175.
11	184.	364.	765.	1317.	445.
Total	13224.	13477.	15122.	15588.	13509.
AGE	2000	2001	2002	2003	2004
1	175.	77.	17.	724.	99.
2	266.	208.	199.	160.	416.
3	652.	658.	546.	479.	780.
4	1885.	2085.	2075.	1705.	1025.
5	3140.	3244.	2242.	3604.	2229.
6	3266.	2976.	2356.	1763.	3299.
7	2771.	2282.	1762.	1478.	1133.
8	1386.	1641.	1216.	1019.	1016.
9	315.	880.	810.	739.	560.
10	249.	178.	497.	491.	402.
11	105.	198.	698.	439.	473.
Total	14210.	14426.	12419.	12600.	11432.
AGE	2005	2006	2007	2008	
1	201.	283.	82.	408.	
2	277.	601.	765.	282.	
3	545.	1056.	2148.	1745.	
4	2195.	1737.	3710.	3819.	
5	1596.	4097.	3373.	5279.	
6	2084.	1513.	4143.	3181.	
7	2893.	1811.	1294.	3945.	
8	835.	2793.	1663.	1193.	
9	697.	675.	2674.	1604.	
10	346.	556.	520.	2380.	
11	500.	542.	820.	1082.	
Total	12171.	15664.	21193.	24918.	

Mean Biomass

AGE	1980	1981	1982	1983	1984
1	1368.	755.	340.	291.	56.
2	2716.	3979.	2187.	500.	815.
3	4475.	4728.	6464.	2699.	1873.
4	5472.	6574.	5752.	7188.	3065.
5	6328.	5716.	5305.	6283.	5401.
6	6947.	7161.	3727.	4382.	3831.
7	5904.	5241.	4149.	2306.	2522.
8	3780.	3537.	3200.	1711.	1385.
9	2518.	2463.	1993.	1460.	837.
10	2857.	1355.	1761.	959.	737.
11	6401.	2366.	2100.	2258.	2638.
=====					
Total	48765.	43874.	36978.	30035.	23161.
=====					
AGE	1985	1986	1987	1988	1989
1	310.	342.	490.	773.	171.
2	663.	577.	790.	1401.	1342.
3	1182.	1233.	1319.	2052.	2450.
4	1766.	2261.	1472.	1865.	2058.
5	2009.	2115.	2450.	1680.	1397.
6	2472.	1913.	1913.	2088.	914.
7	2129.	1695.	1449.	1556.	1163.
8	1162.	1083.	1021.	1047.	758.
9	676.	454.	628.	582.	648.
10	587.	332.	217.	393.	319.
11	511.	398.	278.	321.	479.
=====					
Total	13467.	12404.	12026.	13759.	11698.
=====					
AGE	1990	1991	1992	1993	1994
1	216.	82.	137.	108.	140.
2	571.	430.	534.	574.	753.
3	3370.	1247.	1427.	3047.	2804.
4	4120.	5456.	2577.	3315.	3570.
5	1993.	4126.	4648.	2297.	2374.
6	1223.	1789.	3142.	2561.	1349.
7	816.	1308.	1126.	1690.	1366.
8	731.	812.	1104.	671.	681.
9	513.	538.	582.	698.	271.
10	357.	402.	337.	360.	315.
11	778.	508.	328.	435.	1040.
=====					
Total	14687.	16698.	15942.	15756.	14665.

Mean Biomass

AGE	1995	1996	1997	1998	1999
1	145.	66.	116.	197.	192.
2	743.	709.	370.	474.	233.
3	2891.	2069.	2196.	1415.	1063.
4	3293.	5060.	5359.	2878.	2701.
5	2779.	3210.	4077.	3566.	3343.
6	1413.	1657.	2015.	2571.	3096.
7	869.	680.	995.	1187.	1709.
8	754.	498.	367.	618.	499.
9	203.	360.	272.	225.	322.
10	134.	95.	202.	151.	133.
11	115.	249.	546.	927.	325.
Total	13339.	14655.	16515.	14209.	13617.
AGE	2000	2001	2002	2003	2004
1	191.	124.	51.	550.	167.
2	370.	227.	322.	497.	316.
3	1805.	1172.	1319.	713.	1243.
4	3248.	2323.	3624.	2185.	1430.
5	3487.	2884.	2021.	3481.	2155.
6	2896.	2263.	1840.	1456.	3079.
7	2359.	1698.	1389.	1295.	967.
8	1228.	1150.	1006.	782.	840.
9	240.	654.	668.	557.	455.
10	203.	142.	385.	370.	336.
11	76.	138.	499.	321.	384.
Total	16103.	12775.	13124.	12208.	11373.
AGE	2005	2006	2007		
1	348.	466.	170.		
2	462.	1043.	1254.		
3	944.	2430.	4427.		
4	3859.	3154.	5609.		
5	1660.	4284.	3533.		
6	2005.	1429.	4049.		
7	2873.	1708.	1234.		
8	792.	2792.	1692.		
9	650.	593.	2614.		
10	307.	484.	481.		
11	422.	464.	721.		
Total	14322.	18848.	25784.		

Spawning Stock Biomass

AGE	1980	1981	1982	1983	1984
1	8.	4.	3.	2.	0.
2	77.	111.	61.	20.	32.
3	496.	612.	812.	389.	191.
4	2069.	2339.	2080.	2751.	1326.
5	4076.	3925.	3871.	4054.	4299.
6	6449.	5523.	3535.	3827.	3839.
7	6293.	5055.	4436.	2308.	2591.
8	4086.	3755.	3398.	2015.	1332.
9	2874.	2646.	2203.	1663.	913.
10	3040.	1508.	1803.	1052.	829.
11	7339.	2711.	2521.	2724.	3121.
Total	36807.	28190.	24722.	20805.	18474.
AGE	1985	1986	1987	1988	1989
1	6.	4.	3.	5.	1.
2	18.	28.	25.	39.	39.
3	241.	205.	196.	299.	384.
4	927.	848.	811.	976.	1236.
5	1758.	1472.	1923.	1312.	1315.
6	2719.	1595.	1730.	1906.	1032.
7	2248.	1604.	1385.	1456.	1302.
8	1293.	1111.	1033.	1003.	939.
9	785.	498.	645.	614.	714.
10	593.	348.	234.	416.	362.
11	625.	469.	324.	366.	556.
Total	11215.	8183.	8310.	8393.	7881.
AGE	1990	1991	1992	1993	1994
1	0.	0.	0.	0.	0.
2	6.	6.	4.	5.	5.
3	298.	118.	111.	157.	156.
4	1811.	2326.	995.	1154.	1767.
5	1661.	3400.	3974.	1998.	2302.
6	1101.	1583.	2901.	2699.	1426.
7	731.	1101.	1167.	1819.	1471.
8	759.	707.	1069.	677.	803.
9	505.	518.	611.	779.	344.
10	408.	384.	352.	396.	376.
11	882.	578.	388.	524.	1255.
Total	8162.	10722.	11572.	10208.	9905.

Spawning Stock Biomass

AGE	1995	1996	1997	1998	1999
1	0.	0.	0.	0.	0.
2	6.	6.	3.	4.	4.
3	181.	161.	140.	95.	101.
4	1600.	1991.	1740.	1375.	1013.
5	2600.	2635.	3710.	3658.	2595.
6	1451.	1705.	2118.	2731.	2854.
7	860.	719.	1033.	1259.	1720.
8	783.	513.	384.	642.	589.
9	262.	382.	296.	234.	364.
10	129.	95.	222.	171.	148.
11	142.	297.	640.	1092.	377.
Total	8014.	8503.	10285.	11261.	9764.
AGE	2000	2001	2002	2003	2004
1	0.	0.	0.	0.	0.
2	5.	4.	4.	5.	8.
3	98.	100.	78.	68.	96.
4	1037.	1190.	1146.	867.	517.
5	2601.	2662.	1822.	2916.	1833.
6	2756.	2469.	1959.	1463.	2964.
7	2287.	1846.	1452.	1274.	990.
8	1174.	1323.	1032.	837.	888.
9	256.	745.	690.	624.	480.
10	210.	146.	416.	416.	361.
11	89.	163.	584.	372.	424.
Total	10512.	10648.	9183.	8843.	8560.
AGE	2005	2006	2007		
1	2.	3.	1.		
2	8.	17.	29.		
3	93.	181.	408.		
4	1181.	932.	2065.		
5	1273.	3405.	2818.		
6	1851.	1343.	3800.		
7	2685.	1668.	1197.		
8	758.	2620.	1561.		
9	640.	618.	2527.		
10	317.	513.	487.		
11	458.	500.	768.		
Total	9266.	11799.	15659.		

Catch Biomass

AGE	1980	1981	1982	1983	1984
1	0.	0.	0.	0.	0.
2	8.	106.	69.	22.	17.
3	165.	368.	770.	273.	159.
4	713.	1597.	1326.	1957.	734.
5	1611.	2359.	1882.	2606.	3160.
6	2568.	2838.	2030.	2622.	2044.
7	3011.	2125.	3165.	1868.	1719.
8	1232.	1547.	2319.	1326.	689.
9	1347.	729.	1502.	868.	310.
10	1168.	552.	1143.	650.	421.
11	2616.	963.	1364.	1531.	1506.
Total	14439.	13184.	15571.	13724.	10758.
AGE	1985	1986	1987	1988	1989
1	1.	1.	1.	5.	0.
2	9.	27.	27.	36.	80.
3	102.	102.	241.	292.	274.
4	279.	523.	337.	521.	607.
5	796.	653.	933.	717.	551.
6	1534.	867.	814.	926.	376.
7	1887.	1101.	798.	486.	582.
8	1262.	741.	637.	333.	428.
9	603.	380.	278.	247.	260.
10	445.	183.	107.	151.	151.
11	387.	219.	137.	124.	227.
Total	7306.	4796.	4309.	3839.	3535.
AGE	1990	1991	1992	1993	1994
1	0.	0.	0.	0.	0.
2	42.	7.	8.	9.	23.
3	567.	113.	98.	96.	77.
4	916.	1817.	513.	653.	616.
5	791.	2165.	2911.	1165.	1307.
6	386.	855.	1926.	1635.	816.
7	263.	313.	785.	1307.	920.
8	354.	192.	236.	327.	647.
9	210.	257.	173.	400.	303.
10	125.	149.	193.	238.	213.
11	273.	189.	188.	289.	704.
Total	3927.	6057.	7032.	6118.	5624.

Catch Biomass

AGE	1995	1996	1997	1998	1999
1	0.	0.	0.	0.	0.
2	66.	43.	13.	3.	4.
3	201.	124.	49.	35.	14.
4	720.	1183.	804.	212.	285.
5	1611.	1343.	1518.	995.	665.
6	1233.	957.	1032.	1297.	1207.
7	592.	501.	512.	842.	951.
8	680.	292.	205.	328.	426.
9	231.	176.	113.	80.	166.
10	111.	58.	104.	83.	62.
11	95.	152.	282.	509.	151.
=====					
Total	5540.	4828.	4633.	4384.	3930.
=====					
AGE	2000	2001	2002	2003	2004
=====					
1	0.	0.	0.	0.	0.
2	6.	2.	0.	17.	3.
3	82.	31.	15.	4.	17.
4	258.	304.	228.	84.	107.
5	766.	988.	602.	474.	346.
6	1272.	1147.	916.	676.	581.
7	1339.	1099.	797.	508.	329.
8	571.	761.	456.	457.	285.
9	151.	307.	295.	265.	190.
10	98.	82.	198.	170.	78.
11	37.	79.	256.	148.	89.
=====					
Total	4581.	4800.	3764.	2803.	2023.
=====					
AGE	2005	2006	2007		
=====					
1	0.	0.	1.		
2	5.	3.	8.		
3	7.	13.	38.		
4	126.	140.	188.		
5	395.	320.	347.		
6	389.	280.	263.		
7	283.	220.	139.		
8	150.	157.	93.		
9	92.	92.	67.		
10	45.	59.	34.		
11	62.	56.	47.		
=====					
Total	1556.	1338.	1226.		

Catch Numbers

AGE	1980	1981	1982	1983	1984
1	5.2	5.1	9.6	14.5	2.5
2	98.9	981.8	603.2	662.8	370.5
3	1071.7	2191.8	3348.1	1478.2	990.6
4	2671.5	5055.3	4574.0	5176.8	2422.1
5	3938.7	5337.2	4503.1	4917.9	6031.2
6	3933.3	3648.1	3598.6	3913.0	3244.4
7	3632.0	2400.8	3297.0	2270.2	1935.6
8	1185.4	1581.6	2037.6	1272.1	580.3
9	1138.6	645.1	1256.1	701.2	273.8
10	849.9	439.8	736.7	449.6	307.2
11	1380.4	620.9	717.4	911.4	768.9
Total	19905.6	22907.5	24681.4	21767.7	16927.1
AGE	1985	1986	1987	1988	1989
1	64.8	59.3	38.5	313.5	15.5
2	157.8	638.7	589.6	785.5	2275.0
3	1217.4	738.0	1840.5	1839.5	2605.8
4	1336.4	2284.0	1439.2	1833.4	2517.3
5	2404.6	1700.0	2282.3	1597.4	1521.9
6	2872.0	1476.5	1336.9	1444.4	827.2
7	2228.2	1307.1	895.0	552.8	835.5
8	1081.3	631.5	542.9	270.3	534.5
9	438.1	254.9	187.2	177.1	195.6
10	267.1	104.8	61.6	88.2	103.6
11	181.9	99.9	59.9	55.3	118.0
Total	12249.6	9294.7	9273.6	8957.4	11549.9
AGE	1990	1991	1992	1993	1994
1	0.0	0.4	9.6	21.8	58.2
2	1094.4	255.2	244.5	280.6	885.8
3	4725.5	1030.8	861.7	421.6	406.9
4	3606.7	5997.5	1604.6	1774.5	1710.6
5	1971.8	4865.9	5810.5	2382.2	2840.7
6	696.0	1260.9	2649.2	2578.6	1341.7
7	367.2	326.5	848.7	1384.1	1158.2
8	404.1	165.8	190.7	264.9	597.0
9	193.0	201.6	131.2	286.6	234.7
10	96.1	97.0	117.6	151.2	149.7
11	161.0	104.1	93.5	124.8	290.5
Total	13315.8	14305.7	12561.8	9670.9	9674.0

Catch Numbers

AGE	1995	1996	1997	1998	1999
1	45.3	12.5	14.7	37.2	4.2
2	2433.7	1149.7	636.1	85.5	216.3
3	1572.9	1257.3	336.9	348.7	169.0
4	2359.5	3732.1	2317.2	866.1	1136.2
5	3294.4	2712.5	3615.0	2859.4	1674.7
6	1854.2	1506.3	1716.5	2603.7	2352.1
7	654.6	566.3	633.9	1071.4	1388.6
8	588.5	242.6	182.1	317.9	488.4
9	210.3	126.4	84.9	59.5	149.7
10	52.6	36.8	66.3	56.8	42.3
11	49.6	68.3	116.2	154.5	79.0
Total	13115.6	11410.8	9719.8	8460.7	7700.5
AGE	2000	2001	2002	2003	2004
1	2.7	0.0	1.1	11.9	6.1
2	303.0	91.7	12.9	689.2	140.0
3	442.2	413.8	108.7	45.5	226.2
4	797.2	958.8	771.8	297.1	440.3
5	1650.5	2296.8	1449.5	1238.0	923.9
6	2223.8	2198.0	1810.7	1275.1	1195.3
7	1755.2	1579.0	1191.3	743.8	508.0
8	567.3	911.8	516.1	557.3	364.4
9	138.2	293.4	283.1	278.7	195.3
10	69.8	56.3	161.4	153.9	77.3
11	19.8	51.8	177.2	119.0	73.8
Total	7969.7	8851.4	6483.8	5409.5	4150.6
AGE	2005	2006	2007		
1	34.3	28.4	160.0		
2	283.5	83.4	237.7		
3	106.5	114.0	223.7		
4	434.2	477.6	596.4		
5	989.7	768.1	806.2		
6	766.8	535.7	511.0		
7	442.2	353.5	216.3		
8	177.3	191.2	112.5		
9	97.2	99.4	68.3		
10	42.3	59.9	33.4		
11	48.8	43.5	30.8		
Total	3422.8	2754.7	2996.3		

Surplus Production

Average Adjustment Factor (Delta) = 1.0000

Year	Biomass	Delta Biomass	Catch Biomass	Surplus Production
1980	52640.218	-9388.332	14438.521	5050.189
1981	43251.887	-2146.978	13184.160	11037.182
1982	41104.909	-7434.662	15571.310	8136.649
1983	33670.247	-6908.762	13723.817	6815.055
1984	26761.485	-9973.316	10758.293	784.978
1985	16788.169	-4568.418	7305.689	2737.271
1986	12219.751	-299.043	4796.441	4497.398
1987	11920.708	702.752	4309.415	5012.167
1988	12623.460	-32.184	3839.044	3806.860
1989	12591.276	419.175	3535.290	3954.464
1990	13010.451	2619.375	3926.749	6546.124
1991	15629.826	406.972	6057.404	6464.377
1992	16036.798	-1039.888	7031.703	5991.815
1993	14996.910	206.181	6117.735	6323.916
1994	15203.091	-1979.560	5624.494	3644.934
1995	13223.531	253.672	5540.118	5793.789
1996	13477.203	1644.821	4827.751	6472.572
1997	15122.024	465.966	4632.705	5098.671
1998	15587.990	-2078.878	4384.243	2305.364
1999	13509.112	701.117	3930.338	4631.456
2000	14210.229	215.765	4580.812	4796.577
2001	14425.995	-2006.746	4799.699	2792.953
2002	12419.249	181.206	3763.717	3944.923
2003	12600.455	-1168.929	2802.821	1633.892
2004	11431.526	739.219	2023.203	2762.422
2005	12170.745	3493.289	1556.197	5049.486
2006	15664.034	5528.882	1338.464	6867.345
2007	21192.915	3724.808	1225.713	4950.521
2008	24917.724			

Summary of Survey Indices Used in the Estimate

INDEX	Survey Tag	Age	Time	Type	Catchability	Std. Error	CV
1	spr_us	1	JAN-1	NUMBER	0.7563E-02	0.1425E-02	0.1885E+00
2	spr_us	2	JAN-1	NUMBER	0.1178E+00	0.1310E-01	0.1112E+00
3	spr_us	3	JAN-1	NUMBER	0.2371E+00	0.2267E-01	0.9563E-01
4	spr_us	4	JAN-1	NUMBER	0.3453E+00	0.2786E-01	0.8069E-01
5	spr_us	5	JAN-1	NUMBER	0.3320E+00	0.2341E-01	0.7051E-01
6	spr_us	6	JAN-1	NUMBER	0.2705E+00	0.1984E-01	0.7332E-01
7	spr_us	7	JAN-1	NUMBER	0.2393E+00	0.2230E-01	0.9318E-01
8	spr_us	8	JAN-1	NUMBER	0.1781E+00	0.2432E-01	0.1366E+00
9	spr_us	9 - 11	JAN-1	NUMBER	0.1832E+00	0.2799E-01	
0.1528E+00							
11	us1aut	2	JAN-1	NUMBER	0.1066E+00	0.1249E-01	0.1171E+00
12	us2aut	3	JAN-1	NUMBER	0.2997E+00	0.2595E-01	0.8660E-01
13	us3aut	4	JAN-1	NUMBER	0.4547E+00	0.3963E-01	0.8715E-01
14	us4aut	5	JAN-1	NUMBER	0.5453E+00	0.4076E-01	0.7475E-01
15	us5aut	6	JAN-1	NUMBER	0.5214E+00	0.4468E-01	0.8569E-01
16	us6aut	7	JAN-1	NUMBER	0.4606E+00	0.4478E-01	0.9721E-01
17	us7aut	8	JAN-1	NUMBER	0.3284E+00	0.4166E-01	0.1269E+00
18	us8paut	9 - 11	JAN-1	NUMBER	0.3104E+00	0.4414E-01	
0.1422E+00							
20	spr_ma	1	JAN-1	NUMBER	0.4218E-01	0.1026E-01	0.2432E+00
21	spr_ma	2	JAN-1	NUMBER	0.2342E+00	0.3702E-01	0.1581E+00
22	spr_ma	3	JAN-1	NUMBER	0.3188E+00	0.2495E-01	0.7828E-01
23	spr_ma	4	JAN-1	NUMBER	0.2290E+00	0.1828E-01	0.7986E-01
24	spr_ma	5	JAN-1	NUMBER	0.1282E+00	0.1269E-01	0.9901E-01
26	ma1aut	2	JAN-1	NUMBER	0.2656E+00	0.4001E-01	0.1506E+00
27	ma2aut	3	JAN-1	NUMBER	0.3412E+00	0.3933E-01	0.1153E+00
28	ma3aut	4	JAN-1	NUMBER	0.2712E+00	0.3045E-01	0.1123E+00
29	ma4aut	5	JAN-1	NUMBER	0.1403E+00	0.1948E-01	0.1389E+00
30	ma5aut	6	JAN-1	NUMBER	0.5424E-01	0.1028E-01	0.1895E+00

Survey Index: 1 Tag: spr_us AGE = 1
Time = JAN-1 Type = NUMBER
Catchability = 0.756315E-02 % Variance Contribution = 8.3115
Residual = LN(Observed) - LN(Predicted)

Year	Observed	Predicted	Residual
1980	0.133361E+04	0.380428E+03	0.125435E+01
1981	0.385260E+03	0.196844E+03	0.671508E+00
1982	0.889100E+02	0.157682E+03	-0.572957E+00
1983	0.592710E+03	0.186551E+03	0.115600E+01
1984	0.296400E+02	0.117378E+03	-0.137628E+01
1985	0.889100E+02	0.143789E+03	-0.480721E+00
1986	0.296400E+02	0.178505E+03	-0.179549E+01
1987	0.266720E+03	0.314726E+03	-0.165505E+00
1988	0.592710E+03	0.404585E+03	0.381845E+00
1989	0.148180E+03	0.158681E+03	-0.684651E-01
1990	N/A	0.163726E+03	N/A
1991	0.889100E+02	0.171442E+03	-0.656623E+00

1992	0.177810E+03	0.190111E+03	-0.668933E-01
1993	0.977980E+03	0.299900E+03	0.118204E+01
1994	0.889100E+02	0.293118E+03	-0.119295E+01
1995	0.889100E+02	0.201323E+03	-0.817288E+00
1996	0.592700E+02	0.183035E+03	-0.112757E+01
1997	0.296400E+02	0.161459E+03	-0.169513E+01
1998	0.177810E+03	0.126626E+03	0.339476E+00
1999	0.237090E+03	0.200148E+03	0.169384E+00
2000	0.889100E+02	0.122320E+03	-0.319012E+00
2001	N/A	0.938545E+02	N/A
2002	0.297840E+03	0.214693E+03	0.327348E+00
2003	0.132770E+03	0.170040E+03	-0.247413E+00
2004	0.107429E+04	0.278671E+03	0.134938E+01
2005	0.578790E+03	0.322916E+03	0.583547E+00
2006	0.225824E+04	0.388719E+03	0.175948E+01
2007	0.726080E+03	0.177635E+03	0.140793E+01
2008	0.318290E+03	0.318290E+03	-0.109231E-07

Survey Index: 2 Tag: spr_us AGE = 2
 Time = JAN-1 Type = NUMBER
 Catchability = 0.117776E+00 % Variance Contribution = 3.3489
 Residual = LN(Observed) - LN(Predicted)

Year	Observed	Predicted	Residual
1980	0.109356E+05	0.464939E+04	0.855286E+00
1981	0.101650E+05	0.484972E+04	0.740035E+00
1982	0.311175E+04	0.250912E+04	0.215253E+00
1983	0.109059E+05	0.200935E+04	0.169150E+01
1984	0.103725E+04	0.237689E+04	-0.829220E+00
1985	0.948340E+03	0.149625E+04	-0.456004E+00
1986	0.136324E+04	0.182634E+04	-0.292452E+00
1987	0.180778E+04	0.226955E+04	-0.227481E+00
1988	0.293394E+04	0.400852E+04	-0.312075E+00
1989	0.471208E+04	0.512491E+04	-0.839833E-01
1990	0.168924E+04	0.202145E+04	-0.179537E+00
1991	0.210414E+04	0.208722E+04	0.807461E-02
1992	0.100761E+04	0.218559E+04	-0.774304E+00
1993	0.248940E+04	0.242280E+04	0.271159E-01
1994	0.423791E+04	0.382127E+04	0.103489E+00
1995	0.583824E+04	0.373093E+04	0.447772E+00
1996	0.139288E+04	0.256196E+04	-0.609398E+00
1997	0.251904E+04	0.233227E+04	0.770346E-01
1998	0.563080E+03	0.205696E+04	-0.129556E+01
1999	0.121506E+04	0.161047E+04	-0.281730E+00
2000	0.566042E+04	0.255134E+04	0.796879E+00
2001	0.209821E+04	0.155923E+04	0.296893E+00
2002	0.102451E+04	0.119648E+04	-0.155170E+00
2003	0.224728E+04	0.273696E+04	-0.197127E+00
2004	0.256764E+04	0.216666E+04	0.169802E+00
2005	0.230329E+04	0.355227E+04	-0.433248E+00
2006	0.479980E+04	0.411338E+04	0.154330E+00
2007	0.110921E+05	0.495296E+04	0.806243E+00
2008	0.172895E+04	0.224774E+04	-0.262409E+00

Survey Index: 3 Tag: spr_us AGE = 3

Time = JAN-1 Type = NUMBER
Catchability = 0.237083E+00 % Variance Contribution = 2.4750
Residual = LN(Observed) - LN(Predicted)

Year	Observed	Predicted	Residual
1980	0.134842E+05	0.773728E+04	0.555472E+00
1981	0.124766E+05	0.764154E+04	0.490259E+00
1982	0.530479E+04	0.778270E+04	-0.383294E+00
1983	0.986869E+04	0.400620E+04	0.901524E+00
1984	0.165960E+04	0.316979E+04	-0.647089E+00
1985	0.290430E+04	0.383806E+04	-0.278776E+00
1986	0.100761E+04	0.243220E+04	-0.881215E+00
1987	0.293394E+04	0.287334E+04	0.208708E-01
1988	0.248940E+04	0.361427E+04	-0.372849E+00
1989	0.376374E+04	0.643833E+04	-0.536856E+00
1990	0.785346E+04	0.795968E+04	-0.134352E-01
1991	0.483062E+04	0.309748E+04	0.444385E+00
1992	0.340811E+04	0.338533E+04	0.670620E-02
1993	0.343774E+04	0.354975E+04	-0.320623E-01
1994	0.337847E+04	0.393298E+04	-0.151973E+00
1995	0.951306E+04	0.610827E+04	0.443023E+00
1996	0.574933E+04	0.562855E+04	0.212323E-01
1997	0.491953E+04	0.397641E+04	0.212832E+00
1998	0.302284E+04	0.370770E+04	-0.204215E+00
1999	0.154106E+04	0.337180E+04	-0.782976E+00
2000	0.734966E+04	0.260792E+04	0.103610E+01
2001	0.108763E+05	0.414002E+04	0.965886E+00
2002	0.291112E+04	0.255015E+04	0.132386E+00
2003	0.798980E+03	0.196917E+04	-0.902032E+00
2004	0.600182E+04	0.436330E+04	0.318835E+00
2005	0.308745E+04	0.354092E+04	-0.137040E+00
2006	0.508075E+04	0.579383E+04	-0.131335E+00
2007	0.822776E+04	0.676145E+04	0.196277E+00
2008	0.606613E+04	0.811214E+04	-0.290641E+00

Survey Index: 4 Tag: spr_us AGE = 4
Time = JAN-1 Type = NUMBER
Catchability = 0.345291E+00 % Variance Contribution = 1.7622
Residual = LN(Observed) - LN(Predicted)

Year	Observed	Predicted	Residual
1980	0.903889E+04	0.830944E+04	0.841436E-01
1981	0.102540E+05	0.889194E+04	0.142519E+00
1982	0.939452E+04	0.842908E+04	0.108439E+00
1983	0.132768E+05	0.823792E+04	0.477270E+00
1984	0.266721E+04	0.431673E+04	-0.481466E+00
1985	0.254867E+04	0.347115E+04	-0.308913E+00
1986	0.299321E+04	0.419737E+04	-0.338111E+00
1987	0.204486E+04	0.267030E+04	-0.266863E+00
1988	0.225231E+04	0.285387E+04	-0.236718E+00
1989	0.254867E+04	0.373729E+04	-0.382788E+00
1990	0.302284E+04	0.686585E+04	-0.820364E+00
1991	0.690512E+04	0.802138E+04	-0.149847E+00
1992	0.260794E+04	0.337243E+04	-0.257074E+00

1993	0.468244E+04	0.376823E+04	0.217213E+00
1994	0.331920E+04	0.410132E+04	-0.211585E+00
1995	0.681621E+04	0.456286E+04	0.401355E+00
1996	0.977979E+04	0.679351E+04	0.364350E+00
1997	0.746820E+04	0.631975E+04	0.166974E+00
1998	0.331920E+04	0.463647E+04	-0.334229E+00
1999	0.334884E+04	0.431238E+04	-0.252875E+00
2000	0.657913E+04	0.396786E+04	0.505675E+00
2001	0.998724E+04	0.297188E+04	0.121211E+01
2002	0.696439E+04	0.480759E+04	0.370614E+00
2003	0.208873E+04	0.300692E+04	-0.364360E+00
2004	0.530301E+04	0.233387E+04	0.820748E+00
2005	0.364786E+04	0.513229E+04	-0.341412E+00
2006	0.504252E+04	0.418901E+04	0.185442E+00
2007	0.478054E+04	0.687306E+04	-0.363056E+00
2008	0.842603E+04	0.799264E+04	0.528041E-01

Survey Index: 5 Tag: spr_us AGE = 5
Time = JAN-1 Type = NUMBER
Catchability = 0.332013E+00 % Variance Contribution = 1.3454
Residual = LN(Observed) - LN(Predicted)

Year	Observed	Predicted	Residual
1980	0.868326E+04	0.639246E+04	0.306278E+00
1981	0.773492E+04	0.574210E+04	0.297921E+00
1982	0.631241E+04	0.549009E+04	0.139573E+00
1983	0.782383E+04	0.526919E+04	0.395297E+00
1984	0.382301E+04	0.493968E+04	-0.256261E+00
1985	0.216341E+04	0.267479E+04	-0.212186E+00
1986	0.174851E+04	0.233289E+04	-0.288345E+00
1987	0.151142E+04	0.262198E+04	-0.550881E+00
1988	0.918710E+03	0.167219E+04	-0.598917E+00
1989	0.145215E+04	0.169937E+04	-0.157214E+00
1990	0.160033E+04	0.219087E+04	-0.314090E+00
1991	0.272649E+04	0.432740E+04	-0.461953E+00
1992	0.317102E+04	0.452597E+04	-0.355778E+00
1993	0.180778E+04	0.217528E+04	-0.185059E+00
1994	0.222268E+04	0.243607E+04	-0.916715E-01
1995	0.328956E+04	0.271718E+04	0.191158E+00
1996	0.388228E+04	0.288701E+04	0.296202E+00
1997	0.607532E+04	0.423319E+04	0.361278E+00
1998	0.361556E+04	0.428197E+04	-0.169167E+00
1999	0.234122E+04	0.339061E+04	-0.370337E+00
2000	0.474171E+04	0.305474E+04	0.439704E+00
2001	0.429718E+04	0.288491E+04	0.398464E+00
2002	0.493168E+04	0.205267E+04	0.876537E+00
2003	0.367601E+04	0.355353E+04	0.338868E-01
2004	0.393029E+04	0.227814E+04	0.545353E+00
2005	0.270782E+04	0.170544E+04	0.462320E+00
2006	0.248051E+04	0.391023E+04	-0.455133E+00
2007	0.301721E+04	0.315465E+04	-0.445452E-01
2008	0.414693E+04	0.523203E+04	-0.232431E+00

Survey Index: 6 Tag: spr_us AGE = 6
Time = JAN-1 Type = NUMBER

Catchability = 0.270544E+00 % Variance Contribution = 1.4548
 Residual = LN(Observed) - LN(Predicted)

Year	Observed	Predicted	Residual
1980	0.477135E+04	0.377550E+04	0.234096E+00
1981	0.500844E+04	0.330621E+04	0.415321E+00
1982	0.394155E+04	0.253537E+04	0.441234E+00
1983	0.349701E+04	0.256866E+04	0.308525E+00
1984	0.171887E+04	0.232169E+04	-0.300628E+00
1985	0.254867E+04	0.183571E+04	0.328141E+00
1986	0.859440E+03	0.120067E+04	-0.334358E+00
1987	0.740890E+03	0.114305E+04	-0.433603E+00
1988	0.681620E+03	0.119500E+04	-0.561426E+00
1989	0.859440E+03	0.727961E+03	0.166033E+00
1990	0.503810E+03	0.764223E+03	-0.416661E+00
1991	0.444540E+03	0.982912E+03	-0.793479E+00
1992	0.127434E+04	0.170812E+04	-0.292967E+00
1993	0.133361E+04	0.161406E+04	-0.190866E+00
1994	0.681620E+03	0.873917E+03	-0.248514E+00
1995	0.130397E+04	0.937269E+03	0.330198E+00
1996	0.157069E+04	0.101532E+04	0.436312E+00
1997	0.115579E+04	0.126774E+04	-0.924492E-01
1998	0.201523E+04	0.194614E+04	0.348838E-01
1999	0.189669E+04	0.216114E+04	-0.130526E+00
2000	0.254867E+04	0.185412E+04	0.318164E+00
2001	0.222268E+04	0.163607E+04	0.306415E+00
2002	0.151557E+04	0.136653E+04	0.103514E+00
2003	0.189224E+04	0.101694E+04	0.620961E+00
2004	0.337017E+04	0.206887E+04	0.487962E+00
2005	0.147023E+04	0.129467E+04	0.127161E+00
2006	0.958420E+03	0.896867E+03	0.663790E-01
2007	0.966420E+03	0.242123E+04	-0.918432E+00
2008	0.188631E+04	0.190792E+04	-0.113911E-01

Survey Index: 7 Tag: spr_us AGE = 7
 Time = JAN-1 Type = NUMBER
 Catchability = 0.239287E+00 % Variance Contribution = 2.3496
 Residual = LN(Observed) - LN(Predicted)

Year	Observed	Predicted	Residual
1980	0.337847E+04	0.238017E+04	0.350251E+00
1981	0.417864E+04	0.188898E+04	0.793947E+00
1982	0.272649E+04	0.161077E+04	0.526305E+00
1983	0.171887E+04	0.106507E+04	0.478622E+00
1984	0.651990E+03	0.102256E+04	-0.450039E+00
1985	0.136324E+04	0.986091E+03	0.323871E+00
1986	0.622350E+03	0.714833E+03	-0.138546E+00
1987	0.503810E+03	0.552688E+03	-0.925947E-01
1988	0.355630E+03	0.540781E+03	-0.419123E+00
1989	0.474170E+03	0.555414E+03	-0.158149E+00
1990	0.177810E+03	0.349555E+03	-0.675946E+00
1991	0.207450E+03	0.403746E+03	-0.665895E+00
1992	0.325990E+03	0.441362E+03	-0.303000E+00

1993	0.503810E+03	0.670045E+03	-0.285145E+00
1994	0.296360E+03	0.617267E+03	-0.733727E+00
1995	0.651990E+03	0.345702E+03	0.634451E+00
1996	0.592710E+03	0.283605E+03	0.737121E+00
1997	0.266720E+03	0.412728E+03	-0.436589E+00
1998	0.474170E+03	0.550117E+03	-0.148565E+00
1999	0.121506E+04	0.851151E+03	0.355959E+00
2000	0.177814E+04	0.105982E+04	0.517466E+00
2001	0.109652E+04	0.865436E+03	0.236663E+00
2002	0.988650E+03	0.713604E+03	0.326013E+00
2003	0.653470E+03	0.601381E+03	0.830681E-01
2004	0.102006E+04	0.462899E+03	0.790107E+00
2005	0.702960E+03	0.124059E+04	-0.568040E+00
2006	0.881960E+03	0.772309E+03	0.132762E+00
2007	0.406900E+03	0.534038E+03	-0.271900E+00
2008	0.642210E+03	0.164297E+04	-0.939347E+00

Survey Index: 8 Tag: spr_us AGE = 8
Time = JAN-1 Type = NUMBER
Catchability = 0.178071E+00 % Variance Contribution = 5.0464
Residual = LN(Observed) - LN(Predicted)

Year	Observed	Predicted	Residual
1980	0.770530E+03	0.832982E+03	-0.779340E-01
1981	0.228195E+04	0.870858E+03	0.963306E+00
1982	0.148179E+04	0.767316E+03	0.658107E+00
1983	0.948340E+03	0.457665E+03	0.728575E+00
1984	0.296360E+03	0.288573E+03	0.266284E-01
1985	0.124470E+04	0.315146E+03	0.137361E+01
1986	0.296360E+03	0.247546E+03	0.179978E+00
1987	0.207450E+03	0.227514E+03	-0.923218E-01
1988	0.296400E+02	0.194078E+03	-0.187914E+01
1989	0.889100E+02	0.241024E+03	-0.997272E+00
1990	0.118540E+03	0.205114E+03	-0.548315E+00
1991	0.118540E+03	0.154225E+03	-0.263162E+00
1992	0.118540E+03	0.193682E+03	-0.490965E+00
1993	0.237090E+03	0.133950E+03	0.570971E+00
1994	0.889100E+02	0.188411E+03	-0.751002E+00
1995	0.889100E+02	0.191837E+03	-0.769023E+00
1996	0.148180E+03	0.106508E+03	0.330211E+00
1997	0.296400E+02	0.827966E+02	-0.102726E+01
1998	0.177810E+03	0.150362E+03	0.167669E+00
1999	0.503810E+03	0.164833E+03	0.111727E+01
2000	0.444540E+03	0.297265E+03	0.402415E+00
2001	0.503810E+03	0.366025E+03	0.319497E+00
2002	0.579970E+03	0.275994E+03	0.742597E+00
2003	0.303770E+03	0.244961E+03	0.215172E+00
2004	0.290430E+03	0.247538E+03	0.159799E+00
2005	0.342890E+03	0.200778E+03	0.535209E+00
2006	0.317990E+03	0.684847E+03	-0.767176E+00
2007	0.207750E+03	0.413809E+03	-0.689069E+00
2008	0.253090E+03	0.290649E+03	-0.138373E+00

Survey Index: 9 Tag: spr_us AGE = 9 - 11
Time = JAN-1 Type = NUMBER

Catchability = 0.183208E+00 % Variance Contribution = 6.3162
 Residual = LN(Observed) - LN(Predicted)

Year	Observed	Predicted	Residual
1980	0.194410E+04	0.188545E+04	0.306341E-01
1981	0.308211E+04	0.114337E+04	0.991640E+00
1982	0.204486E+04	0.108259E+04	0.635979E+00
1983	0.154106E+04	0.865628E+03	0.576769E+00
1984	0.266721E+03	0.673151E+03	-0.925764E+00
1985	0.859436E+03	0.316619E+03	0.998578E+00
1986	0.237086E+03	0.186478E+03	0.240106E+00
1987	0.296357E+03	0.167865E+03	0.568405E+00
1988	0.325993E+03	0.192786E+03	0.525296E+00
1989	0.266721E+03	0.236615E+03	0.119771E+00
1990	0.148179E+03	0.289978E+03	-0.671386E+00
1991	0.148179E+03	0.236523E+03	-0.467629E+00
1992	0.118543E+03	0.199584E+03	-0.520960E+00
1993	0.237086E+03	0.245565E+03	-0.351397E-01
1994	0.148179E+03	0.248250E+03	-0.516019E+00
1995	0.355629E+03	0.976208E+02	0.129280E+01
1996	0.592714E+02	0.111673E+03	-0.633448E+00
1997	0.889071E+02	0.140730E+03	-0.459251E+00
1998	0.889071E+02	0.140119E+03	-0.454898E+00
1999	0.118543E+03	0.140073E+03	-0.166889E+00
2000	0.296357E+03	0.105911E+03	0.102896E+01
2001	0.474171E+03	0.206744E+03	0.830086E+00
2002	0.645466E+03	0.328047E+03	0.676817E+00
2003	0.554781E+03	0.296155E+03	0.627691E+00
2004	0.611088E+03	0.261937E+03	0.847139E+00
2005	0.488989E+02	0.282185E+03	-0.175281E+01
2006	0.170702E+03	0.322110E+03	-0.634976E+00
2007	0.120025E+03	0.742816E+03	-0.182275E+01
2008	0.362148E+03	0.916722E+03	-0.928750E+00

Survey Index: 11 Tag: us1aut AGE = 2
 Time = JAN-1 Type = NUMBER
 Catchability = 0.106649E+00 % Variance Contribution = 3.4536
 Residual = LN(Observed) - LN(Predicted)

Year	Observed	Predicted	Residual
1980	N/A	0.421014E+04	N/A
1981	0.468244E+04	0.439154E+04	0.641395E-01
1982	0.130397E+04	0.227207E+04	-0.555279E+00
1983	0.592710E+03	0.181952E+04	-0.112162E+01
1984	0.148179E+04	0.215233E+04	-0.373302E+00
1985	0.651990E+03	0.135489E+04	-0.731447E+00
1986	0.269685E+04	0.165380E+04	0.489008E+00
1987	0.151142E+04	0.205513E+04	-0.307291E+00
1988	0.157069E+04	0.362981E+04	-0.837666E+00
1989	0.841654E+04	0.464073E+04	0.595326E+00
1990	0.142251E+04	0.183048E+04	-0.252153E+00
1991	0.506771E+04	0.189003E+04	0.986297E+00
1992	0.139288E+04	0.197911E+04	-0.351272E+00
1993	0.192632E+04	0.219391E+04	-0.130074E+00

1994	0.503807E+04	0.346025E+04	0.375682E+00
1995	0.113505E+05	0.337845E+04	0.121184E+01
1996	0.148179E+04	0.231992E+04	-0.448280E+00
1997	0.160033E+04	0.211193E+04	-0.277393E+00
1998	0.106689E+04	0.186263E+04	-0.557243E+00
1999	0.512698E+04	0.145832E+04	0.125723E+01
2000	0.592714E+04	0.231030E+04	0.942163E+00
2001	0.139288E+04	0.141192E+04	-0.135774E-01
2002	0.118543E+04	0.108344E+04	0.899618E-01
2003	0.295587E+04	0.247838E+04	0.176186E+00
2004	0.207776E+04	0.196196E+04	0.573449E-01
2005	0.208161E+04	0.321667E+04	-0.435204E+00
2006	0.204101E+04	0.372476E+04	-0.601559E+00
2007	0.605280E+04	0.448503E+04	0.299775E+00
2008	0.318702E+04	0.203538E+04	0.448403E+00

Survey Index: 12 Tag: us2aut AGE = 3
Time = JAN-1 Type = NUMBER
Catchability = 0.299685E+00 % Variance Contribution = 1.8896
Residual = LN(Observed) - LN(Predicted)

Year	Observed	Predicted	Residual
1980	N/A	0.978030E+04	N/A
1981	0.660876E+04	0.965928E+04	-0.379523E+00
1982	0.782383E+04	0.983772E+04	-0.229050E+00
1983	0.269685E+04	0.506403E+04	-0.630078E+00
1984	0.299321E+04	0.400677E+04	-0.291639E+00
1985	0.663840E+04	0.485150E+04	0.313583E+00
1986	0.245976E+04	0.307442E+04	-0.223053E+00
1987	0.432681E+04	0.363204E+04	0.175035E+00
1988	0.376374E+04	0.456862E+04	-0.193797E+00
1989	0.880181E+04	0.813837E+04	0.783679E-01
1990	0.131879E+05	0.100614E+05	0.270590E+00
1991	0.669767E+04	0.391537E+04	0.536850E+00
1992	0.732002E+04	0.427922E+04	0.536841E+00
1993	0.364519E+04	0.448705E+04	-0.207788E+00
1994	0.693476E+04	0.497147E+04	0.332830E+00
1995	0.223157E+05	0.772115E+04	0.106133E+01
1996	0.112616E+05	0.711476E+04	0.459225E+00
1997	0.240049E+04	0.502638E+04	-0.739028E+00
1998	0.314139E+04	0.468671E+04	-0.400066E+00
1999	0.177814E+04	0.426212E+04	-0.874199E+00
2000	0.651986E+04	0.329654E+04	0.681980E+00
2001	0.859436E+04	0.523319E+04	0.496085E+00
2002	0.361556E+04	0.322351E+04	0.114775E+00
2003	0.227069E+04	0.248913E+04	-0.918491E-01
2004	0.669738E+04	0.551542E+04	0.194169E+00
2005	0.284592E+04	0.447589E+04	-0.452819E+00
2006	0.487685E+04	0.732369E+04	-0.406615E+00
2007	0.751799E+04	0.854680E+04	-0.128258E+00
2008	0.102142E+05	0.102541E+05	-0.389800E-02

Survey Index: 13 Tag: us3aut AGE = 4
Time = JAN-1 Type = NUMBER
Catchability = 0.454693E+00 % Variance Contribution = 1.9136

Residual = LN(Observed) - LN(Predicted)

Year	Observed	Predicted	Residual
1980	N/A	0.109422E+05	N/A
1981	0.806091E+04	0.117093E+05	-0.373354E+00
1982	0.640131E+04	0.110998E+05	-0.550420E+00
1983	0.488989E+04	0.108480E+05	-0.796814E+00
1984	0.598641E+04	0.568445E+04	0.517571E-01
1985	0.462317E+04	0.457095E+04	0.113605E-01
1986	0.782383E+04	0.552726E+04	0.347481E+00
1987	0.257831E+04	0.351636E+04	-0.310293E+00
1988	0.293394E+04	0.375809E+04	-0.247564E+00
1989	0.708294E+04	0.492141E+04	0.364094E+00
1990	0.847581E+04	0.904124E+04	-0.645796E-01
1991	0.221972E+05	0.105629E+05	0.742618E+00
1992	0.598641E+04	0.444096E+04	0.298622E+00
1993	0.548261E+04	0.496216E+04	0.997398E-01
1994	0.102836E+05	0.540078E+04	0.644006E+00
1995	0.832764E+04	0.600856E+04	0.326396E+00
1996	0.113208E+05	0.894597E+04	0.235442E+00
1997	0.592714E+04	0.832211E+04	-0.339374E+00
1998	0.459354E+04	0.610549E+04	-0.284538E+00
1999	0.557151E+04	0.567871E+04	-0.190585E-01
2000	0.607532E+04	0.522504E+04	0.150772E+00
2001	0.115876E+05	0.391350E+04	0.108550E+01
2002	0.980942E+04	0.633083E+04	0.437912E+00
2003	0.386420E+04	0.395964E+04	-0.243974E-01
2004	0.372669E+04	0.307333E+04	0.192758E+00
2005	0.353376E+04	0.675841E+04	-0.648426E+00
2006	0.214118E+04	0.551626E+04	-0.946342E+00
2007	0.774233E+04	0.905073E+04	-0.156143E+00
2008	0.838631E+04	0.105250E+05	-0.227157E+00

Survey Index: 14 Tag: us4aut AGE = 5
Time = JAN-1 Type = NUMBER
Catchability = 0.545345E+00 % Variance Contribution = 1.4078
Residual = LN(Observed) - LN(Predicted)

Year	Observed	Predicted	Residual
1980	N/A	0.104999E+05	N/A
1981	0.841654E+04	0.943162E+04	-0.113869E+00
1982	0.734966E+04	0.901769E+04	-0.204535E+00
1983	0.376374E+04	0.865486E+04	-0.832708E+00
1984	0.865363E+04	0.811362E+04	0.644354E-01
1985	0.358592E+04	0.439345E+04	-0.203101E+00
1986	0.311175E+04	0.383187E+04	-0.208168E+00
1987	0.423791E+04	0.430671E+04	-0.161045E-01
1988	0.127434E+04	0.274663E+04	-0.767948E+00
1989	0.231159E+04	0.279129E+04	-0.188568E+00
1990	0.290430E+04	0.359860E+04	-0.214352E+00
1991	0.856472E+04	0.710794E+04	0.186440E+00
1992	0.471208E+04	0.743409E+04	-0.455946E+00
1993	0.379337E+04	0.357299E+04	0.598518E-01

1994	0.675694E+04	0.400134E+04	0.523941E+00
1995	0.506771E+04	0.446308E+04	0.127049E+00
1996	0.740893E+04	0.474203E+04	0.446222E+00
1997	0.812019E+04	0.695319E+04	0.155153E+00
1998	0.551224E+04	0.703331E+04	-0.243687E+00
1999	0.595678E+04	0.556921E+04	0.672766E-01
2000	0.631241E+04	0.501753E+04	0.229579E+00
2001	0.675694E+04	0.473858E+04	0.354832E+00
2002	0.782383E+04	0.337160E+04	0.841788E+00
2003	0.995582E+04	0.583681E+04	0.533972E+00
2004	0.520640E+04	0.374194E+04	0.330284E+00
2005	0.291704E+04	0.280126E+04	0.405016E-01
2006	0.346412E+04	0.642271E+04	-0.617382E+00
2007	0.761964E+04	0.518164E+04	0.385607E+00
2008	0.649141E+04	0.859382E+04	-0.280564E+00

Survey Index: 15 Tag: us5aut AGE = 6
Time = JAN-1 Type = NUMBER
Catchability = 0.521424E+00 % Variance Contribution = 1.8500
Residual = LN(Observed) - LN(Predicted)

Year	Observed	Predicted	Residual
1980	N/A	0.727658E+04	N/A
1981	0.453426E+04	0.637211E+04	-0.340269E+00
1982	0.640131E+04	0.488646E+04	0.270035E+00
1983	0.168924E+04	0.495061E+04	-0.107523E+01
1984	0.403046E+04	0.447463E+04	-0.104543E+00
1985	0.317102E+04	0.353799E+04	-0.109505E+00
1986	0.234122E+04	0.231408E+04	0.116608E-01
1987	0.139288E+04	0.220302E+04	-0.458455E+00
1988	0.204486E+04	0.230314E+04	-0.118942E+00
1989	0.139288E+04	0.140301E+04	-0.724719E-02
1990	0.563080E+03	0.147290E+04	-0.961566E+00
1991	0.174851E+04	0.189438E+04	-0.801280E-01
1992	0.216341E+04	0.329209E+04	-0.419838E+00
1993	0.231159E+04	0.311081E+04	-0.296948E+00
1994	0.311175E+04	0.168431E+04	0.613827E+00
1995	0.385264E+04	0.180641E+04	0.757416E+00
1996	0.266721E+04	0.195684E+04	0.309702E+00
1997	0.275612E+04	0.244333E+04	0.120463E+00
1998	0.308211E+04	0.375083E+04	-0.196363E+00
1999	0.527516E+04	0.416520E+04	0.236245E+00
2000	0.474171E+04	0.357346E+04	0.282862E+00
2001	0.400082E+04	0.315323E+04	0.238072E+00
2002	0.432681E+04	0.263374E+04	0.496425E+00
2003	0.512016E+04	0.195997E+04	0.960257E+00
2004	0.514772E+04	0.398736E+04	0.255425E+00
2005	0.217289E+04	0.249524E+04	-0.138328E+00
2006	0.220994E+04	0.172854E+04	0.245686E+00
2007	0.418693E+04	0.466647E+04	-0.108436E+00
2008	0.250896E+04	0.367716E+04	-0.382273E+00

Survey Index: 16 Tag: us6aut AGE = 7
Time = JAN-1 Type = NUMBER
Catchability = 0.460618E+00 % Variance Contribution = 2.3812

Residual = LN(Observed) - LN(Predicted)

Year	Observed	Predicted	Residual
1980	N/A	0.458173E+04	N/A
1981	0.302284E+04	0.363621E+04	-0.184746E+00
1982	0.426754E+04	0.310066E+04	0.319423E+00
1983	0.142251E+04	0.205022E+04	-0.365526E+00
1984	0.201523E+04	0.196839E+04	0.235164E-01
1985	0.151142E+04	0.189818E+04	-0.227848E+00
1986	0.121506E+04	0.137602E+04	-0.124404E+00
1987	0.124470E+04	0.106390E+04	0.156952E+00
1988	0.740890E+03	0.104098E+04	-0.340066E+00
1989	0.296360E+03	0.106915E+04	-0.128304E+01
1990	0.296360E+03	0.672879E+03	-0.819991E+00
1991	0.740890E+03	0.777193E+03	-0.478368E-01
1992	0.859440E+03	0.849604E+03	0.115108E-01
1993	0.889070E+03	0.128981E+04	-0.372072E+00
1994	0.237086E+04	0.118821E+04	0.690802E+00
1995	0.118543E+04	0.665462E+03	0.577379E+00
1996	0.651990E+03	0.545928E+03	0.177541E+00
1997	0.115579E+04	0.794484E+03	0.374847E+00
1998	0.948340E+03	0.105895E+04	-0.110322E+00
1999	0.320066E+04	0.163843E+04	0.669619E+00
2000	0.240049E+04	0.204011E+04	0.162667E+00
2001	0.222268E+04	0.166593E+04	0.288331E+00
2002	0.157069E+04	0.137366E+04	0.134038E+00
2003	0.157306E+04	0.115763E+04	0.306646E+00
2004	0.262128E+04	0.891061E+03	0.107900E+01
2005	0.147290E+04	0.238808E+04	-0.483255E+00
2006	0.125952E+04	0.148666E+04	-0.165803E+00
2007	0.167709E+04	0.102800E+04	0.489444E+00
2008	0.123937E+04	0.316265E+04	-0.936808E+00

Survey Index: 17 Tag: us7aut AGE = 8
Time = JAN-1 Type = NUMBER
Catchability = 0.328359E+00 % Variance Contribution = 4.0561
Residual = LN(Observed) - LN(Predicted)

Year	Observed	Predicted	Residual
1980	N/A	0.153600E+04	N/A
1981	0.275612E+04	0.160584E+04	0.540175E+00
1982	0.174851E+04	0.141491E+04	0.211696E+00
1983	0.889070E+03	0.843924E+03	0.521131E-01
1984	0.100761E+04	0.532121E+03	0.638465E+00
1985	0.355630E+03	0.581122E+03	-0.491070E+00
1986	0.563080E+03	0.456470E+03	0.209900E+00
1987	0.474170E+03	0.419531E+03	0.122429E+00
1988	0.296360E+03	0.357876E+03	-0.188612E+00
1989	0.207450E+03	0.444443E+03	-0.761931E+00
1990	0.592700E+02	0.378226E+03	-0.185339E+01
1991	0.355630E+03	0.284387E+03	0.223553E+00
1992	0.118540E+03	0.357144E+03	-0.110289E+01
1993	0.207450E+03	0.247001E+03	-0.174503E+00
1994	0.325990E+03	0.347426E+03	-0.636850E-01

1995	0.740890E+03	0.353744E+03	0.739280E+00
1996	0.118540E+03	0.196398E+03	-0.504891E+00
1997	0.207450E+03	0.152675E+03	0.306578E+00
1998	0.118540E+03	0.277264E+03	-0.849721E+00
1999	0.355630E+03	0.303949E+03	0.157032E+00
2000	0.592710E+03	0.548150E+03	0.781554E-01
2001	0.977980E+03	0.674942E+03	0.370862E+00
2002	0.121506E+04	0.508927E+03	0.870245E+00
2003	0.117031E+04	0.451703E+03	0.952000E+00
2004	0.103399E+04	0.456454E+03	0.817693E+00
2005	0.566930E+03	0.370230E+03	0.426110E+00
2006	0.432980E+03	0.126284E+04	-0.107043E+01
2007	0.130575E+04	0.763054E+03	0.537204E+00
2008	0.442160E+03	0.535951E+03	-0.192371E+00

Survey Index: 18 Tag: us8paut AGE = 9 - 11
Time = JAN-1 Type = NUMBER
Catchability = 0.310350E+00 % Variance Contribution = 5.0959
Residual = LN(Observed) - LN(Predicted)

Year	Observed	Predicted	Residual
1980	N/A	0.319391E+04	N/A
1981	0.411936E+04	0.193683E+04	0.754644E+00
1982	0.325993E+04	0.183387E+04	0.575274E+00
1983	0.145215E+04	0.146635E+04	-0.973354E-02
1984	0.133361E+04	0.114030E+04	0.156595E+00
1985	0.503807E+03	0.536345E+03	-0.625832E-01
1986	0.325993E+03	0.315890E+03	0.314807E-01
1987	0.563079E+03	0.284359E+03	0.683180E+00
1988	0.325993E+03	0.326575E+03	-0.178326E-02
1989	0.148179E+03	0.400820E+03	-0.995095E+00
1990	0.266721E+03	0.491215E+03	-0.610678E+00
1991	0.414900E+03	0.400665E+03	0.349110E-01
1992	0.237086E+03	0.338091E+03	-0.354892E+00
1993	0.355629E+03	0.415981E+03	-0.156754E+00
1994	0.355629E+03	0.420530E+03	-0.167629E+00
1995	0.563079E+03	0.165367E+03	0.122525E+01
1996	0.148179E+03	0.189172E+03	-0.244236E+00
1997	0.325993E+03	0.238393E+03	0.312953E+00
1998	0.118543E+03	0.237358E+03	-0.694295E+00
1999	0.237086E+03	0.237280E+03	-0.821011E-03
2000	0.889071E+02	0.179411E+03	-0.702089E+00
2001	0.592714E+03	0.350220E+03	0.526151E+00
2002	0.118543E+04	0.555703E+03	0.757625E+00
2003	0.165545E+04	0.501679E+03	0.119387E+01
2004	0.923745E+03	0.443715E+03	0.733254E+00
2005	0.430607E+03	0.478015E+03	-0.104446E+00
2006	0.678658E+03	0.545647E+03	0.218145E+00
2007	0.734669E+03	0.125831E+04	-0.538107E+00
2008	0.120025E+03	0.155291E+04	-0.256019E+01

Survey Index: 20 Tag: spr_ma AGE = 1
Time = JAN-1 Type = NUMBER
Catchability = 0.421847E-01 % Variance Contribution = 12.8161
Residual = LN(Observed) - LN(Predicted)

Year	Observed	Predicted	Residual
1980	N/A	0.212190E+04	N/A
1981	N/A	0.109793E+04	N/A
1982	0.162223E+04	0.879498E+03	0.612205E+00
1983	0.436060E+03	0.104052E+04	-0.869694E+00
1984	0.485760E+03	0.654696E+03	-0.298457E+00
1985	0.487120E+04	0.802006E+03	0.180398E+01
1986	0.611385E+04	0.995642E+03	0.181492E+01
1987	0.776319E+04	0.175544E+04	0.148667E+01
1988	0.184071E+05	0.225664E+04	0.209886E+01
1989	0.182331E+04	0.885067E+03	0.722746E+00
1990	0.174649E+04	0.913208E+03	0.648399E+00
1991	0.474470E+03	0.956248E+03	-0.700819E+00
1992	0.185228E+04	0.106038E+04	0.557793E+00
1993	0.261990E+04	0.167274E+04	0.448671E+00
1994	0.262100E+04	0.163492E+04	0.471964E+00
1995	0.122190E+03	0.112291E+04	-0.221811E+01
1996	0.516760E+03	0.102091E+04	-0.680867E+00
1997	0.349820E+03	0.900566E+03	-0.945604E+00
1998	0.639400E+03	0.706279E+03	-0.994797E-01
1999	0.305010E+03	0.111636E+04	-0.129748E+01
2000	0.779280E+03	0.682258E+03	0.132963E+00
2001	0.158200E+02	0.523489E+03	-0.349924E+01
2002	0.141436E+04	0.119749E+04	0.166453E+00
2003	0.116357E+04	0.948424E+03	0.204447E+00
2004	0.372796E+04	0.155433E+04	0.874816E+00
2005	0.150474E+04	0.180112E+04	-0.179787E+00
2006	0.107094E+04	0.216815E+04	-0.705336E+00
2007	0.571620E+03	0.990786E+03	-0.550024E+00
2008	N/A	0.177532E+04	N/A

Survey Index: 21 Tag: spr_ma AGE = 2
 Time = JAN-1 Type = NUMBER
 Catchability = 0.234209E+00 % Variance Contribution = 5.4133
 Residual = LN(Observed) - LN(Predicted)

Year	Observed	Predicted	Residual
1980	N/A	0.924579E+04	N/A
1981	N/A	0.964415E+04	N/A
1982	0.111274E+05	0.498964E+04	0.802045E+00
1983	0.423857E+04	0.399580E+04	0.589824E-01
1984	0.619971E+04	0.472669E+04	0.271277E+00
1985	0.387708E+04	0.297544E+04	0.264689E+00
1986	0.249140E+05	0.363187E+04	0.192568E+01
1987	0.389967E+04	0.451323E+04	-0.146121E+00
1988	0.143628E+05	0.797134E+04	0.588789E+00
1989	0.287527E+05	0.101914E+05	0.103719E+01
1990	0.573202E+04	0.401986E+04	0.354820E+00
1991	0.451422E+04	0.415065E+04	0.839682E-01
1992	0.249827E+04	0.434627E+04	-0.553719E+00
1993	0.428844E+04	0.481799E+04	-0.116435E+00
1994	0.118765E+05	0.759898E+04	0.446551E+00
1995	0.782878E+04	0.741933E+04	0.537176E-01

1996	0.935970E+03	0.509471E+04	-0.169438E+01
1997	0.179907E+04	0.463796E+04	-0.947005E+00
1998	0.978310E+03	0.409048E+04	-0.143059E+01
1999	0.263216E+04	0.320258E+04	-0.196151E+00
2000	0.127684E+05	0.507360E+04	0.922925E+00
2001	0.107320E+04	0.310069E+04	-0.106098E+01
2002	0.937640E+03	0.237932E+04	-0.931205E+00
2003	0.101400E+05	0.544272E+04	0.622213E+00
2004	0.267509E+04	0.430862E+04	-0.476635E+00
2005	0.475371E+04	0.706405E+04	-0.396093E+00
2006	0.122525E+05	0.817987E+04	0.404058E+00
2007	0.110212E+05	0.984947E+04	0.112403E+00
2008	N/A	0.446985E+04	N/A

Survey Index: 22 Tag: spr_ma AGE = 3
 Time = JAN-1 Type = NUMBER
 Catchability = 0.318789E+00 % Variance Contribution = 1.3275
 Residual = LN(Observed) - LN(Predicted)

Year	Observed	Predicted	Residual
1980	N/A	0.104038E+05	N/A
1981	N/A	0.102750E+05	N/A
1982	0.753499E+04	0.104648E+05	-0.328464E+00
1983	0.506550E+04	0.538684E+04	-0.615069E-01
1984	0.481697E+04	0.426219E+04	0.122362E+00
1985	0.547219E+04	0.516077E+04	0.585937E-01
1986	0.607996E+04	0.327040E+04	0.620085E+00
1987	0.356754E+04	0.386357E+04	-0.797162E-01
1988	0.403297E+04	0.485985E+04	-0.186504E+00
1989	0.101604E+05	0.865716E+04	0.160109E+00
1990	0.128129E+05	0.107028E+05	0.179944E+00
1991	0.785582E+04	0.416496E+04	0.634548E+00
1992	0.767713E+04	0.455201E+04	0.522677E+00
1993	0.363370E+04	0.477309E+04	-0.272742E+00
1994	0.499872E+04	0.528839E+04	-0.563316E-01
1995	0.112164E+05	0.821334E+04	0.311615E+00
1996	0.337125E+04	0.756830E+04	-0.808685E+00
1997	0.315184E+04	0.534680E+04	-0.528511E+00
1998	0.258698E+04	0.498548E+04	-0.656038E+00
1999	0.263216E+04	0.453382E+04	-0.543759E+00
2000	0.787559E+04	0.350668E+04	0.809098E+00
2001	0.535696E+04	0.556679E+04	-0.384219E-01
2002	0.243334E+04	0.342900E+04	-0.343004E+00
2003	0.279710E+04	0.264780E+04	0.548531E-01
2004	0.766152E+04	0.586701E+04	0.266866E+00
2005	0.518073E+04	0.476122E+04	0.844431E-01
2006	0.790779E+04	0.779055E+04	0.149371E-01
2007	0.968817E+04	0.909163E+04	0.635516E-01
2008	N/A	0.109078E+05	N/A

Survey Index: 23 Tag: spr_ma AGE = 4
 Time = JAN-1 Type = NUMBER
 Catchability = 0.228953E+00 % Variance Contribution = 1.3815
 Residual = LN(Observed) - LN(Predicted)

Year	Observed	Predicted	Residual
1980	N/A	0.550978E+04	N/A
1981	N/A	0.589601E+04	N/A
1982	0.387256E+04	0.558910E+04	-0.366903E+00
1983	0.484860E+04	0.546235E+04	-0.119189E+00
1984	0.238815E+04	0.286231E+04	-0.181111E+00
1985	0.214640E+04	0.230163E+04	-0.698238E-01
1986	0.326027E+04	0.278316E+04	0.158222E+00
1987	0.881150E+03	0.177061E+04	-0.697850E+00
1988	0.197017E+04	0.189232E+04	0.403144E-01
1989	0.270898E+04	0.247810E+04	0.890815E-01
1990	0.372344E+04	0.455257E+04	-0.201044E+00
1991	0.428828E+04	0.531877E+04	-0.215356E+00
1992	0.338729E+04	0.223617E+04	0.415265E+00
1993	0.206940E+04	0.249862E+04	-0.188478E+00
1994	0.161136E+04	0.271948E+04	-0.523361E+00
1995	0.233275E+04	0.302551E+04	-0.260032E+00
1996	0.709252E+04	0.450460E+04	0.453942E+00
1997	0.389413E+04	0.419046E+04	-0.733410E-01
1998	0.170130E+04	0.307432E+04	-0.591691E+00
1999	0.341391E+04	0.285942E+04	0.177238E+00
2000	0.451372E+04	0.263099E+04	0.539763E+00
2001	0.384770E+04	0.197058E+04	0.669149E+00
2002	0.420017E+04	0.318779E+04	0.275798E+00
2003	0.412787E+04	0.199381E+04	0.727714E+00
2004	0.295299E+04	0.154753E+04	0.646160E+00
2005	0.186172E+04	0.340309E+04	-0.603183E+00
2006	0.321056E+04	0.277762E+04	0.144851E+00
2007	0.356302E+04	0.455735E+04	-0.246133E+00
2008	N/A	0.529971E+04	N/A

Survey Index: 24 Tag: spr_ma AGE = 5
 Time = JAN-1 Type = NUMBER
 Catchability = 0.128202E+00 % Variance Contribution = 2.1238
 Residual = LN(Observed) - LN(Predicted)

Year	Observed	Predicted	Residual
1980	N/A	0.246836E+04	N/A
1981	N/A	0.221723E+04	N/A
1982	0.112968E+04	0.211992E+04	-0.629446E+00
1983	0.230907E+04	0.203463E+04	0.126532E+00
1984	0.104835E+04	0.190739E+04	-0.598518E+00
1985	0.851780E+03	0.103284E+04	-0.192735E+00
1986	0.641660E+03	0.900816E+03	-0.339242E+00
1987	0.397650E+03	0.101244E+04	-0.934550E+00
1988	0.347940E+03	0.645692E+03	-0.618293E+00
1989	0.684590E+03	0.656190E+03	0.423694E-01
1990	0.774960E+03	0.845976E+03	-0.876800E-01
1991	0.732040E+03	0.167097E+04	-0.825324E+00
1992	0.167695E+04	0.174764E+04	-0.412908E-01
1993	0.779100E+03	0.839957E+03	-0.752107E-01
1994	0.876360E+03	0.940655E+03	-0.707994E-01
1995	0.712940E+03	0.104920E+04	-0.386390E+00
1996	0.142932E+04	0.111478E+04	0.248542E+00
1997	0.275849E+04	0.163459E+04	0.523291E+00

1998	0.201762E+04	0.165343E+04	0.199069E+00
1999	0.171034E+04	0.130924E+04	0.267247E+00
2000	0.300288E+04	0.117955E+04	0.934442E+00
2001	0.107094E+04	0.111397E+04	-0.393936E-01
2002	0.133981E+04	0.792612E+03	0.524950E+00
2003	0.402619E+04	0.137215E+04	0.107644E+01
2004	0.128106E+04	0.879674E+03	0.375892E+00
2005	0.108450E+04	0.658533E+03	0.498859E+00
2006	0.111613E+04	0.150988E+04	-0.302165E+00
2007	0.168323E+04	0.121813E+04	0.323401E+00
2008	N/A	0.202028E+04	N/A

Survey Index: 26 Tag: ma1aut AGE = 2
Time = JAN-1 Type = NUMBER
Catchability = 0.265599E+00 % Variance Contribution = 4.9154
Residual = LN(Observed) - LN(Predicted)

Year	Observed	Predicted	Residual
1980	N/A	0.104850E+05	N/A
1981	N/A	0.109367E+05	N/A
1982	N/A	0.565838E+04	N/A
1983	0.299140E+04	0.453134E+04	-0.415275E+00
1984	0.117871E+05	0.536019E+04	0.788009E+00
1985	0.709440E+03	0.337423E+04	-0.155945E+01
1986	0.137754E+05	0.411863E+04	0.120736E+01
1987	0.932441E+04	0.511811E+04	0.599850E+00
1988	0.104744E+05	0.903970E+04	0.147311E+00
1989	0.193470E+05	0.115573E+05	0.515218E+00
1990	0.130049E+05	0.455863E+04	0.104831E+01
1991	0.722772E+04	0.470694E+04	0.428886E+00
1992	0.543830E+04	0.492878E+04	0.983756E-01
1993	0.104674E+05	0.546373E+04	0.650133E+00
1994	0.172178E+05	0.861743E+04	0.692160E+00
1995	0.829412E+04	0.841371E+04	-0.143156E-01
1996	0.267539E+04	0.577753E+04	-0.769882E+00
1997	0.367215E+04	0.525957E+04	-0.359271E+00
1998	0.307529E+04	0.463871E+04	-0.411037E+00
1999	0.780838E+04	0.363180E+04	0.765469E+00
2000	0.660413E+04	0.575359E+04	0.137871E+00
2001	0.141436E+04	0.351625E+04	-0.910719E+00
2002	0.680070E+03	0.269821E+04	-0.137815E+01
2003	0.888158E+04	0.617218E+04	0.363927E+00
2004	0.541796E+04	0.488608E+04	0.103328E+00
2005	0.135607E+05	0.801081E+04	0.526387E+00
2006	0.935830E+04	0.927617E+04	0.881444E-02
2007	0.327834E+04	0.111696E+05	-0.122585E+01
2008	0.179620E+04	0.506892E+04	-0.103746E+01

Survey Index: 27 Tag: ma2aut AGE = 3
Time = JAN-1 Type = NUMBER
Catchability = 0.341196E+00 % Variance Contribution = 2.8785
Residual = LN(Observed) - LN(Predicted)

Year	Observed	Predicted	Residual
1980	N/A	0.111350E+05	N/A

1981	N/A	0.109972E+05	N/A
1982	N/A	0.112004E+05	N/A
1983	0.349298E+04	0.576547E+04	-0.501132E+00
1984	0.428828E+04	0.456177E+04	-0.618247E-01
1985	0.299140E+04	0.552350E+04	-0.613271E+00
1986	0.213510E+04	0.350027E+04	-0.494327E+00
1987	0.905555E+04	0.413513E+04	0.783858E+00
1988	0.329868E+04	0.520144E+04	-0.455412E+00
1989	0.932667E+04	0.926565E+04	0.656400E-02
1990	0.276208E+05	0.114551E+05	0.880135E+00
1991	0.320830E+04	0.445771E+04	-0.328893E+00
1992	0.204157E+05	0.487196E+04	0.143281E+01
1993	0.293598E+04	0.510858E+04	-0.553880E+00
1994	0.831402E+04	0.566010E+04	0.384502E+00
1995	0.179199E+05	0.879064E+04	0.712224E+00
1996	0.999047E+04	0.810025E+04	0.209736E+00
1997	0.434863E+04	0.572261E+04	-0.274564E+00
1998	0.634512E+04	0.533589E+04	0.173230E+00
1999	0.138273E+04	0.485249E+04	-0.125543E+01
2000	0.735876E+04	0.375316E+04	0.673294E+00
2001	0.579980E+04	0.595807E+04	-0.269225E-01
2002	0.332353E+04	0.367002E+04	-0.991685E-01
2003	0.211703E+04	0.283391E+04	-0.291643E+00
2004	0.747399E+04	0.627939E+04	0.174157E+00
2005	0.431539E+04	0.509587E+04	-0.166243E+00
2006	0.123181E+05	0.833813E+04	0.390229E+00
2007	0.101988E+05	0.973066E+04	0.469878E-01
2008	0.554223E+04	0.116745E+05	-0.745009E+00

Survey Index: 28 Tag: ma3aut AGE = 4
 Time = JAN-1 Type = NUMBER
 Catchability = 0.271214E+00 % Variance Contribution = 2.7312
 Residual = LN(Observed) - LN(Predicted)

Year	Observed	Predicted	Residual
1980	N/A	0.652678E+04	N/A
1981	N/A	0.698431E+04	N/A
1982	N/A	0.662075E+04	N/A
1983	0.230907E+04	0.647060E+04	-0.103042E+01
1984	0.226389E+04	0.339064E+04	-0.403936E+00
1985	0.964750E+03	0.272646E+04	-0.103889E+01
1986	0.321056E+04	0.329689E+04	-0.265328E-01
1987	0.272706E+04	0.209743E+04	0.262511E+00
1988	0.677810E+03	0.224161E+04	-0.119608E+01
1989	0.315860E+04	0.293551E+04	0.732484E-01
1990	0.701082E+04	0.539289E+04	0.262373E+00
1991	0.454585E+04	0.630051E+04	-0.326416E+00
1992	0.904877E+04	0.264893E+04	0.122847E+01
1993	0.673163E+04	0.295982E+04	0.821690E+00
1994	0.397369E+04	0.322144E+04	0.209866E+00
1995	0.243185E+04	0.358397E+04	-0.387818E+00
1996	0.563215E+04	0.533607E+04	0.540023E-01
1997	0.622564E+04	0.496395E+04	0.226475E+00
1998	0.404592E+04	0.364178E+04	0.105235E+00
1999	0.311793E+04	0.338722E+04	-0.828407E-01

2000	0.465656E+04	0.311662E+04	0.401528E+00
2001	0.438769E+04	0.233431E+04	0.631086E+00
2002	0.696111E+04	0.377619E+04	0.611622E+00
2003	0.266154E+04	0.236183E+04	0.119467E+00
2004	0.321734E+04	0.183317E+04	0.562507E+00
2005	0.225033E+04	0.403124E+04	-0.582997E+00
2006	0.333031E+04	0.329032E+04	0.120808E-01
2007	0.469949E+04	0.539855E+04	-0.138677E+00
2008	0.434702E+04	0.627794E+04	-0.367552E+00

Survey Index: 29 Tag: ma4aut AGE = 5
Time = JAN-1 Type = NUMBER
Catchability = 0.140295E+00 % Variance Contribution = 4.1766
Residual = LN(Observed) - LN(Predicted)

Year	Observed	Predicted	Residual
1980	N/A	0.270119E+04	N/A
1981	N/A	0.242638E+04	N/A
1982	N/A	0.231989E+04	N/A
1983	0.115454E+04	0.222655E+04	-0.656750E+00
1984	0.187528E+04	0.208731E+04	-0.107116E+00
1985	0.413460E+03	0.113026E+04	-0.100564E+01
1986	0.352460E+03	0.985786E+03	-0.102850E+01
1987	0.119747E+04	0.110794E+04	0.777058E-01
1988	0.117490E+03	0.706598E+03	-0.179411E+01
1989	0.302760E+03	0.718086E+03	-0.863649E+00
1990	0.526430E+03	0.925774E+03	-0.564512E+00
1991	0.887930E+03	0.182858E+04	-0.722405E+00
1992	0.260053E+04	0.191249E+04	0.307309E+00
1993	0.249513E+04	0.919186E+03	0.998607E+00
1994	0.154796E+04	0.102938E+04	0.407978E+00
1995	0.656620E+03	0.114817E+04	-0.558820E+00
1996	0.952170E+03	0.121993E+04	-0.247807E+00
1997	0.315519E+04	0.178878E+04	0.567518E+00
1998	0.232545E+04	0.180939E+04	0.250925E+00
1999	0.160415E+04	0.143273E+04	0.113010E+00
2000	0.239041E+04	0.129081E+04	0.616196E+00
2001	0.135788E+04	0.121905E+04	0.107856E+00
2002	0.204925E+04	0.867376E+03	0.859757E+00
2003	0.336194E+04	0.150158E+04	0.806003E+00
2004	0.171260E+04	0.962650E+03	0.576078E+00
2005	0.142566E+04	0.720650E+03	0.682237E+00
2006	0.263216E+04	0.165231E+04	0.465633E+00
2007	0.245819E+04	0.133303E+04	0.611973E+00
2008	0.244464E+04	0.221084E+04	0.100524E+00

Survey Index: 30 Tag: ma5aut AGE = 6
Time = JAN-1 Type = NUMBER
Catchability = 0.542392E-01 % Variance Contribution = 7.7781
Residual = LN(Observed) - LN(Predicted)

Year	Observed	Predicted	Residual
1980	N/A	0.756920E+03	N/A
1981	N/A	0.662836E+03	N/A
1982	N/A	0.508296E+03	N/A

1983	0.257570E+03	0.514970E+03	-0.692816E+00
1984	0.314050E+03	0.465457E+03	-0.393467E+00
1985	0.173970E+03	0.368026E+03	-0.749272E+00
1986	0.316300E+02	0.240714E+03	-0.202950E+01
1987	0.881200E+02	0.229161E+03	-0.955725E+00
1988	0.519700E+02	0.239575E+03	-0.152820E+01
1989	0.101670E+03	0.145943E+03	-0.361485E+00
1990	0.293700E+02	0.153213E+03	-0.165186E+01
1991	0.474500E+02	0.197056E+03	-0.142381E+01
1992	0.264350E+03	0.342448E+03	-0.258846E+00
1993	0.311230E+03	0.323591E+03	-0.389476E-01
1994	0.386260E+03	0.175205E+03	0.790556E+00
1995	0.351760E+03	0.187906E+03	0.627010E+00
1996	0.204520E+03	0.203553E+03	0.473886E-02
1997	0.313400E+03	0.254158E+03	0.209523E+00
1998	0.329730E+03	0.390167E+03	-0.168299E+00
1999	0.849520E+03	0.433270E+03	0.673311E+00
2000	0.643920E+03	0.371717E+03	0.549443E+00
2001	0.675550E+03	0.328003E+03	0.722504E+00
2002	0.603250E+03	0.273965E+03	0.789330E+00
2003	0.840480E+03	0.203879E+03	0.141645E+01
2004	0.903750E+03	0.414770E+03	0.778828E+00
2005	0.619070E+03	0.259558E+03	0.869237E+00
2006	0.953450E+03	0.179806E+03	0.166821E+01
2007	0.933120E+03	0.485413E+03	0.653534E+00
2008	0.630360E+03	0.382503E+03	0.499553E+00

Appendix H. Table H3. Bootstrap summary report for BASE VPA.

Number of Bootstrap Repetitions Requested = 1000
Number of Bootstrap Repetitions Completed = 1000
Bootstrap Output Variable: Stock Estimates (2008)

	NLLS Estimate	Bootstrap Mean	Bootstrap Std Error	C.V. For NLLS Soln.
N 1	42084.	65284.	71615.	1.0970
N 2	19085.	20537.	8568.	0.4172
N 3	34216.	35707.	9150.	0.2562
N 4	23148.	23598.	4586.	0.1943
N 5	15758.	15998.	2621.	0.1638
N 6	7052.	7115.	1162.	0.1634
N 7	6866.	6927.	998.	0.1440
N 8	1632.	1649.	316.	0.1920
N 9	1801.	1831.	351.	0.1916
N 10	2375.	2401.	446.	0.1858

	Bias Estimate	Bias Std. Error	Per Cent Bias	NLLS Estimate Corrected For Bias	C.V. For Corrected Estimate
N 1	23200.	2381.	55.1265	18885.	3.7922

N 2	1452.	275.	7.6088	17633.	0.4859
N 3	1491.	293.	4.3571	32726.	0.2796
N 4	451.	146.	1.9463	22697.	0.2020
N 5	239.	83.	1.5193	15519.	0.1689
N 6	63.	37.	0.8873	6990.	0.1663
N 7	61.	32.	0.8814	6806.	0.1466
N 8	16.	10.	1.0063	1616.	0.1959
N 9	30.	11.	1.6734	1771.	0.1981
N 10	26.	14.	1.0773	2349.	0.1899

	LOWER	UPPER
	80. % CI	80. % CI
N 1	10757.	144356.
N 2	11236.	31673.
N 3	24756.	47556.
N 4	18153.	30140.
N 5	12816.	19328.
N 6	5679.	8659.
N 7	5690.	8264.
N 8	1257.	2058.
N 9	1392.	2310.
N 10	1848.	2985.

Bootstrap Output Variable: Catchability Estimates

	NLLS Estimate	Bootstrap Mean	Bootstrap Std Error	C.V. For NLLS Soln.
Q 1	0.756315E-02	0.770774E-02	0.144252E-02	0.1872
Q 2	0.117776E+00	0.118771E+00	0.127091E-01	0.1070
Q 3	0.237083E+00	0.239087E+00	0.227411E-01	0.0951
Q 4	0.345291E+00	0.346650E+00	0.280943E-01	0.0810
Q 5	0.332013E+00	0.331733E+00	0.233815E-01	0.0705
Q 6	0.270544E+00	0.270522E+00	0.199042E-01	0.0736
Q 7	0.239287E+00	0.241399E+00	0.213392E-01	0.0884
Q 8	0.178071E+00	0.178580E+00	0.247282E-01	0.1385
Q 9	0.183208E+00	0.185229E+00	0.276103E-01	0.1491
Q 11	0.106649E+00	0.107148E+00	0.123519E-01	0.1153
Q 12	0.299685E+00	0.299161E+00	0.263101E-01	0.0879
Q 13	0.454693E+00	0.457009E+00	0.395940E-01	0.0866
Q 14	0.545345E+00	0.549657E+00	0.421753E-01	0.0767
Q 15	0.521424E+00	0.520937E+00	0.449762E-01	0.0863
Q 16	0.460618E+00	0.462973E+00	0.460468E-01	0.0995
Q 17	0.328359E+00	0.331775E+00	0.424902E-01	0.1281
Q 18	0.310350E+00	0.313354E+00	0.455381E-01	0.1453
Q 20	0.421847E-01	0.436443E-01	0.107612E-01	0.2466
Q 21	0.234209E+00	0.237316E+00	0.384314E-01	0.1619
Q 22	0.318789E+00	0.320039E+00	0.252073E-01	0.0788
Q 23	0.228953E+00	0.228867E+00	0.178809E-01	0.0781
Q 24	0.128202E+00	0.129252E+00	0.124536E-01	0.0964
Q 26	0.265599E+00	0.269927E+00	0.388474E-01	0.1439
Q 27	0.341196E+00	0.342865E+00	0.398068E-01	0.1161
Q 28	0.271214E+00	0.272847E+00	0.304749E-01	0.1117
Q 29	0.140295E+00	0.141027E+00	0.192814E-01	0.1367
Q 30	0.542392E-01	0.551007E-01	0.103137E-01	0.1872

	Bias Estimate	Bias Std. Error	Per Cent Bias	NLLS Estimate Corrected For Bias	C.V. For Corrected Estimate
Q 1	0.1446E-03	0.4585E-04	1.9119	0.7419E-02	0.1944
Q 2	0.9957E-03	0.4031E-03	0.8454	0.1168E+00	0.1088
Q 3	0.2003E-02	0.7219E-03	0.8450	0.2351E+00	0.0967
Q 4	0.1359E-02	0.8895E-03	0.3937	0.3439E+00	0.0817
Q 5	-0.2807E-03	0.7394E-03	-0.0845	0.3323E+00	0.0704
Q 6	-0.2239E-04	0.6294E-03	-0.0083	0.2706E+00	0.0736
Q 7	0.2112E-02	0.6781E-03	0.8826	0.2372E+00	0.0900
Q 8	0.5089E-03	0.7821E-03	0.2858	0.1776E+00	0.1393
Q 9	0.2021E-02	0.8755E-03	1.1031	0.1812E+00	0.1524
Q 11	0.4990E-03	0.3909E-03	0.4679	0.1061E+00	0.1164
Q 12	-0.5239E-03	0.8322E-03	-0.1748	0.3002E+00	0.0876
Q 13	0.2316E-02	0.1254E-02	0.5094	0.4524E+00	0.0875
Q 14	0.4312E-02	0.1341E-02	0.7907	0.5410E+00	0.0780
Q 15	-0.4867E-03	0.1422E-02	-0.0933	0.5219E+00	0.0862
Q 16	0.2356E-02	0.1458E-02	0.5114	0.4583E+00	0.1005
Q 17	0.3416E-02	0.1348E-02	1.0402	0.3249E+00	0.1308
Q 18	0.3004E-02	0.1443E-02	0.9680	0.3073E+00	0.1482
Q 20	0.1460E-02	0.3434E-03	3.4600	0.4073E-01	0.2642
Q 21	0.3107E-02	0.1219E-02	1.3268	0.2311E+00	0.1663
Q 22	0.1250E-02	0.7981E-03	0.3921	0.3175E+00	0.0794
Q 23	-0.8653E-04	0.5654E-03	-0.0378	0.2290E+00	0.0781
Q 24	0.1049E-02	0.3952E-03	0.8186	0.1272E+00	0.0979
Q 26	0.4328E-02	0.1236E-02	1.6297	0.2613E+00	0.1487
Q 27	0.1669E-02	0.1260E-02	0.4893	0.3395E+00	0.1172
Q 28	0.1633E-02	0.9651E-03	0.6022	0.2696E+00	0.1130
Q 29	0.7314E-03	0.6102E-03	0.5213	0.1396E+00	0.1382
Q 30	0.8614E-03	0.3273E-03	1.5882	0.5338E-01	0.1932

		LOWER	UPPER
		80. % CI	80. % CI
Q 1		0.592635E-02	0.973937E-02
Q 2		0.102788E+00	0.135353E+00
Q 3		0.210345E+00	0.269494E+00
Q 4		0.312310E+00	0.385463E+00
Q 5		0.302428E+00	0.362163E+00
Q 6		0.246814E+00	0.297561E+00
Q 7		0.213922E+00	0.269274E+00
Q 8		0.148702E+00	0.212379E+00
Q 9		0.152209E+00	0.219613E+00
Q 11		0.918104E-01	0.122527E+00
Q 12		0.266269E+00	0.332966E+00
Q 13		0.406826E+00	0.510527E+00
Q 14		0.496418E+00	0.604570E+00
Q 15		0.464128E+00	0.577613E+00
Q 16		0.404882E+00	0.523305E+00
Q 17		0.279897E+00	0.384030E+00
Q 18		0.258180E+00	0.376934E+00
Q 20		0.309468E-01	0.586785E-01
Q 21		0.190101E+00	0.288070E+00
Q 22		0.288129E+00	0.353768E+00
Q 23		0.206341E+00	0.251690E+00
Q 24		0.113929E+00	0.146198E+00
Q 26		0.222215E+00	0.322941E+00
Q 27		0.293258E+00	0.396187E+00
Q 28		0.234032E+00	0.311780E+00
Q 29		0.118008E+00	0.166817E+00
Q 30		0.427027E-01	0.689150E-01

Bootstrap Output Variable: Fishing Mortality (2007)

	NLLS Estimate	Bootstrap Mean	Bootstrap Std Error	C.V. For NLLS Soln.
AGE 1	0.0075	0.0083	0.003652	0.4410
AGE 2	0.0063	0.0064	0.001608	0.2520
AGE 3	0.0087	0.0088	0.001683	0.1903
AGE 4	0.0336	0.0340	0.005419	0.1596
AGE 5	0.0981	0.0996	0.015321	0.1538
AGE 6	0.0650	0.0657	0.009321	0.1418
AGE 7	0.1129	0.1203	0.155959	1.2962
AGE 8	0.0548	0.0559	0.010728	0.1919
AGE 9	0.0256	0.0262	0.004954	0.1888
AGE 10	0.0646	0.0670	0.039266	0.5857
AGE 11	0.0646	0.0670	0.039266	0.5857

	Bias Estimate	Bias Std. Error	Per Cent Bias	NLLS Estimate Corrected For Bias	C.V. For Corrected Estimate
AGE 1	0.000736	0.000118	9.7528	0.0068	0.5364
AGE 2	0.000127	0.000051	2.0251	0.0061	0.2625
AGE 3	0.000150	0.000053	1.7285	0.0085	0.1970
AGE 4	0.000354	0.000172	1.0543	0.0332	0.1630
AGE 5	0.001507	0.000487	1.5357	0.0966	0.1586
AGE 6	0.000724	0.000296	1.1142	0.0643	0.1450
AGE 7	0.007448	0.004937	6.5992	0.1054	1.4794
AGE 8	0.001052	0.000341	1.9177	0.0538	0.1994
AGE 9	0.000607	0.000158	2.3687	0.0250	0.1979
AGE 10	0.002458	0.001244	3.8056	0.0621	0.6320
AGE 11	0.002458	0.001244	3.8056	0.0621	0.6320

	LOWER 80. % CI	UPPER 80. % CI
AGE 1	0.004546	0.012777
AGE 2	0.004500	0.008627
AGE 3	0.006669	0.011067
AGE 4	0.027473	0.041134
AGE 5	0.080179	0.120161
AGE 6	0.054207	0.077782
AGE 7	0.090534	0.144093
AGE 8	0.042854	0.070363
AGE 9	0.020429	0.032789
AGE 10	0.057349	0.074650
AGE 11	0.057349	0.074650

Bootstrap Output Variable: Average F (2007) AGES 6 - 9

	NLLS Estimate	Bootstrap Mean	Bootstrap Std Error	C.V. For NLLS Soln.
AVG F	0.0646	0.0670	0.039266	0.5857
N WTD	0.0629	0.0629	0.006226	0.0989
B WTD	0.0588	0.0588	0.005666	0.0964
C WTD	0.0722	0.0745	0.037699	0.5058

	Bias Estimate	Bias Std. Error	Per Cent Bias	NLLS Estimate Corrected For Bias	C.V. For Corrected Estimate
AVG F	0.002458	0.001244	3.8056	0.0621	0.6320
N WTD	0.000008	0.000197	0.0125	0.0629	0.0989
B WTD	-0.000040	0.000179	-0.0677	0.0589	0.0962
C WTD	0.002358	0.001194	3.2662	0.0698	0.5399

	LOWER 80. % CI	UPPER 80. % CI
AVG F	0.057349	0.074650
N WTD	0.055657	0.070912
B WTD	0.051933	0.066022
C WTD	0.063608	0.083727

Bootstrap Output Variable: Biomass

JAN-1 Biomass (2008) Mean Biomass & SSB (2007)

	NLLS Estimate	Bootstrap Mean	Bootstrap Std Error	C.V. For NLLS Soln.
JAN-1	24918.	25522.	1924.	0.0754
MEAN	25784.	26150.	1859.	0.0711
SSB	15659.	15815.	1128.	0.0713

	Bias Estimate	Bias Std. Error	Per Cent Bias	NLLS Estimate Corrected For Bias	C.V. For Corrected Estimate
JAN-1	604.	64.	2.4253	24313.	0.0792
MEAN	366.	60.	1.4200	25418.	0.0731
SSB	156.	36.	0.9938	15503.	0.0728

	LOWER 80. % CI	UPPER 80. % CI
JAN-1	23116.	27952.
MEAN	23776.	28602.
SSB	14382.	17229.

Plus Group Diagnostic Report

Calculation Method Selected = Backward

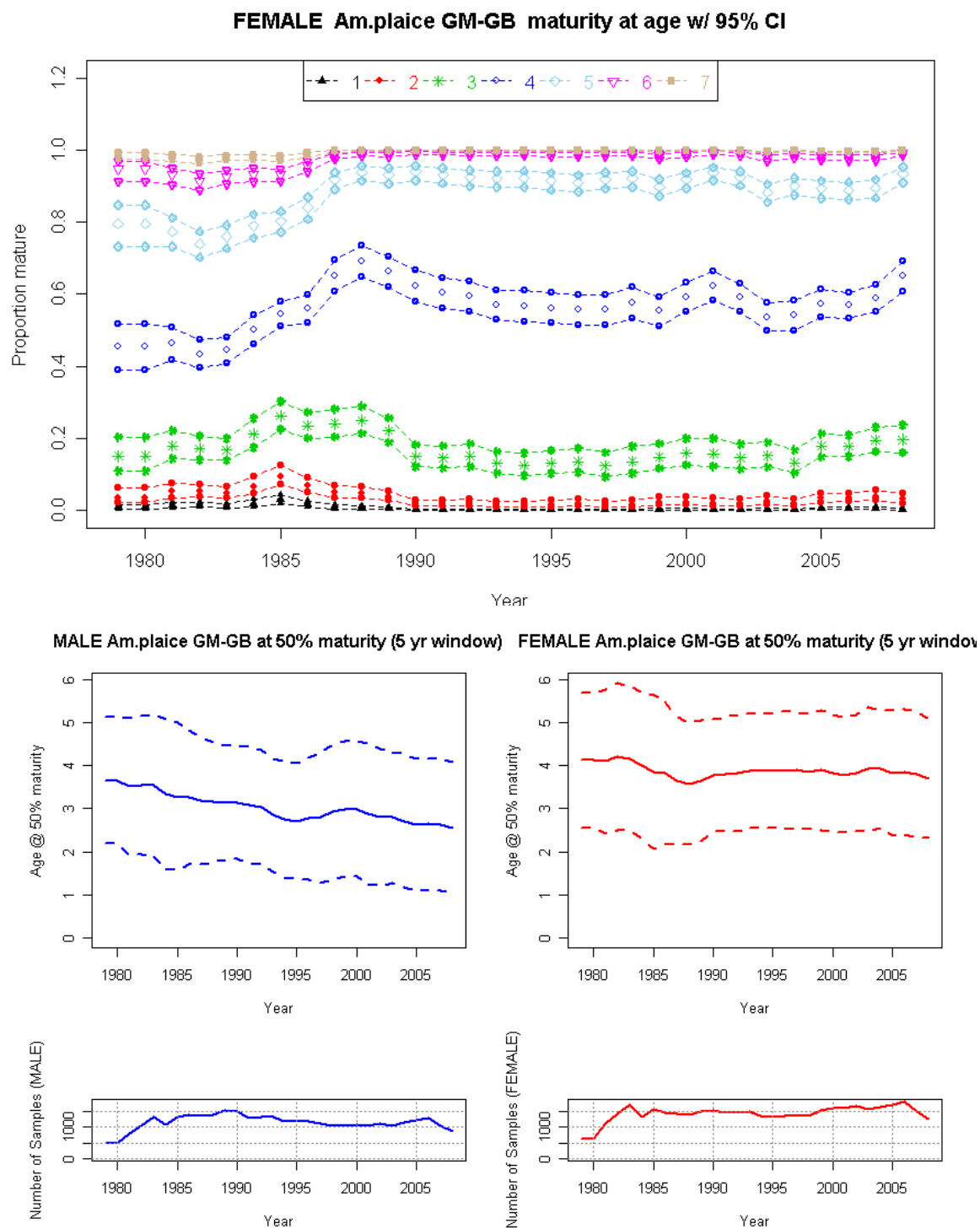
Year	Population Backward	Population Forward	F Forward	F Backward	Ratio
1980	4509.	4509.	0.408676	0.408673	0.999992
1981	2035.	3964.	0.189078	0.407096	2.153053
1982	1640.	3472.	0.257504	0.649320	2.521596
1983	2019.	2917.	0.419029	0.678075	1.618207
1984	1933.	1985.	0.550844	0.570704	1.036052
1985	373.	1294.	0.168017	0.757274	4.507116
1986	258.	1106.	0.104786	0.550632	5.254830
1987	169.	943.	0.072554	0.492033	6.781583
1988	189.	805.	0.078711	0.385659	4.899662
1989	342.	777.	0.182671	0.474510	2.597627
1990	597.	683.	0.299398	0.350873	1.171930
1991	368.	620.	0.204128	0.371846	1.821630
1992	235.	607.	0.185578	0.572218	3.083446
1993	281.	549.	0.287051	0.662789	2.308960
1994	645.	481.	1.063442	0.676688	0.636318
1995	96.	274.	0.221655	0.827379	3.732734
1996	164.	216.	0.424547	0.608911	1.434258
1997	316.	155.	1.637405	0.514499	0.314216
1998	402.	189.	2.078124	0.545921	0.262699
1999	234.	96.	2.078124	0.461173	0.221918
2000	57.	65.	0.404322	0.476097	1.177520
2001	132.	138.	0.527333	0.559539	1.061073
2002	497.	216.	2.078124	0.494489	0.237950
2003	363.	227.	0.843471	0.445250	0.527878
2004	452.	326.	0.285708	0.197950	0.692839
2005	444.	519.	0.109412	0.128863	1.177783
2006	452.	658.	0.075662	0.111961	1.479752
2007	531.	955.	0.036202	0.066081	1.825331
2008	834.	1181.	N/A	N/A	

Warning **** Infeasible Mass Balance in Plus Group

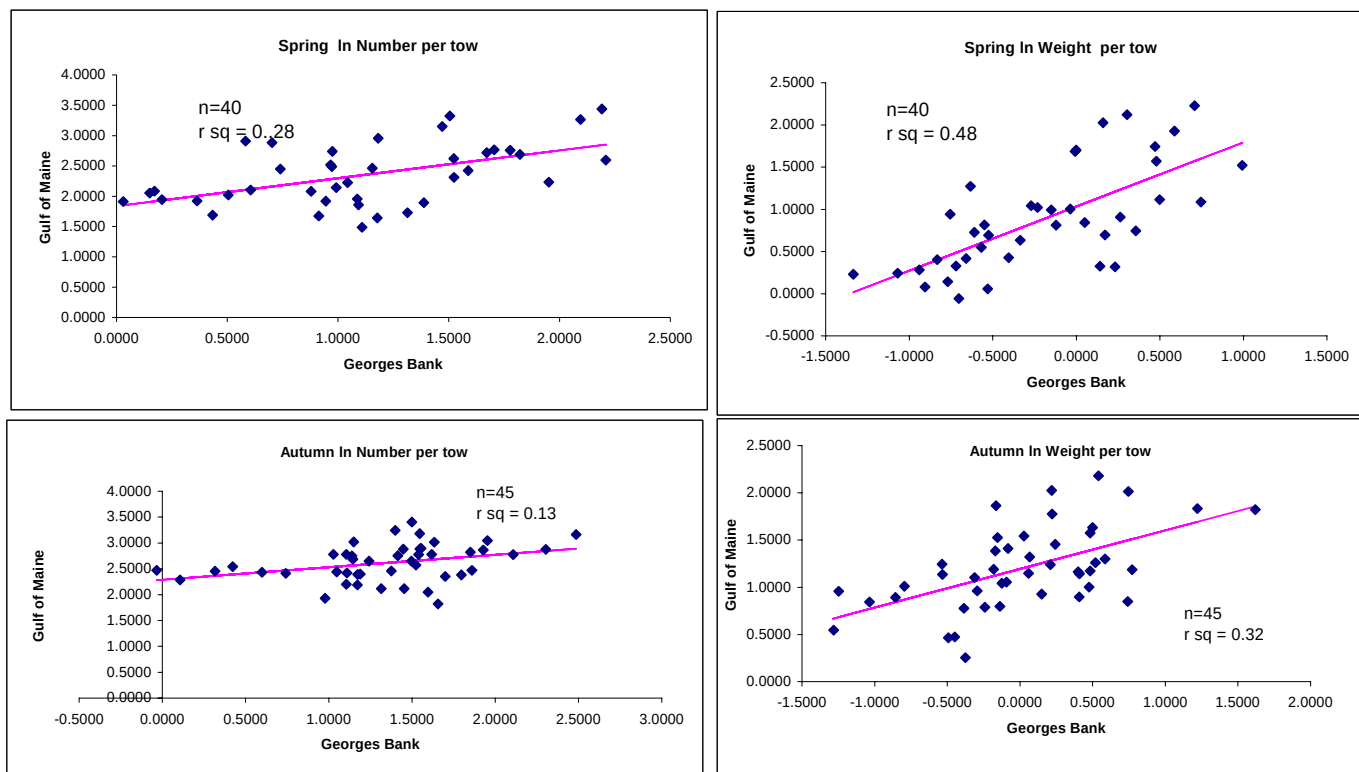
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Year = 1997

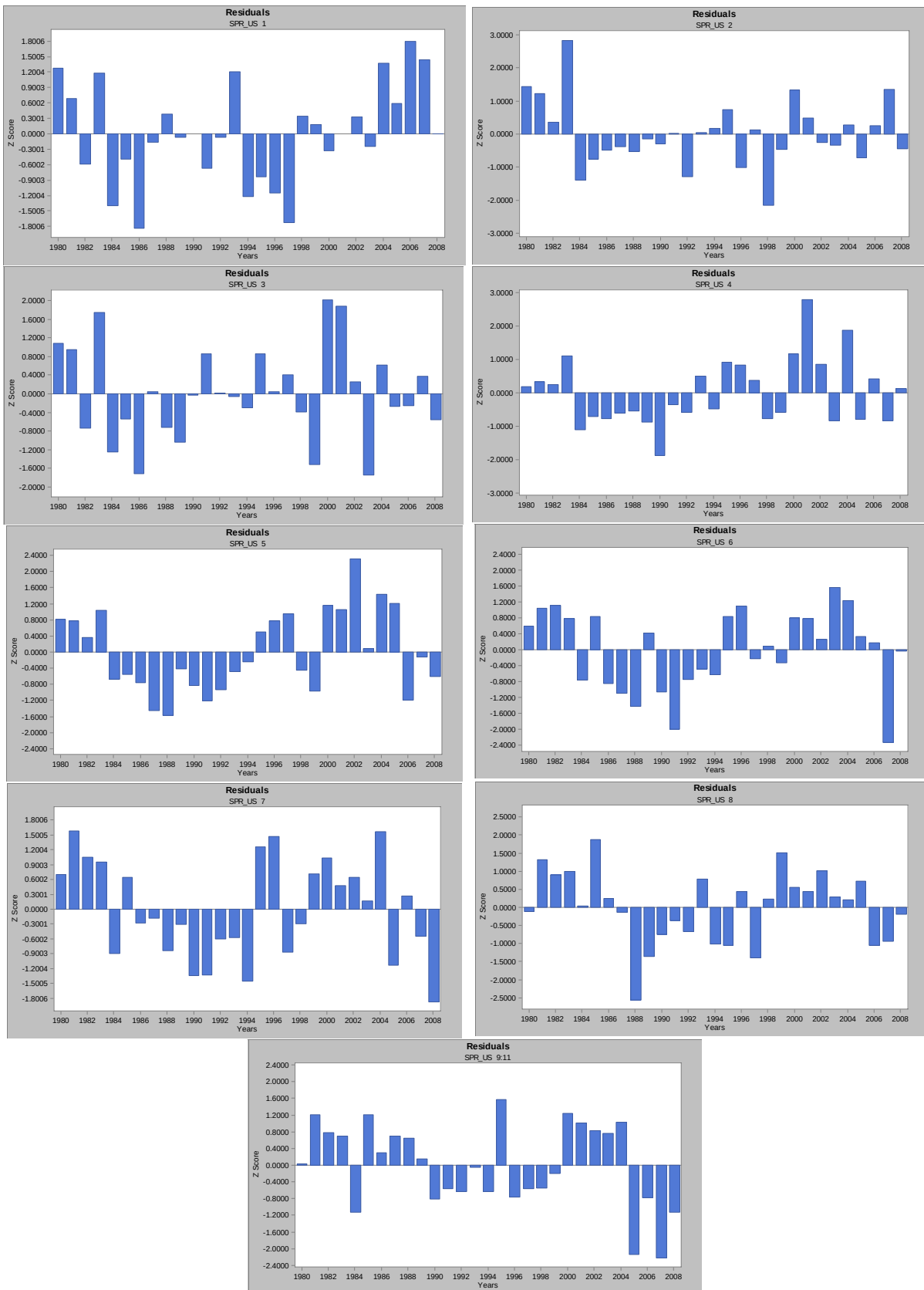
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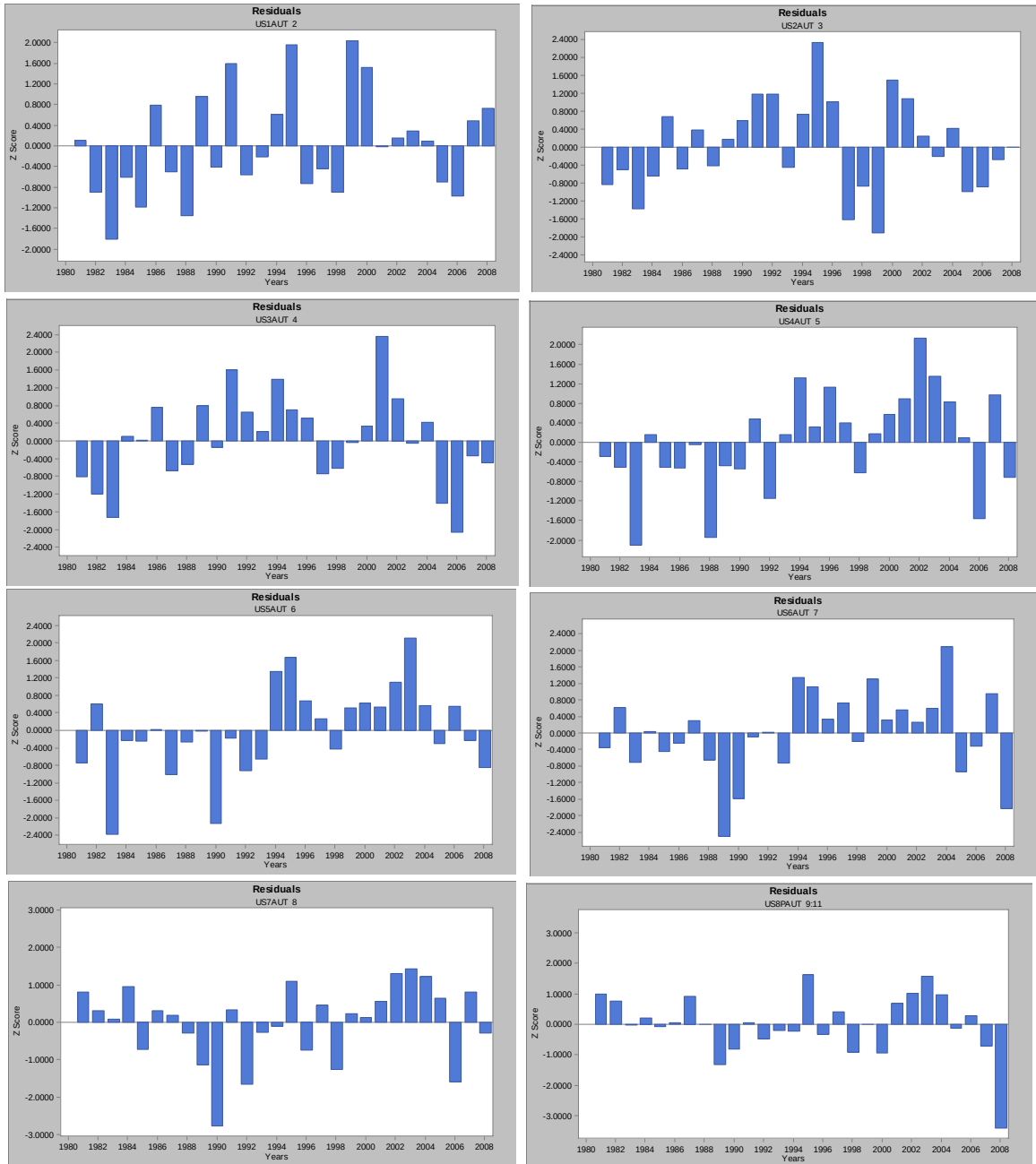
Appendix H. Figure H1. Proportion mature at age with 95% confidence intervals for female Gulf of Maine-Georges Bank American plaice using a 5-year moving window for ages 1-7 (upper panel), median age at maturity (A50) for males (middle left panel) and females (middle right panel) with 95% confidence intervals, and number of samples in the combined 5-year moving average for males (lower left panel) and females (lower right panel).



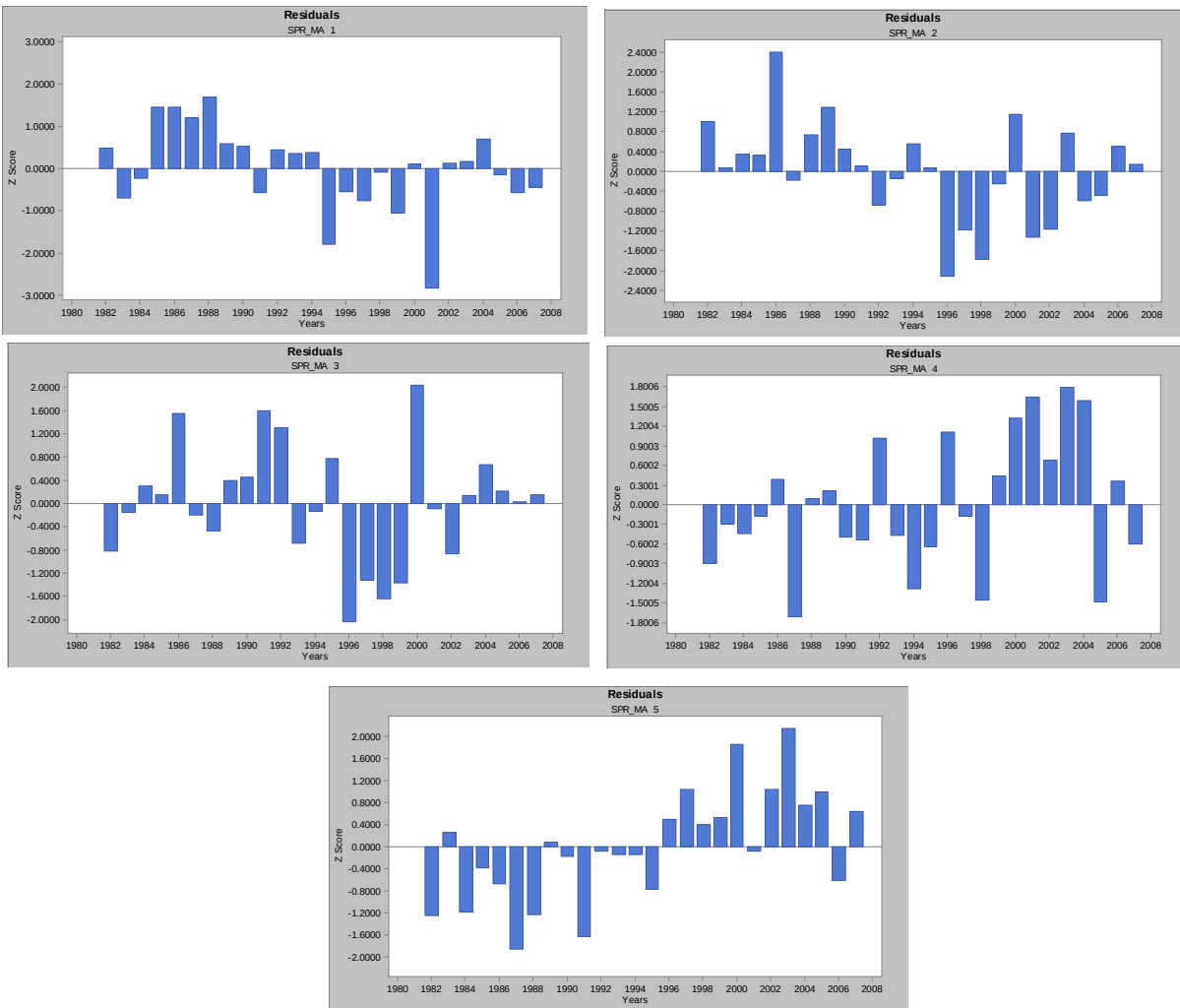
Appendix H. Figure H2. Regression of Georges Bank and Gulf of Maine spring and autumn NEFSC research survey ln(mean number per tow) and ln(mean weight per tow) for American plaice.



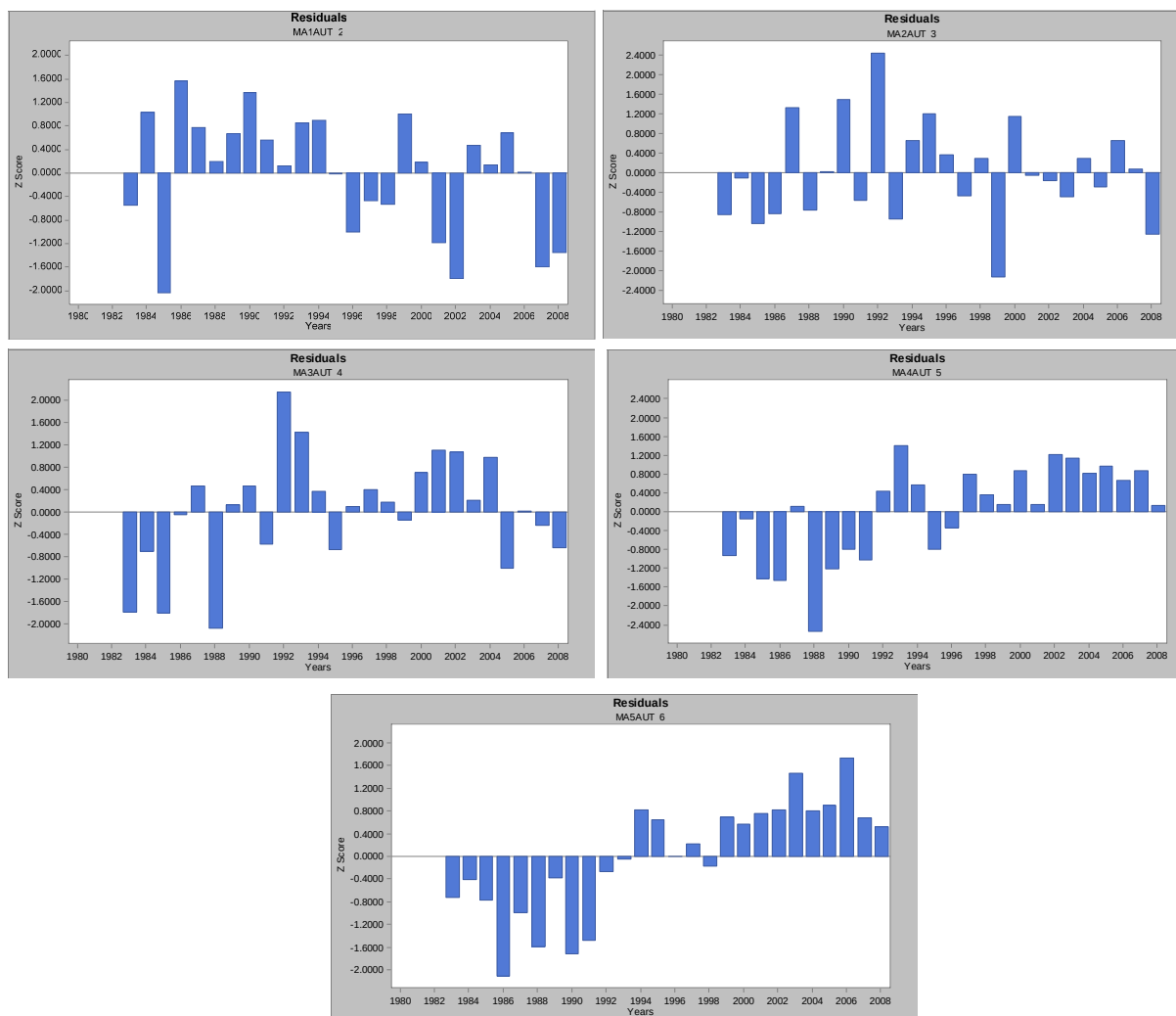
Appendix H. Figure H3a. Base VPA residuals for ages 1-9+ for NEFSC spring surveys, 1980-2008.



Appendix H. Figure H3b. Base VPA residuals for ages 2-9+ for NEFSC autumn surveys, 1981-2008.



Appendix H. Figure H3c. Base VPA residuals for ages 1-5 for MA Division of Marine Fisheries spring surveys, 1982-2007.



Appendix H. Figure H3d. Base VPA residuals for ages 2-6 for MA Division of Marine Fisheries autumn surveys, 1983-2008.

Appendix I. Gulf of Maine winter flounder by Paul Nitschke

SCALE Model Results

The use of a simple forward projecting model that tunes to length data for larger fish and indices of recruitment at age (SCALE) was investigated as an alternative model for Gulf of Maine winter flounder. For the biological reference point meeting recruitment indices at age in SCALE were estimated by length slicing due to questions of smearing across ages in the age-length keys. The assumed negligible error in the catch for the VPA was questioned with the poor sampling of the commercial landings data. For the final GARM III meeting length slicing indices were not used with the exception of the Seabrook index (Figures I19 through I22). Some SCALE runs modeled the population with the sexes separated. Females grow larger and appear to have a lower natural mortality rate than males (Figures I25 through I27). A natural mortality of 0.2 was assumed for females and 0.3 for males. Female based reference points were developed for the sex specific model. Similar results and status determinations are seen between the sex specific model and the single sex model. Both models had similar problems in the diagnostics.

The retrospective pattern in the SCALE model was very similar to the retrospective pattern seen in the VPA. The scale model can not fit the age 1 and 2 recruitment indices along with the trends in the catch, 30+ cm abundance indices, and 30+ cm survey length frequencies. Lower weights on the recruitment indices and a low penalty on recruitment variation were used to allow the model to produce a lack of fit to the recruitment indices so that a larger initial population in 1982 can be estimated by the model. The model needs to estimate a declining trend in recruitment to fit the trend in the catch and the adult abundance in the surveys. Splitting the surveys had the same effect as in the VPA (Figure I31). This allowed the model to estimate further declines in the recruitment indices to produce a closer fit to the catch. Comparisons between the split SCALE and VPA runs can be seen in Table I4 and Figure I32. The splitting of the survey results in about a tripling of the survey Qs (Table I3).

SCALE Model Biological Reference Points

For SCALE the length based selectivity was converted to an age based vector (Figure I56). Mean weights of the population and the catch was estimated by sex or for the sexes combined (Figure I35). Long term AGEPRO projections were run to determine the biological reference points. Separate runs were done for each sex in the sex specific model to estimate biological reference points.

$F_{40\%}$ was also estimated within the SCALE model so that the model will be consistent with the reference points. $F_{40\%}$ was estimated with the sexes combined using a female maturity vector. $F_{40\%}$ was also estimated for a female only SSB_{msy} reference point and a two sex MSY yield. The scale model estimated $F_{40\%}$ at 0.38 in the combined sex model (run 5) and 0.35 for females in the sex specific model (run 6) (Table I4). Little differences in the estimated selectivity exists between the age based VPA model and the SCALE model. Lower mean weights of the older fish from the estimated growth curve in the SCALE model likely contributed to the higher $F_{40\%}$ reference points from the SCALE model.

Table II. Gulf of Maine winter flounder large and small mesh trawl and gillnet kept ratios (kept/sum all species kept), CVs, and estimated landings in metric tons.

Kept Ratio				CV			Metric Tons		
year	trawl		gillnet	trawl		gillnet	trawl		gillnet
	lg mesh	sm mesh		lg mesh	sm mesh		lg mesh	sm mesh	
1989	0.006	0.015	0.007	0.38	0.45	0.58	131	27	107
1990	0.001	0.000	0.015	0.47	0.77	0.44	42	1	244
1991	0.019	0.001	0.003	0.44	0.54	0.22	572	2	43
1992	0.008	0.001	0.013	0.49	0.58	0.13	227	4	163
1993	0.004	0.027	0.014	0.76	0.53	0.14	93	68	236
1994	0.001		0.006	0.83		0.88	14	0	84
1995	0.032	0.000	0.005	1.03		0.28	575	0	83
1996	0.017	0.000	0.007	2.32		0.41	305	0	99
1997	0.001	0.040	0.021	2.01	0.33	0.51	12	76	262
1998	0.005		0.010	0.80		0.37	65	0	136
1999	0.110	0.000	0.007	0.66		0.45	1241	0	57
2000	0.012		0.023	0.40		0.39	179	0	183
2001	0.025	0.000	0.011	0.25		0.72	410	0	85
2002	0.028	0.005	0.045	0.29	0.51	0.40	446	7	295
2003	0.021	0.013	0.033	0.19	0.54	0.18	369	7	220
2004	0.031	0.034	0.025	0.21	0.72	0.13	841	13	176
2005	0.021	0.018	0.012	0.16	0.38	0.15	404	6	78
2006	0.017	0.003	0.002	0.27	0.39	0.41	189	1	12
2007	0.012	0.005	0.013	0.20	0.34	0.37	121	4	98

Table I2. Split SCALE area swept estimated Qs.

Scale run 5 (0.1 wt rec, 20wt catch)

survey	season	age	split	q
DMF	Spr	1	1	0.44
DMF	Spr	2	1	0.92
DMF	Spr	3	1	0.85
DMF	Fall	0	1	0.01
DMF	Fall	1	1	0.89
DMF	Fall	2	1	1.03
SEA	Spr	1	1	0.000001
SEA	Spr	2	1	0.000002
NEFSC	spr	1	1	0.01
NEFSC	spr	2	1	0.10
NEFSC	spr	3	1	0.20
NEFSC	Fa	1	1	0.05
NEFSC	Fa	2	1	0.22
DMF	Spr	1	2	1.46
DMF	Spr	2	2	3.16
DMF	Spr	3	2	2.09
DMF	Fall	0	2	0.05
DMF	Fall	1	2	3.05
DMF	Fall	2	2	3.07
NEFSC	spr	1	2	0.03
NEFSC	spr	2	2	0.21
NEFSC	spr	3	2	0.52
NEFSC	Fall	0	2	0.13
NEFSC	Fall	1	2	0.55
DMF	Spr	30+	1	0.62
DMF	Fall	30+	1	0.38
NEFSC	Spr	30+	1	0.20
NEFSC	Fall	30+	1	0.20
DMF	Spr	30+	2	1.44
DMF	Fall	30+	2	1.27
NEFSC	Spr	30+	2	0.46
NEFSC	Fall	30+	2	0.80

Table I3. Split SCALE area swept Q ratios (2nd/1st).

Scale run 5 (0.1 wt rec, 20wt catch)

survey		age	q ratio (2nd/1st)
DMF	Spr	1	3.3
DMF	Spr	2	3.4
DMF	Spr	3	2.5
DMF	Fall	0	4.8
DMF	Fall	1	3.4
DMF	Fall	2	3.0
DMF	Spr	1	3.3
DMF	Spr	2	3.4
DMF	Spr	3	2.5
DMF	Fall	0	4.8
DMF	Fall	1	3.4
DMF	Fall	2	3.0
DMF	Spr	30+	2.3
DMF	Fall	30+	3.4
NEFSC	Spr	30+	2.3
NEFSC	Fall	30+	4.0

Table I4. Non-parametric empirical biological reference points from the VPA and SCALE models for Gulf of Maine winter flounder.

	1 VPA Base all indices	2 VPA Split all indices	3 SCALE Split 1.0 wt rec	4 SCALE Split 0.1 wt rec	5 SCALE Split 0.1 wt rec 20 wt catch	6 SCALE Split separate sex
F40%	0.30	0.28	0.38	0.39	0.38	0.35
YPR	0.237	0.235	0.214	0.215	0.214	0.162
SSBR	0.972	0.972	0.846	0.851	0.843	0.481
Mean Recruit million	4.585	4.072	4.286	4.251	4.289	2.582
MSY	1,050	917	902	873	873	lower
SSBMSY	4,305	3,792	3,162	3,069	3,040	2,146
SSB07	2,765	1,100	1,723	1,030	1,067	725
F07	0.11	0.42	0.27	0.53	0.47	0.48
SSB07/SSBMSY	64%	29%	54%	34%	35%	34%
F07/FMSY	39%	147%	71%	135%	125%	136%

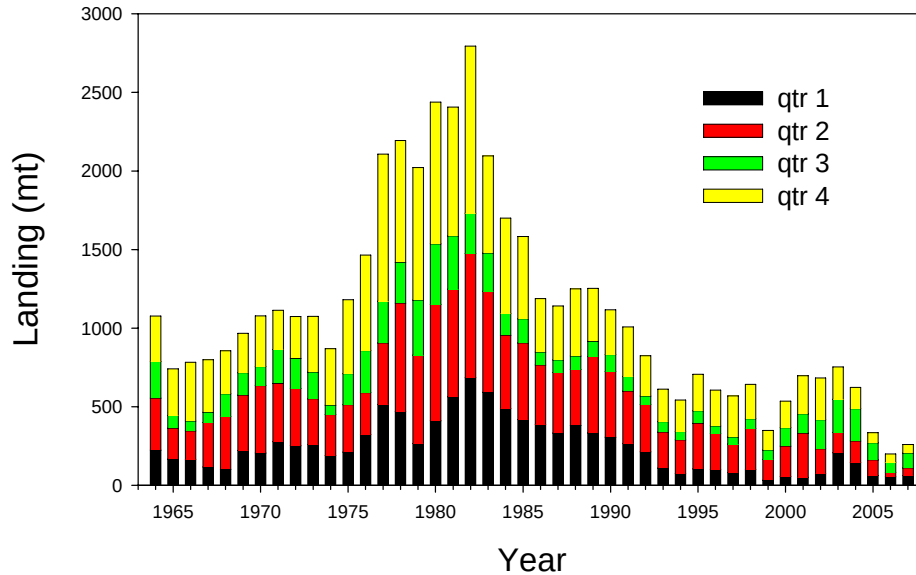


Figure I1. Gulf of Maine winter flounder commercial landings by quarter from 1964-2007.

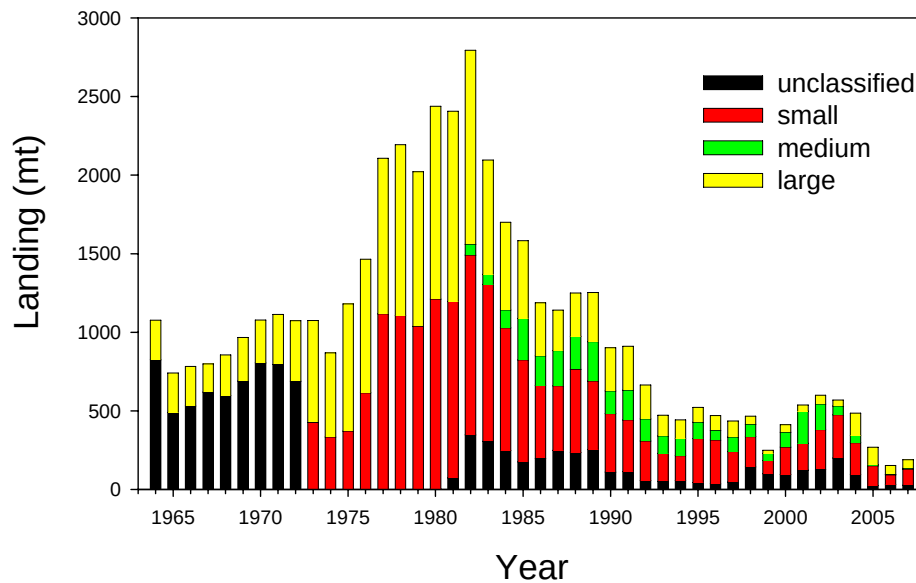


Figure I2. Gulf of Maine winter flounder commercial landings by market category from 1964-2007.

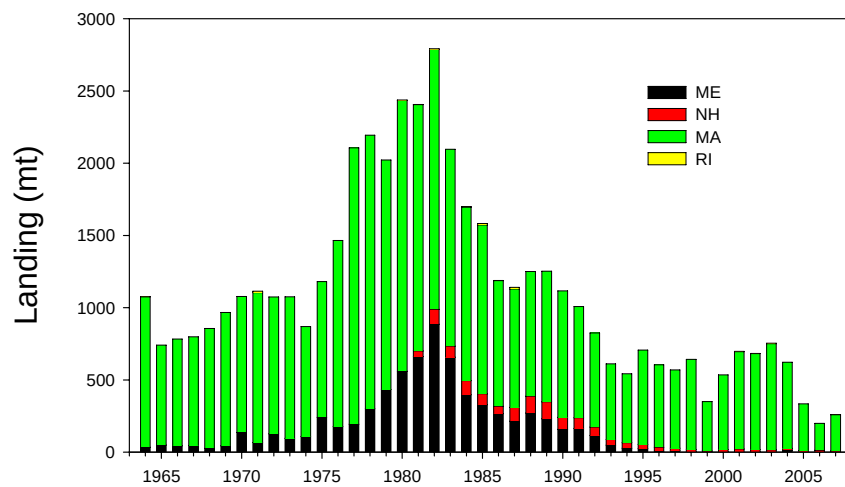


Figure I3. Commercial landings by state from 1964-2007.

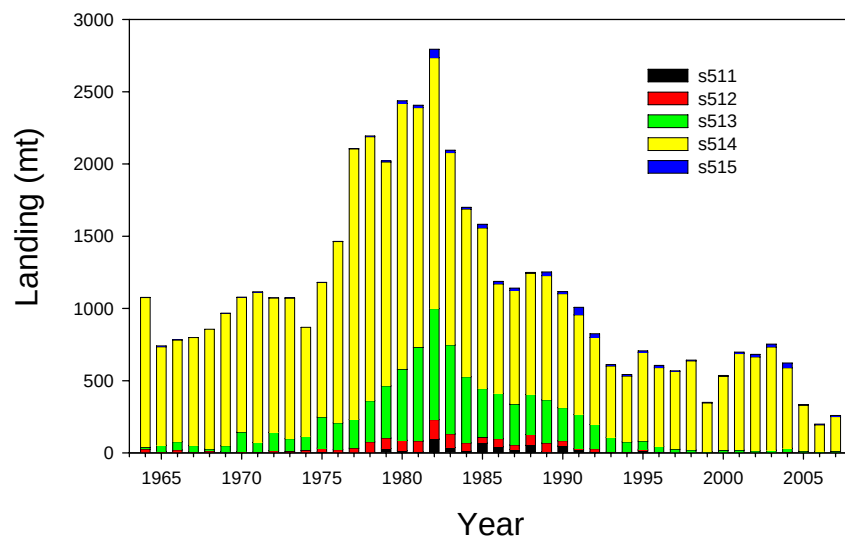


Figure I4. Commercial landings by statistical area from 1964-2007

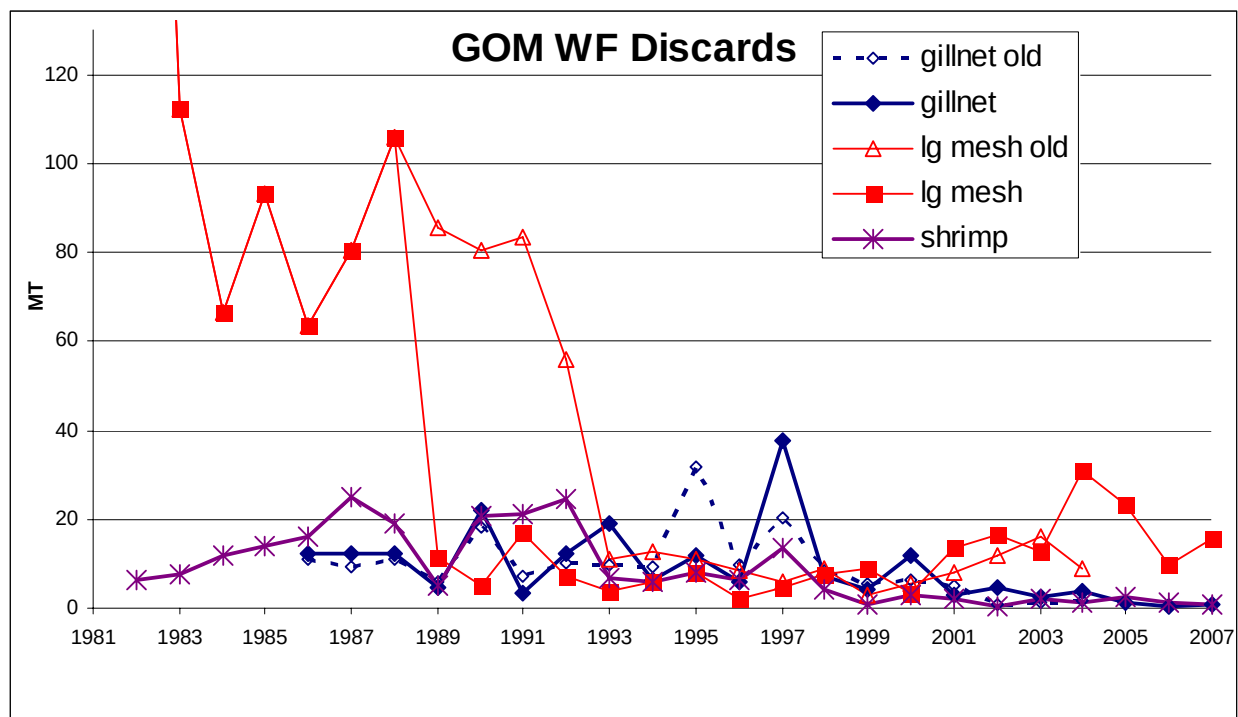


Figure I5. Estimated discards using the GARM II method and updated GARM III method.

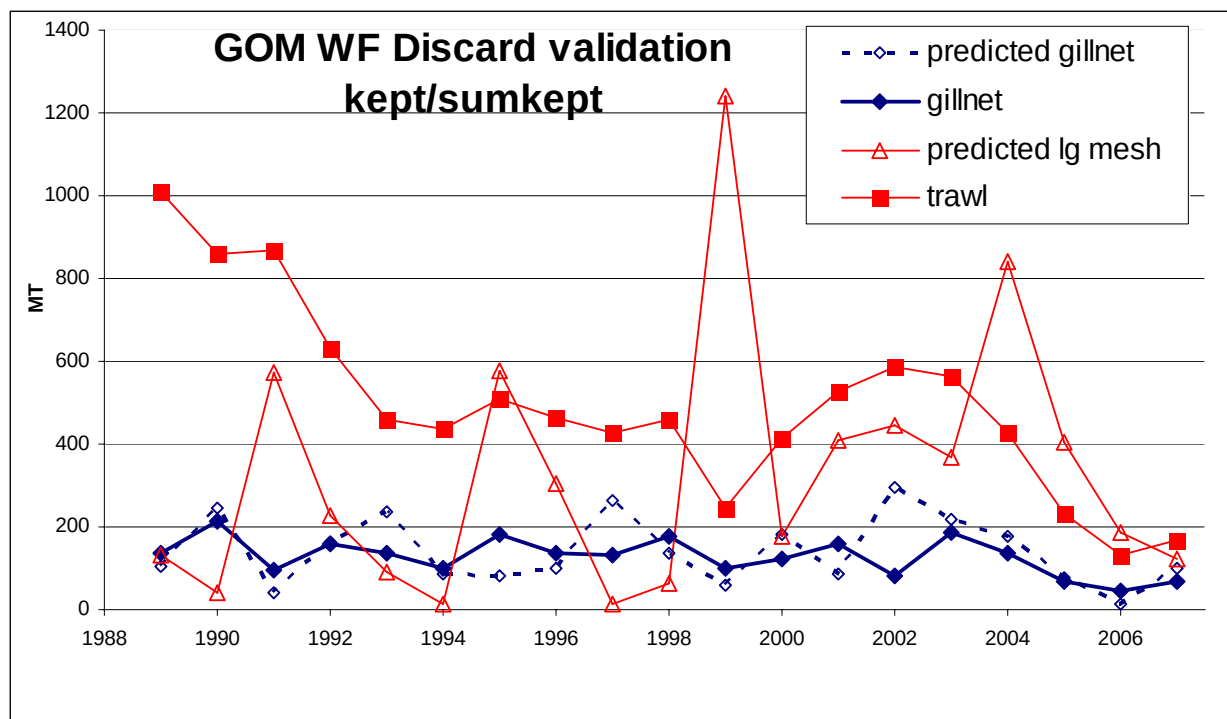


Figure I6. Estimated landings using the kept to sum all species ratios and the actual landings by fleet.

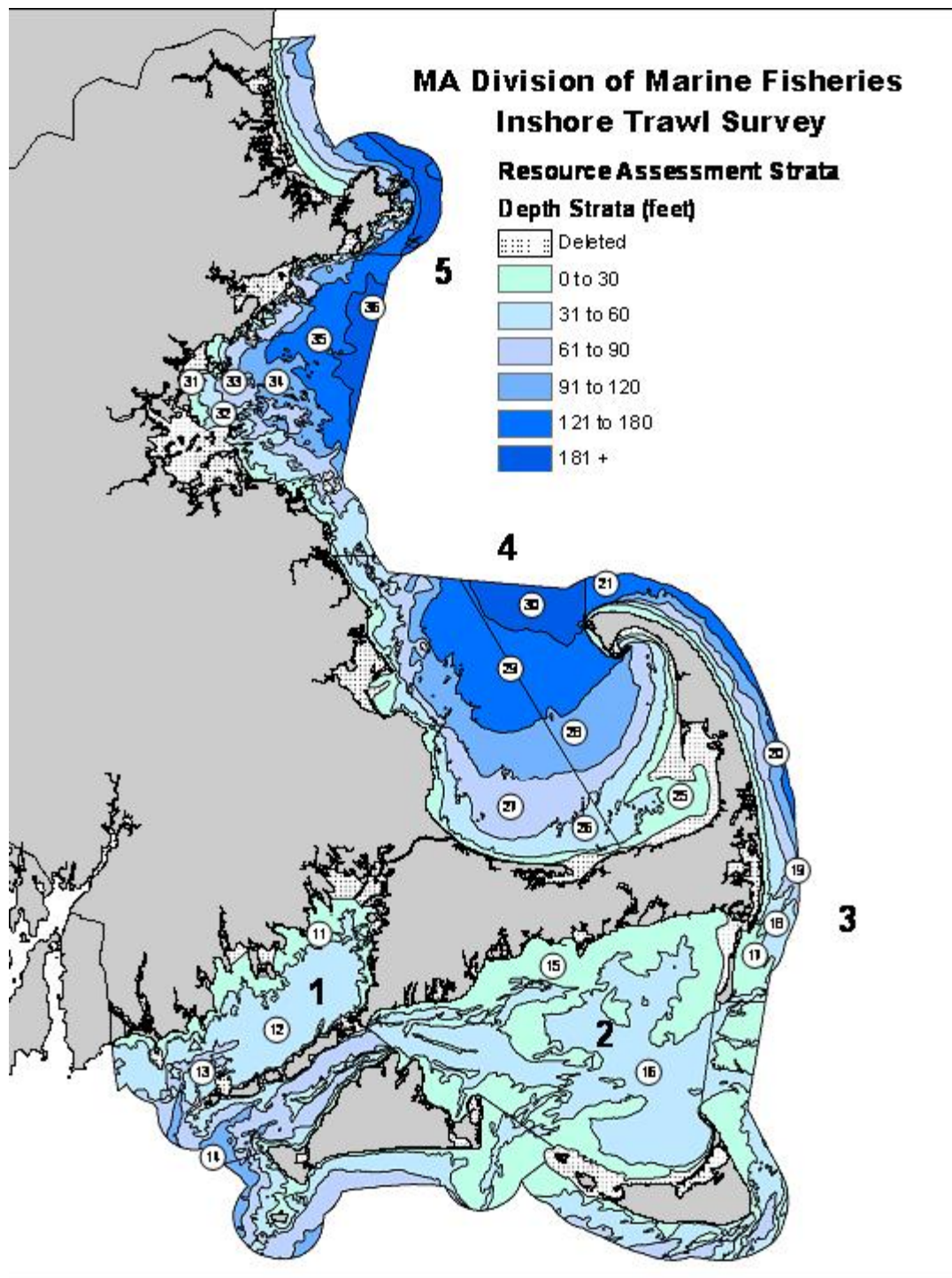


Figure I7. Survey strata for the MDMF bottom trawl survey.

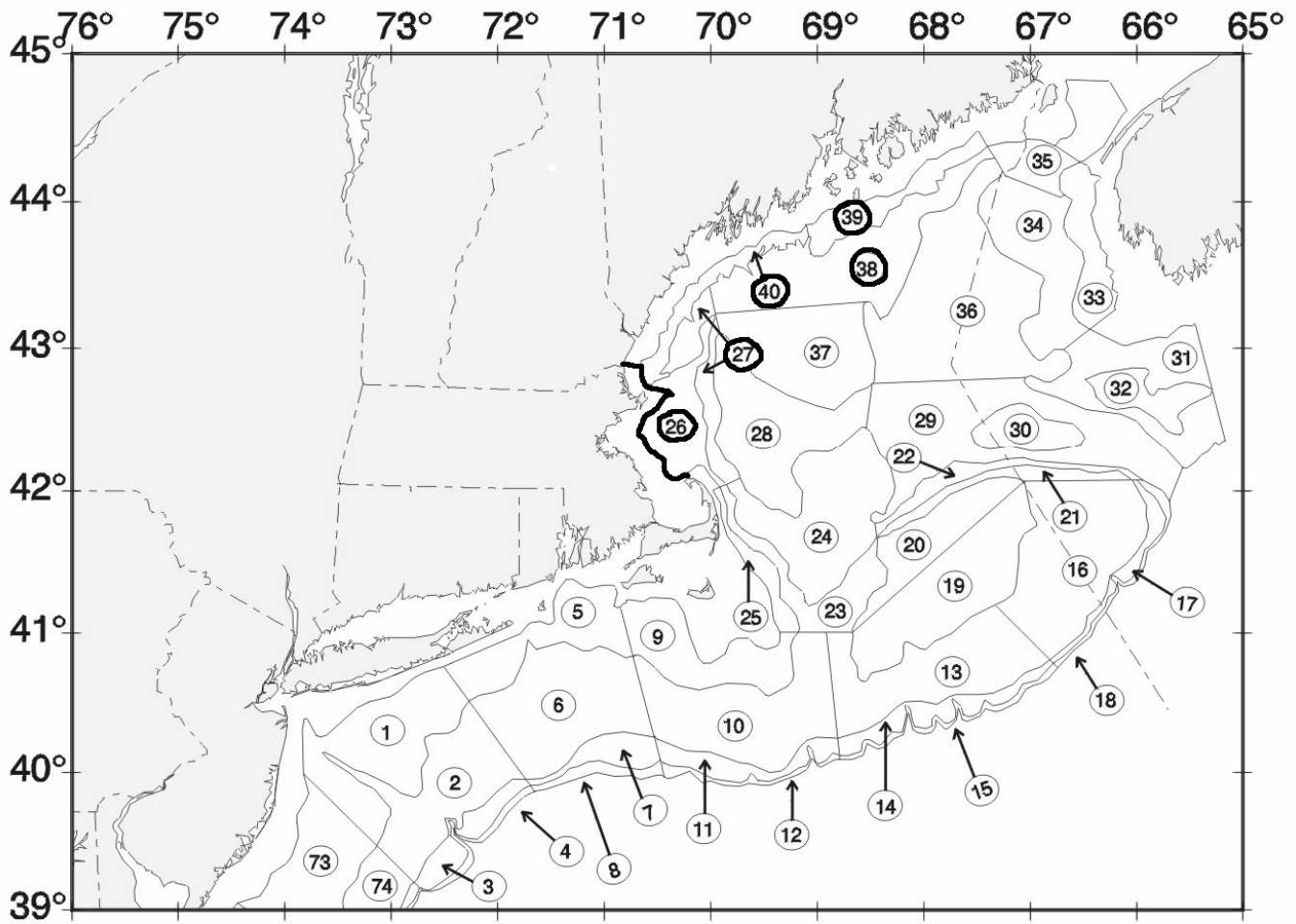


Figure I8. Offshore survey strata for the NEFSC bottom trawl survey for Gulf of Maine winter flounder.

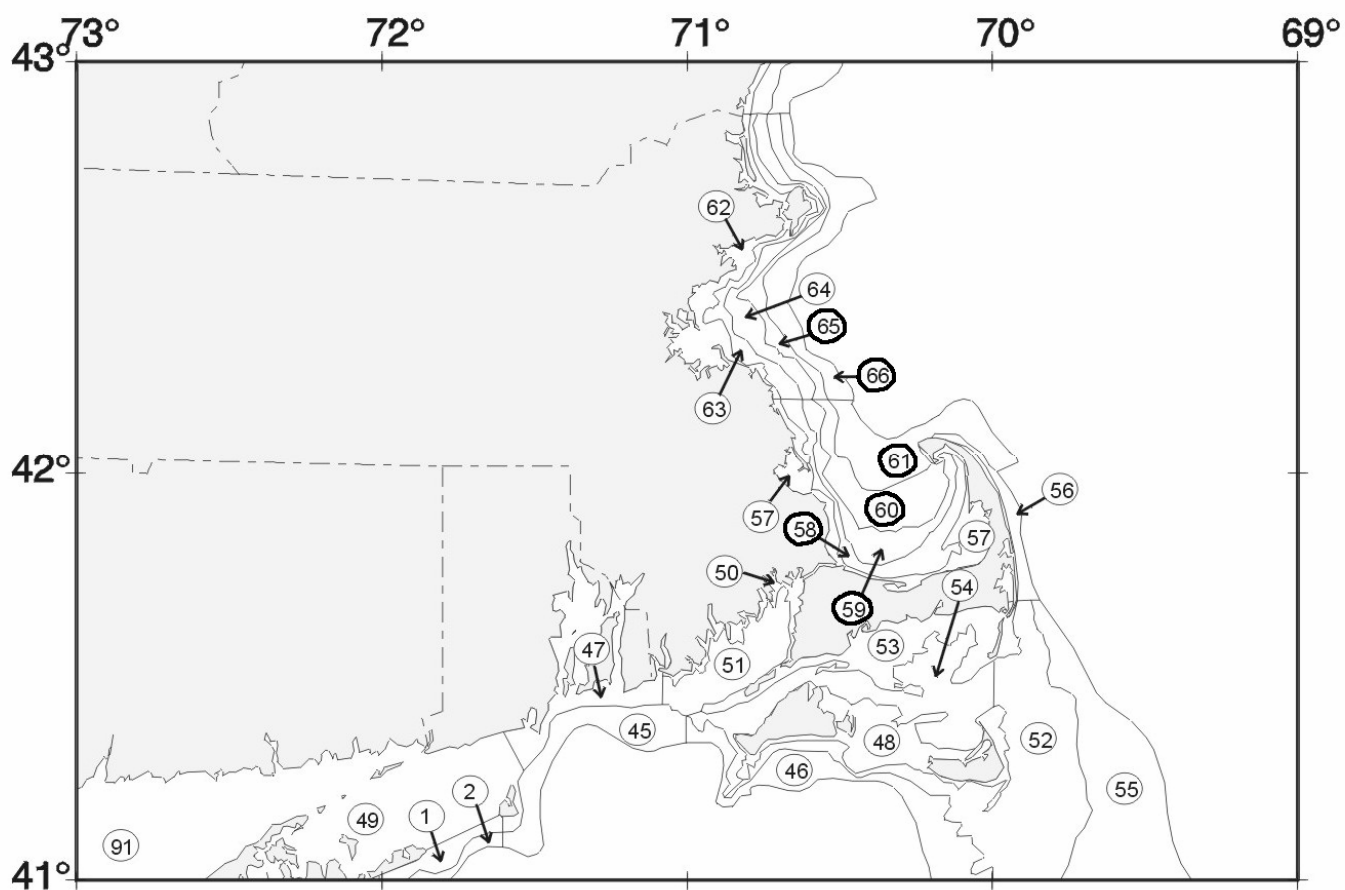


Figure I9. Inshore survey strata for the NEFSC bottom trawl survey for Gulf of Maine winter flounder.

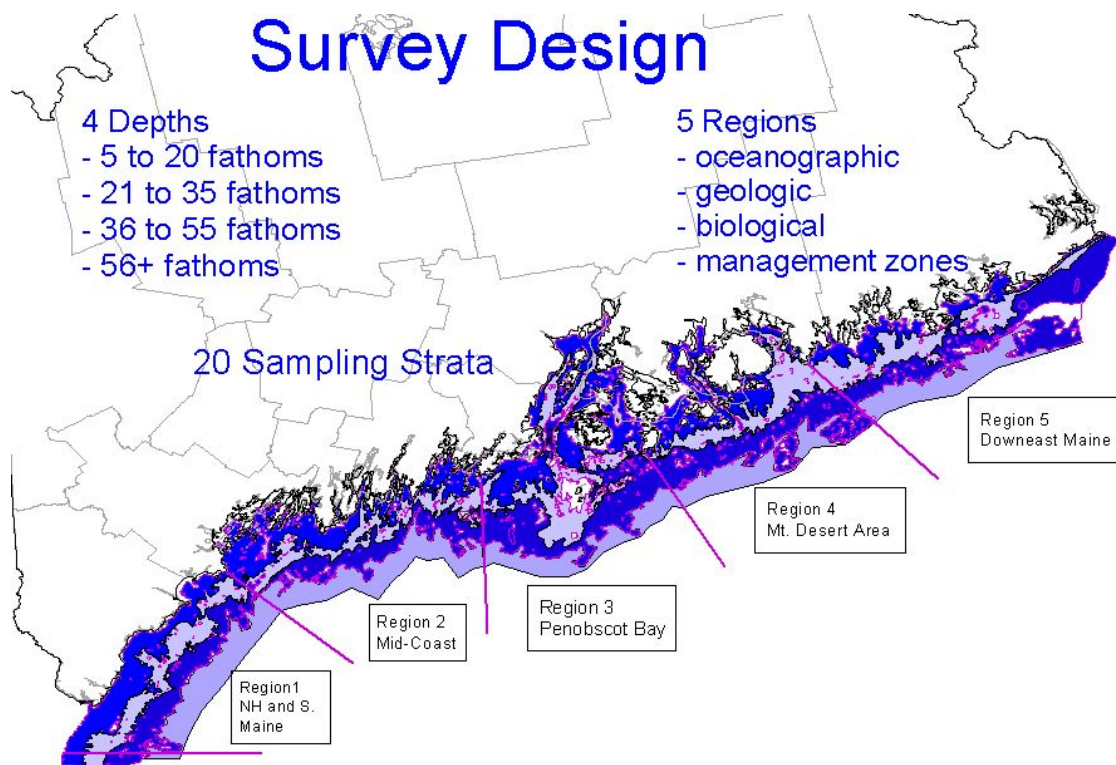


Figure I10. Survey strata for the NH/ME bottom trawl survey.

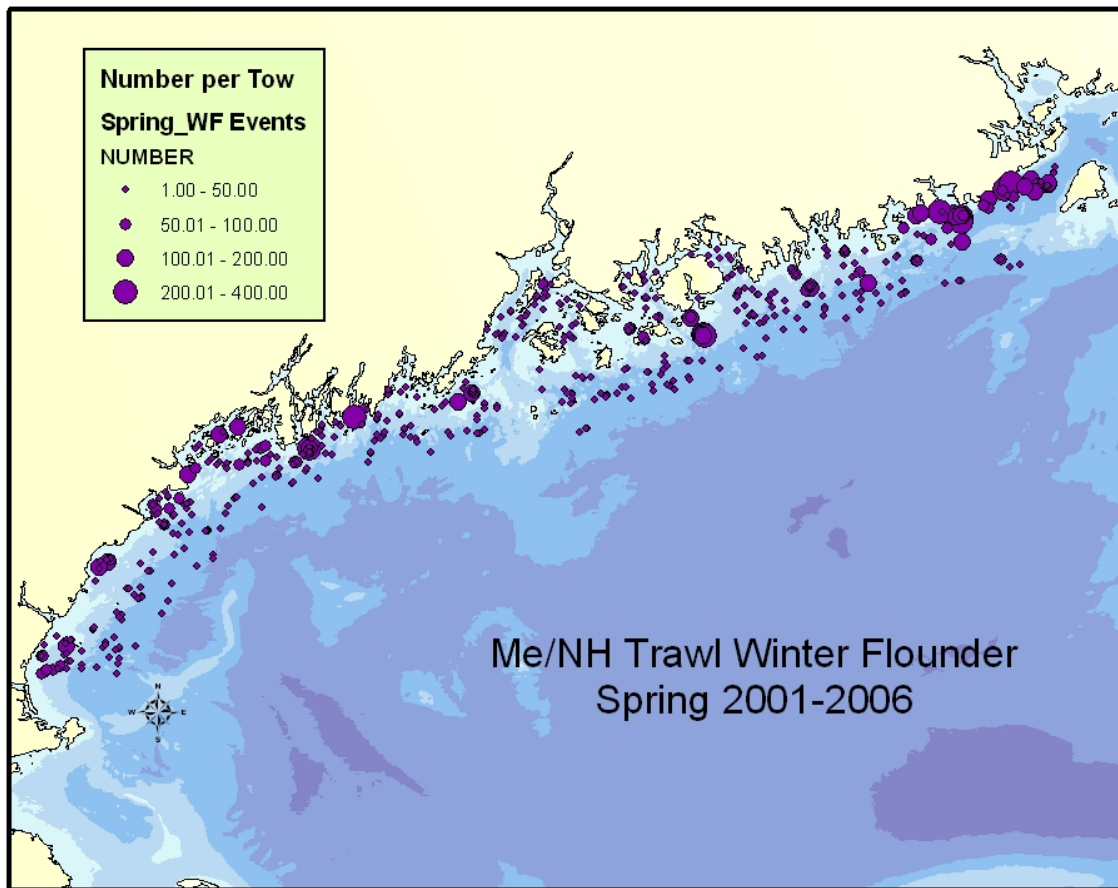


Figure I11. Spring ME/NH bottom trawl survey winter flounder distribution.

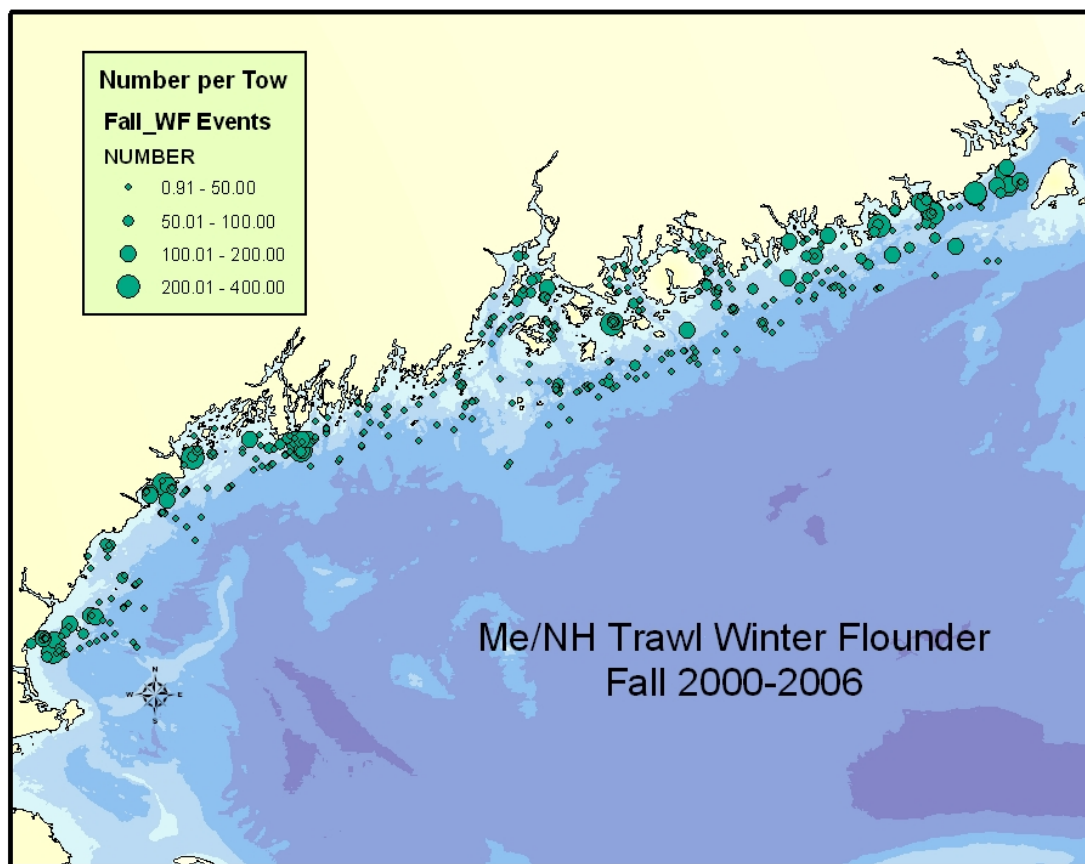


Figure I12. Fall ME/NH bottom trawl survey winter flounder distribution.

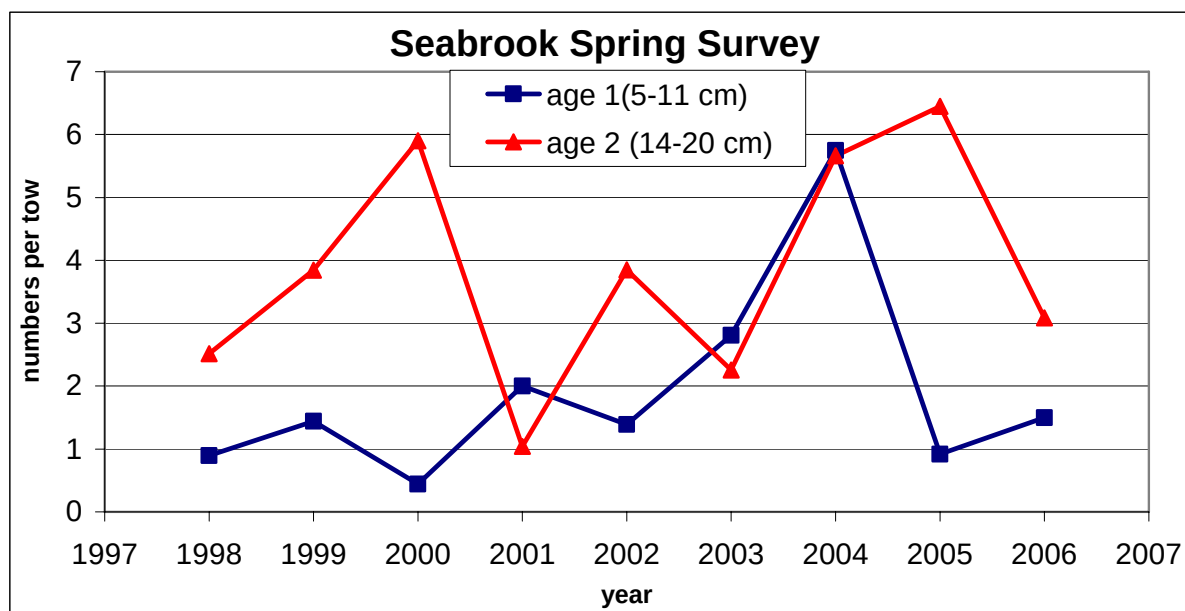


Figure I13. Estimated Seabrook age 1 and 2 index using length slicing.

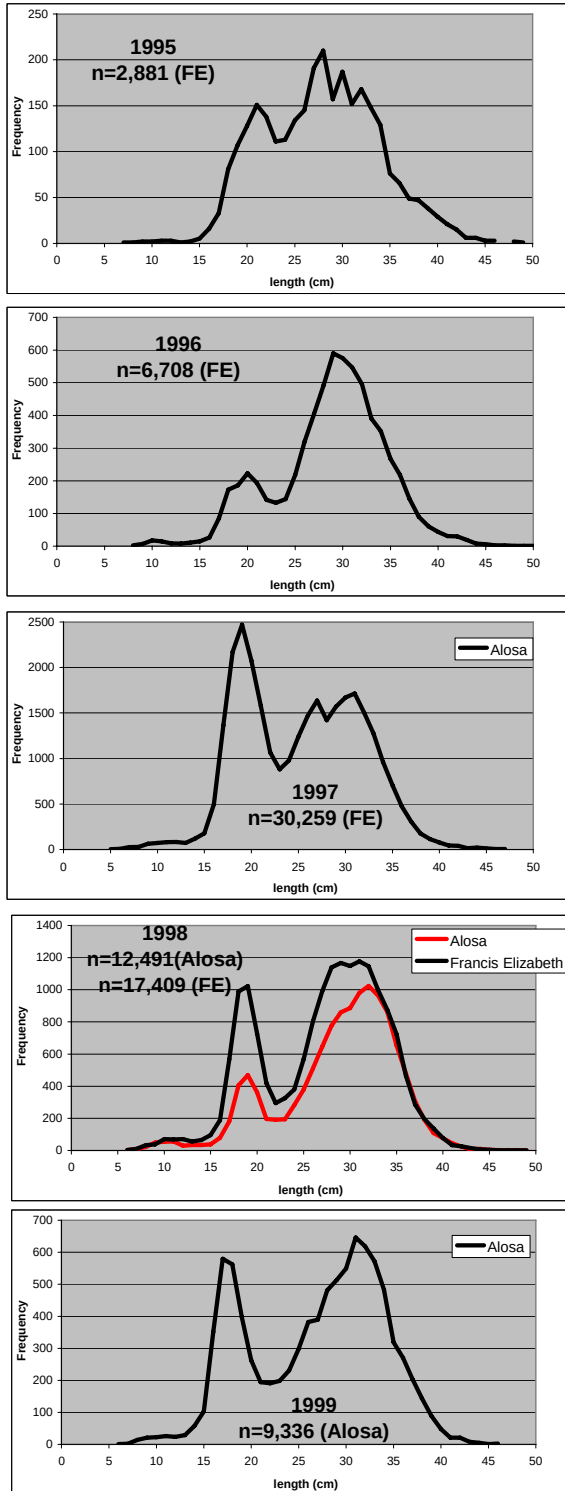


Figure I14. Length frequency distributions from the Pilgrim Nuclear power plant winter flounder area swept study in Western Cape Cod Bay. 1998 and 1999 had an additional vessel (FV Alosa) was contracted for the survey.

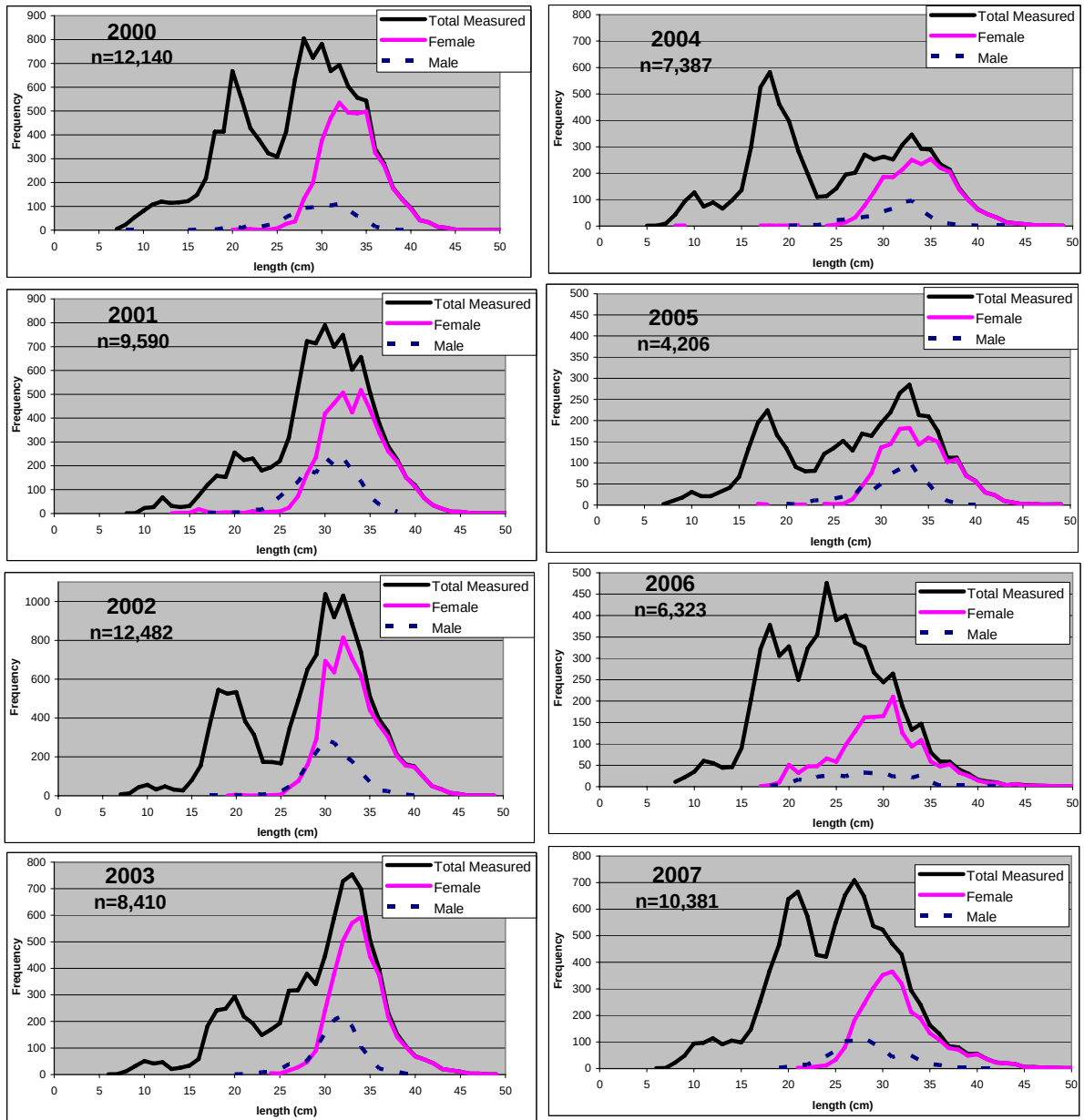


Figure I4. Cont.

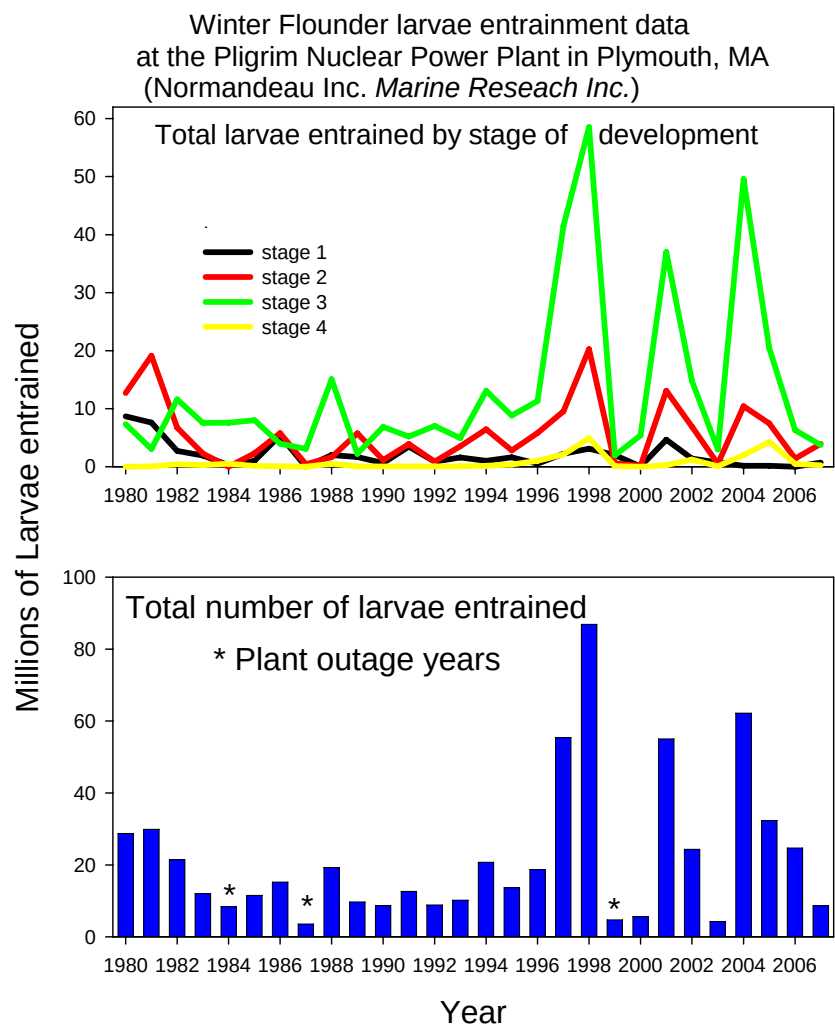


Figure I15. Entrainment of winter flounder larvae at the Pilgrim Nuclear power plant in Plymouth MA from Normandeau Inc.

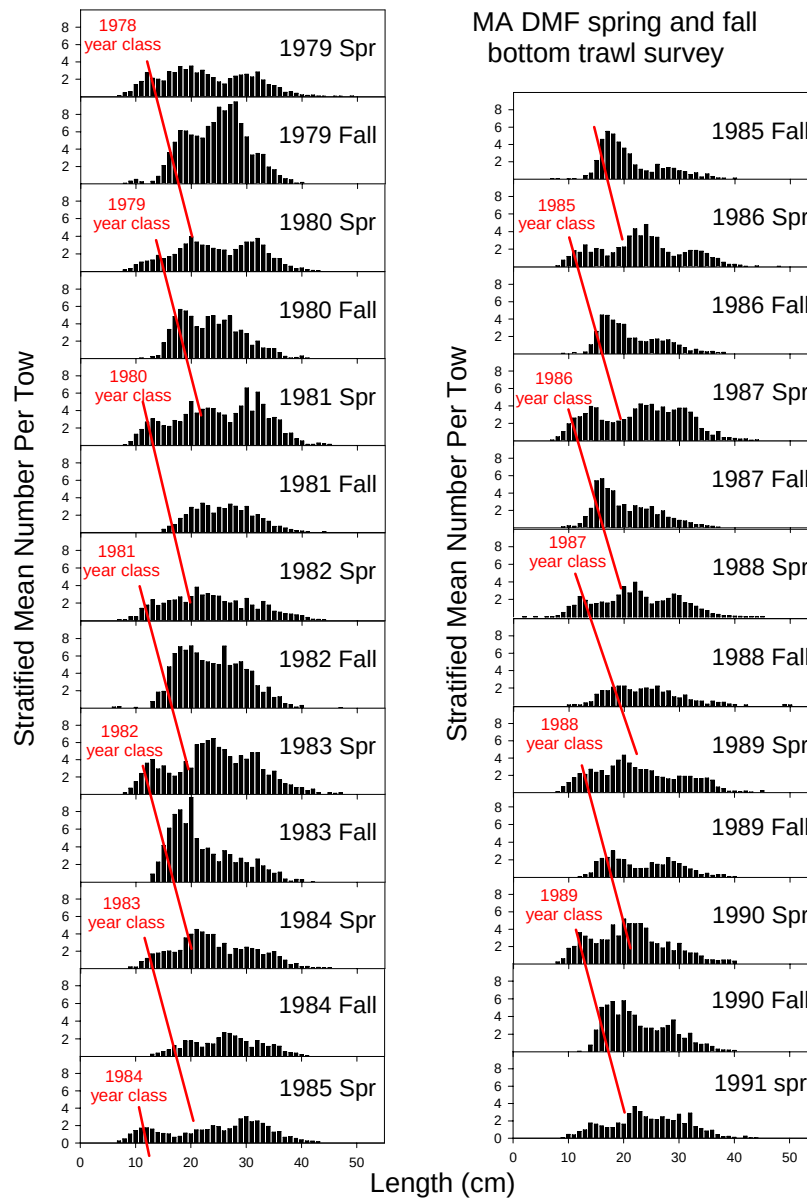


Figure I16. Spring and fall MDMF bottom trawl survey Gulf of Maine winter flounder catch per tow at length.

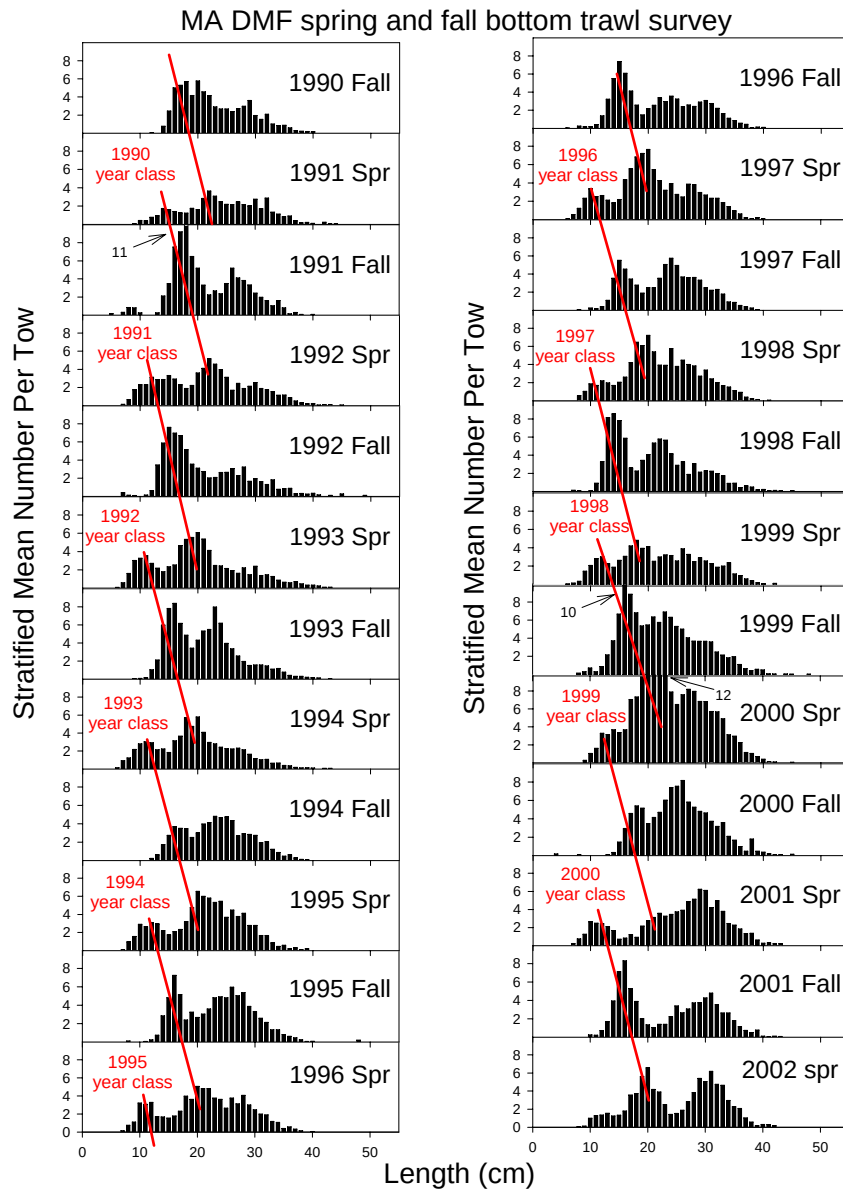


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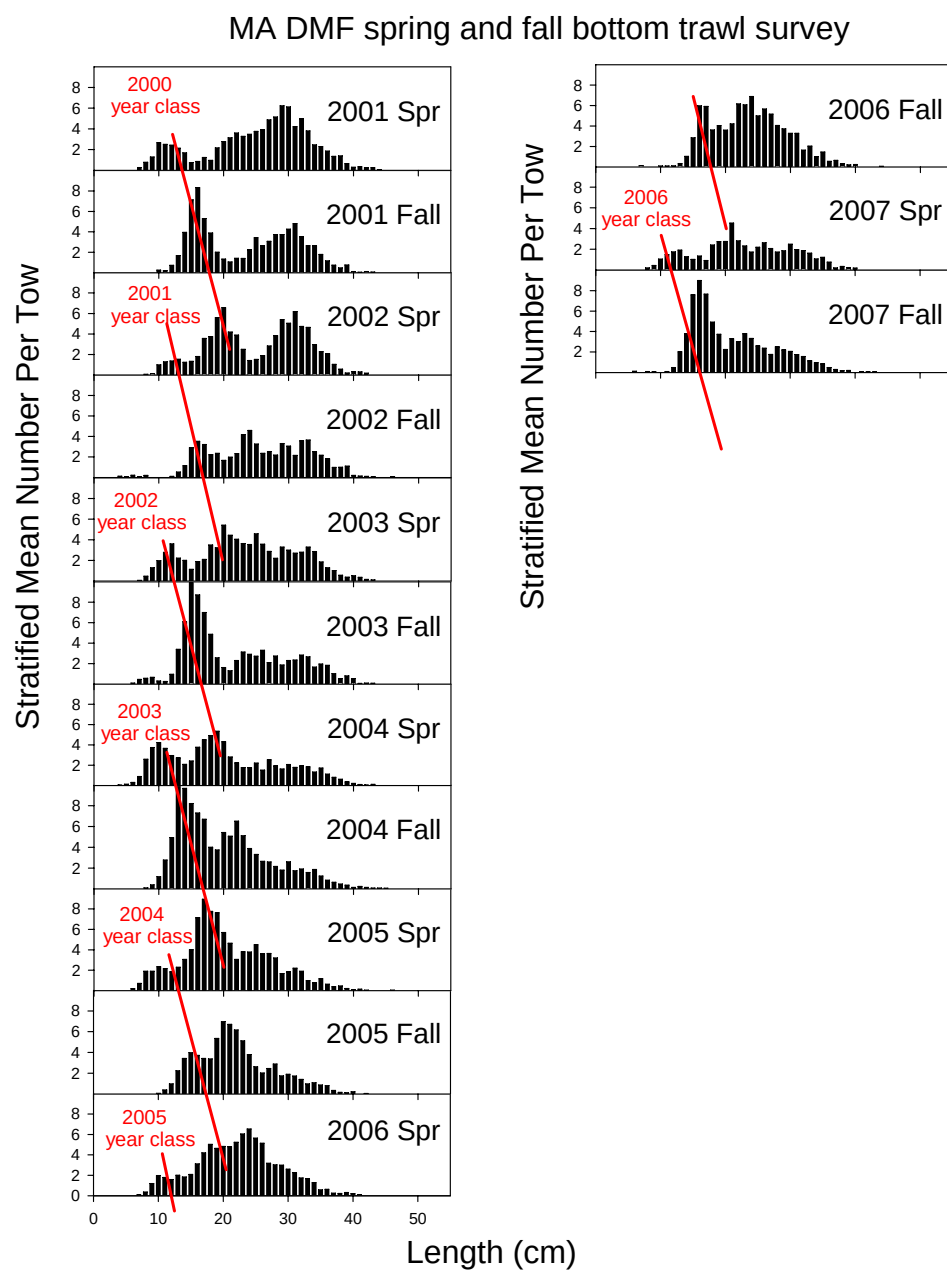


Figure I16. Cont.

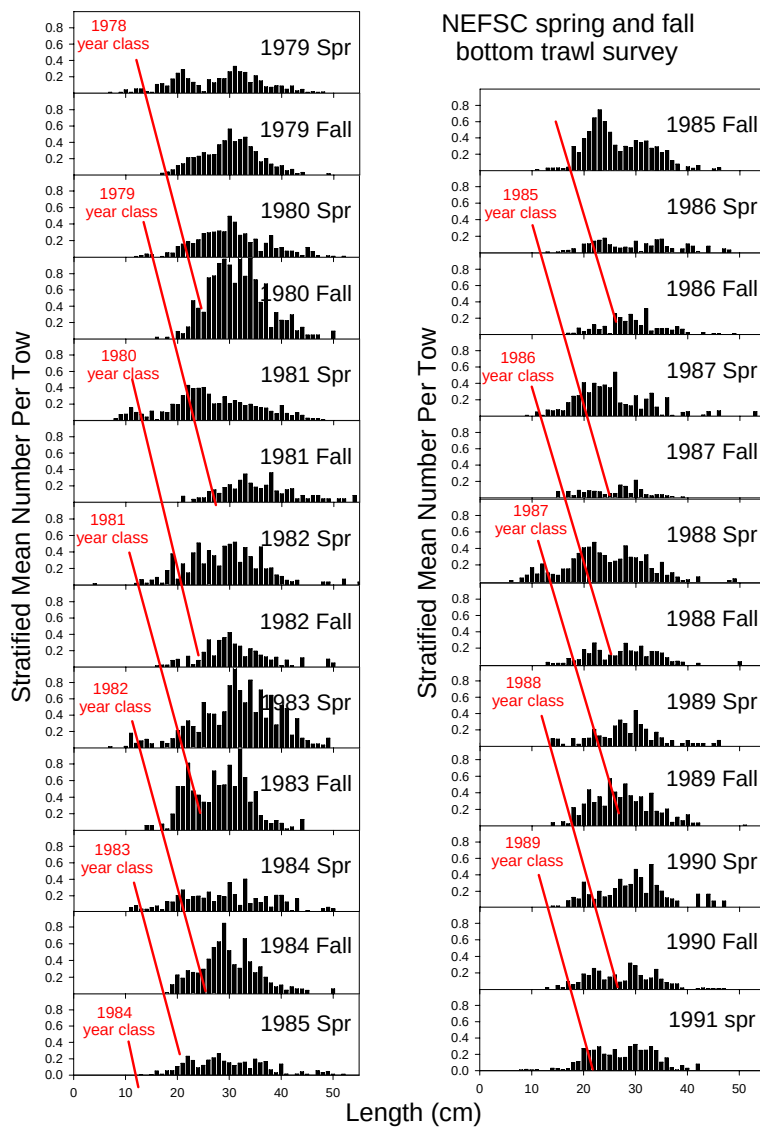


Figure I17. Spring and fall NEFSC bottom trawl survey Gulf of Maine winter flounder catch per tow at length.

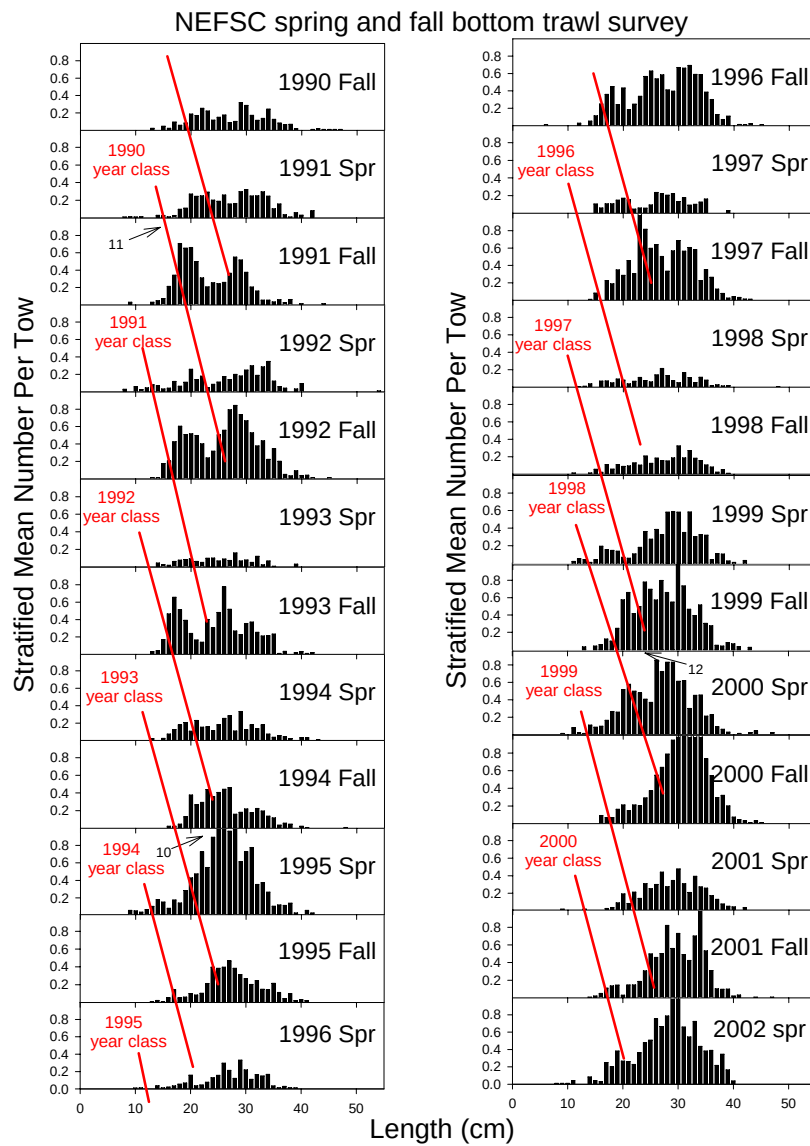


Figure I17. Cont.

NEFSC spring and fall bottom trawl survey

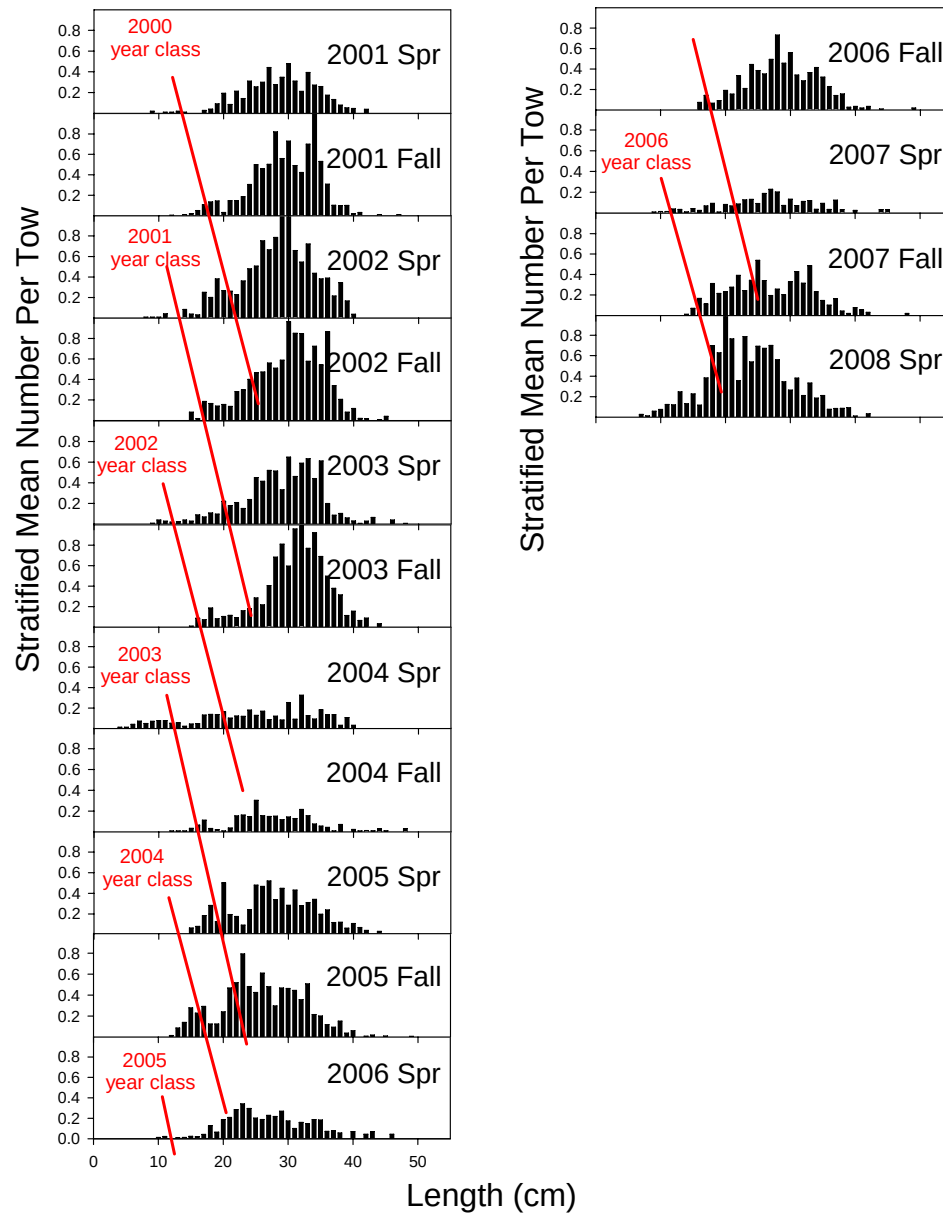


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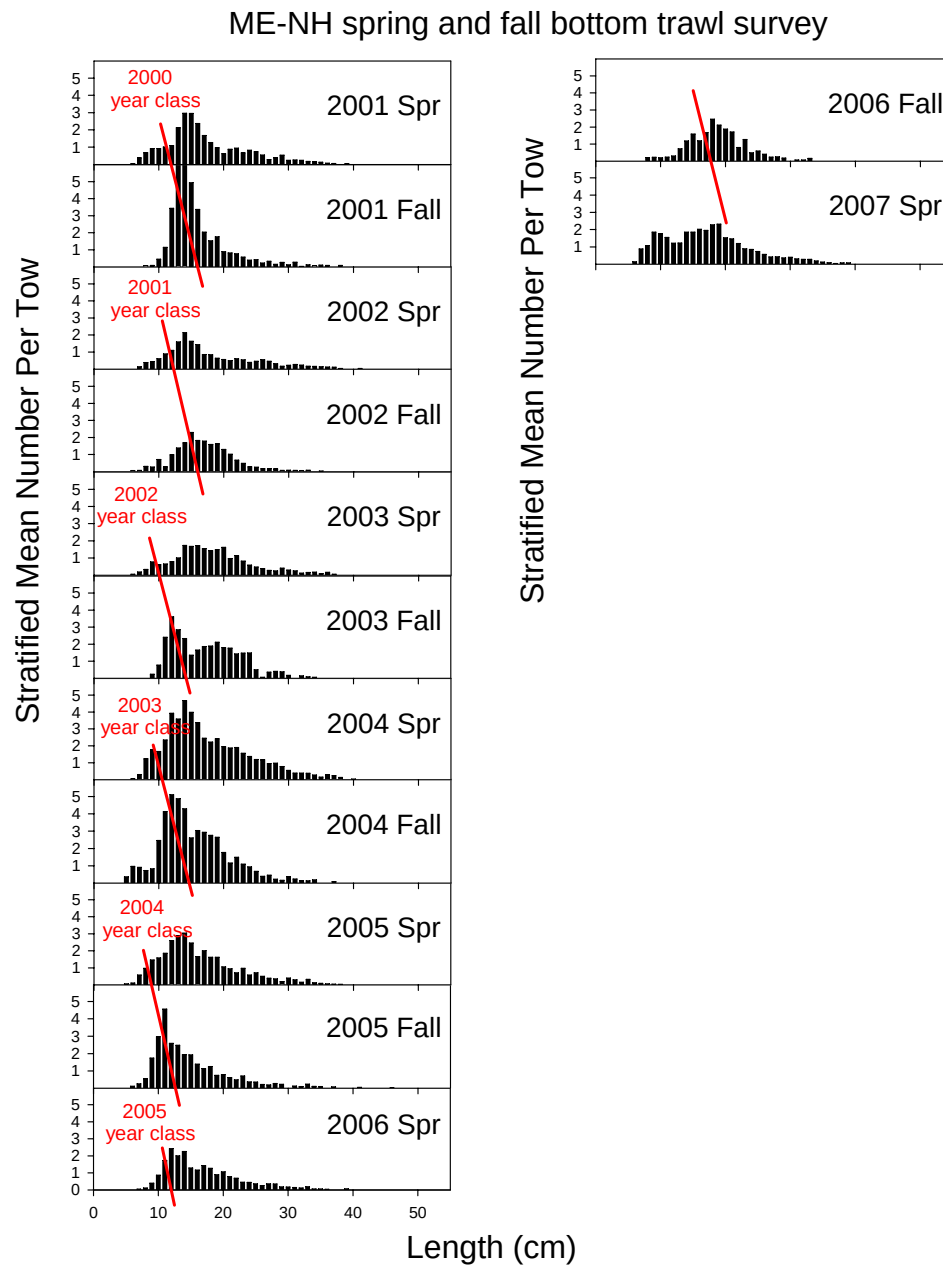


Figure I18. Spring and fall ME/NH bottom trawl survey Gulf of Maine winter flounder catch per tow at length.

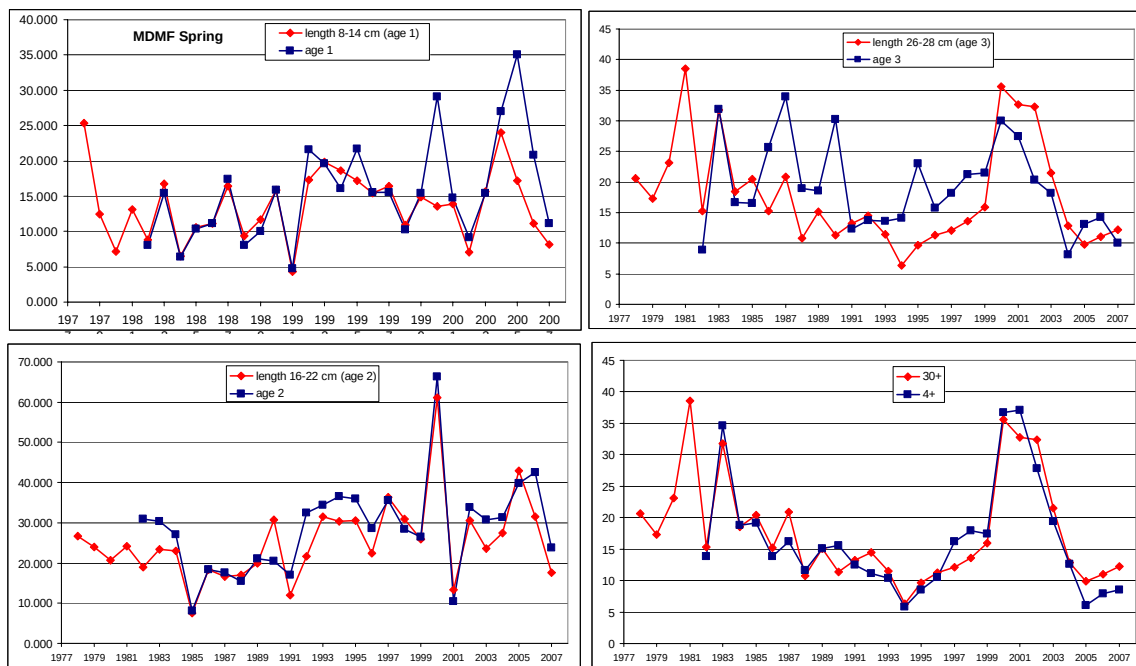


Figure I19. MDMF spring comparison of indices at age with the estimated index at age from slicing of length modes from the catch per tow at length distributions.

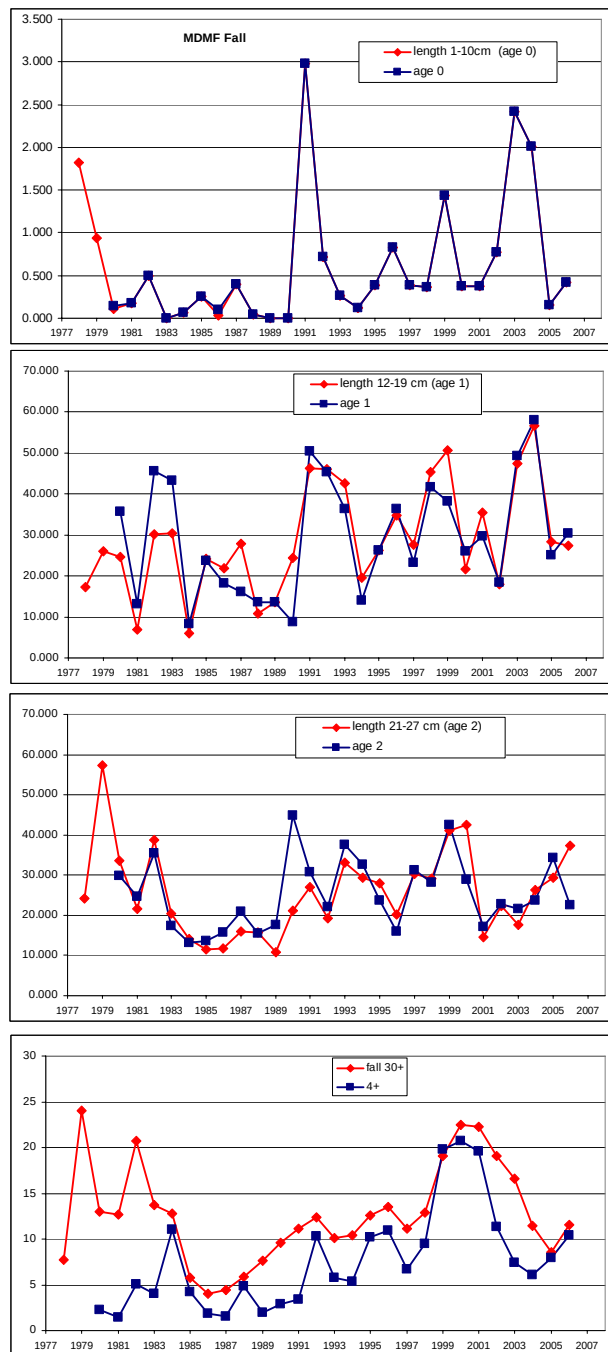


Figure I20. MDMF fall comparison of indices at age with the estimated index at age from slicing of length modes from the catch per tow at length distribution.

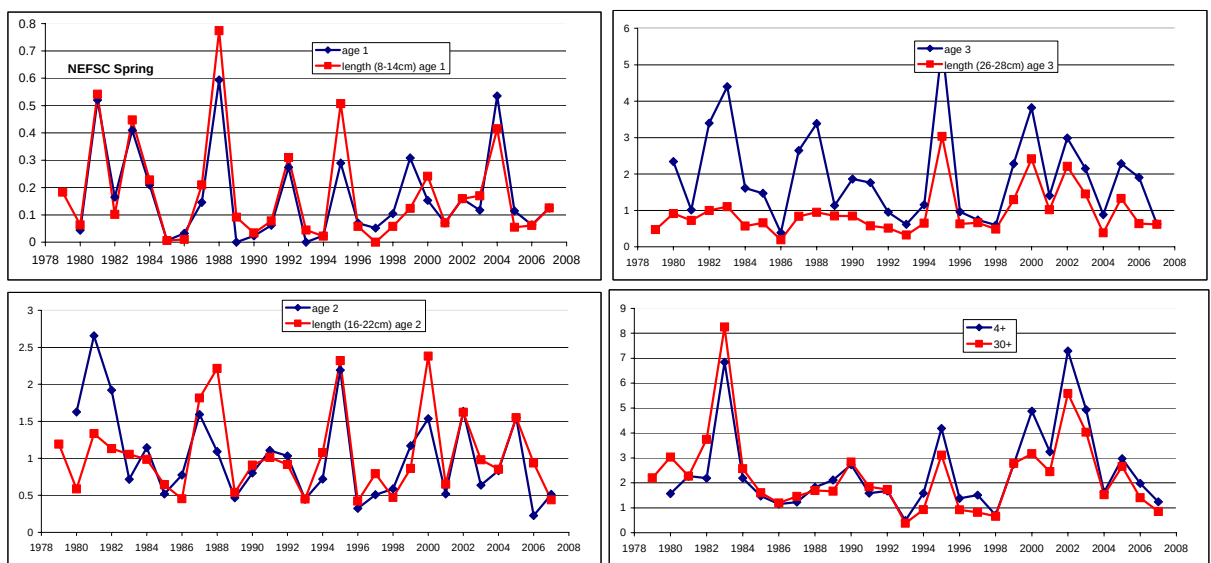


Figure I21. NEFSC spring comparison of indices at age with the estimated index at age from slicing of length modes from the catch per tow at length distribution.

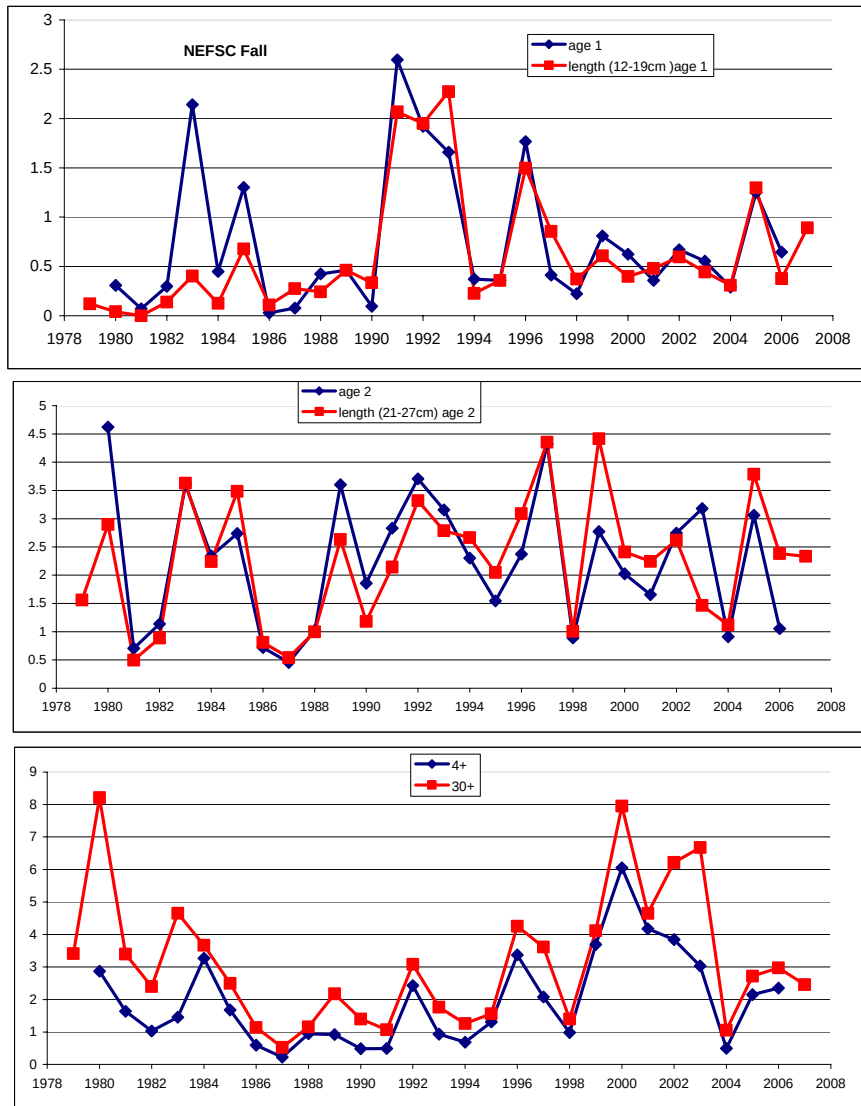


Figure I22. NEFSC fall Spring comparison of indices at age with the estimated index at age from slicing of length modes from the catch per tow at length distribution.

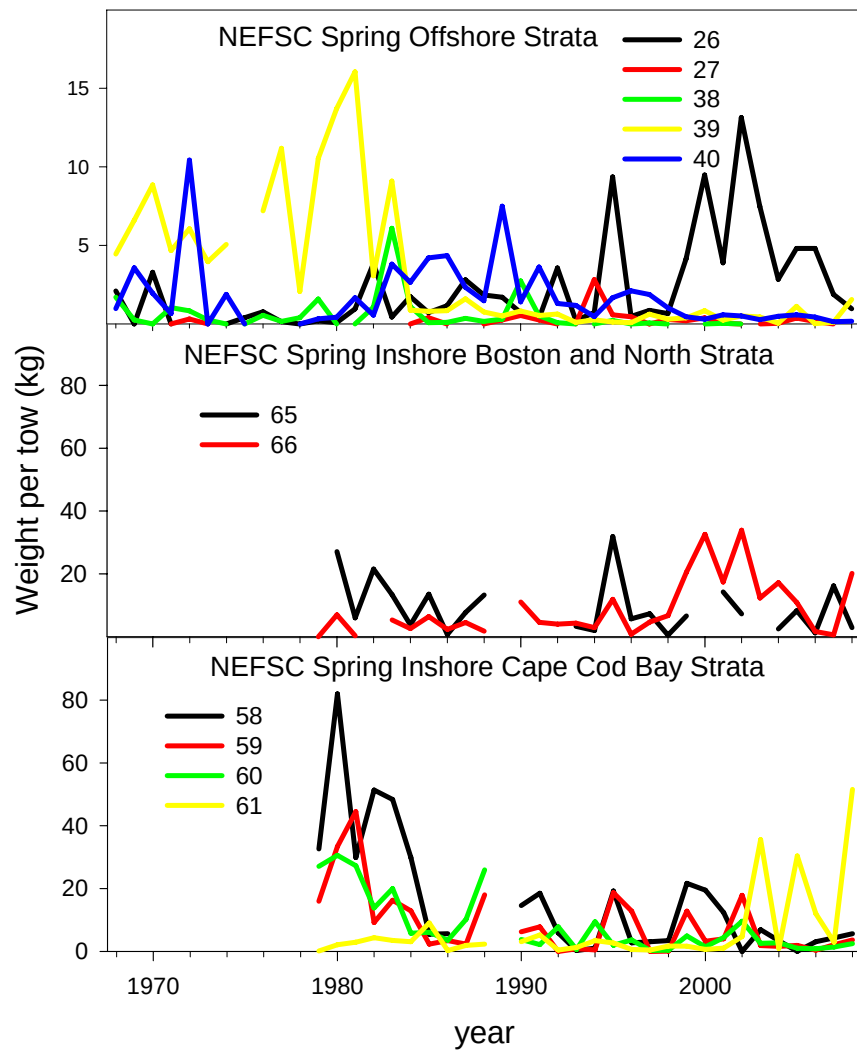


Figure I23. NEFSC spring weight per tow by strata.

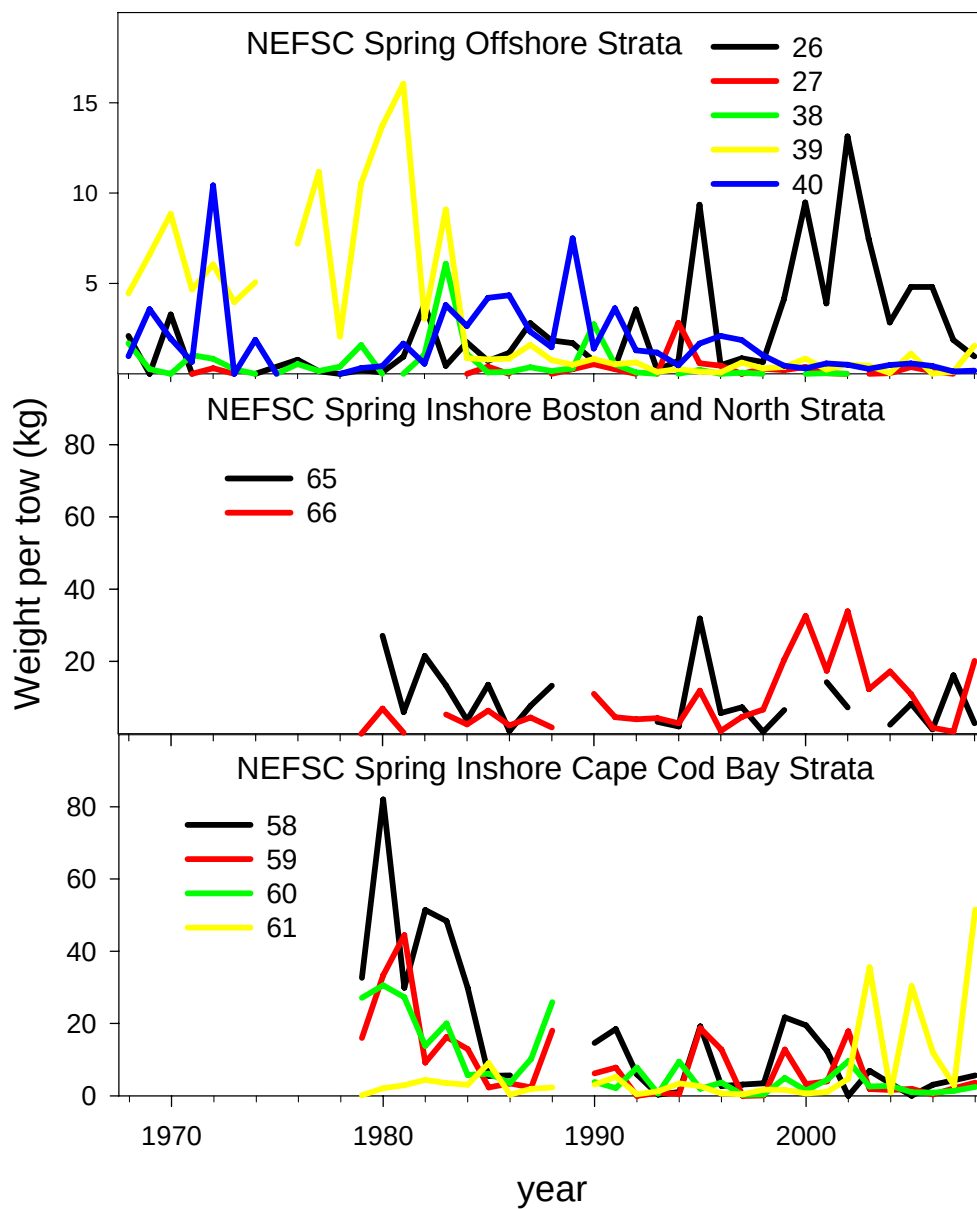


Figure I24. NEFSC fall weight per tow by strata.

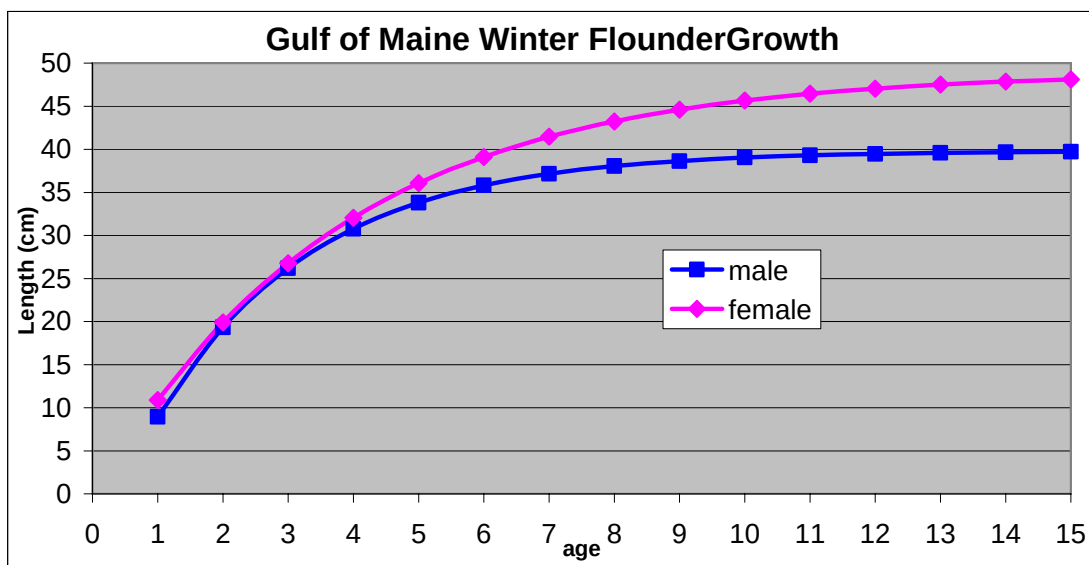


Figure I25. Von Bertalanffy growth curves by sex from Witherell and Burnett (1993).

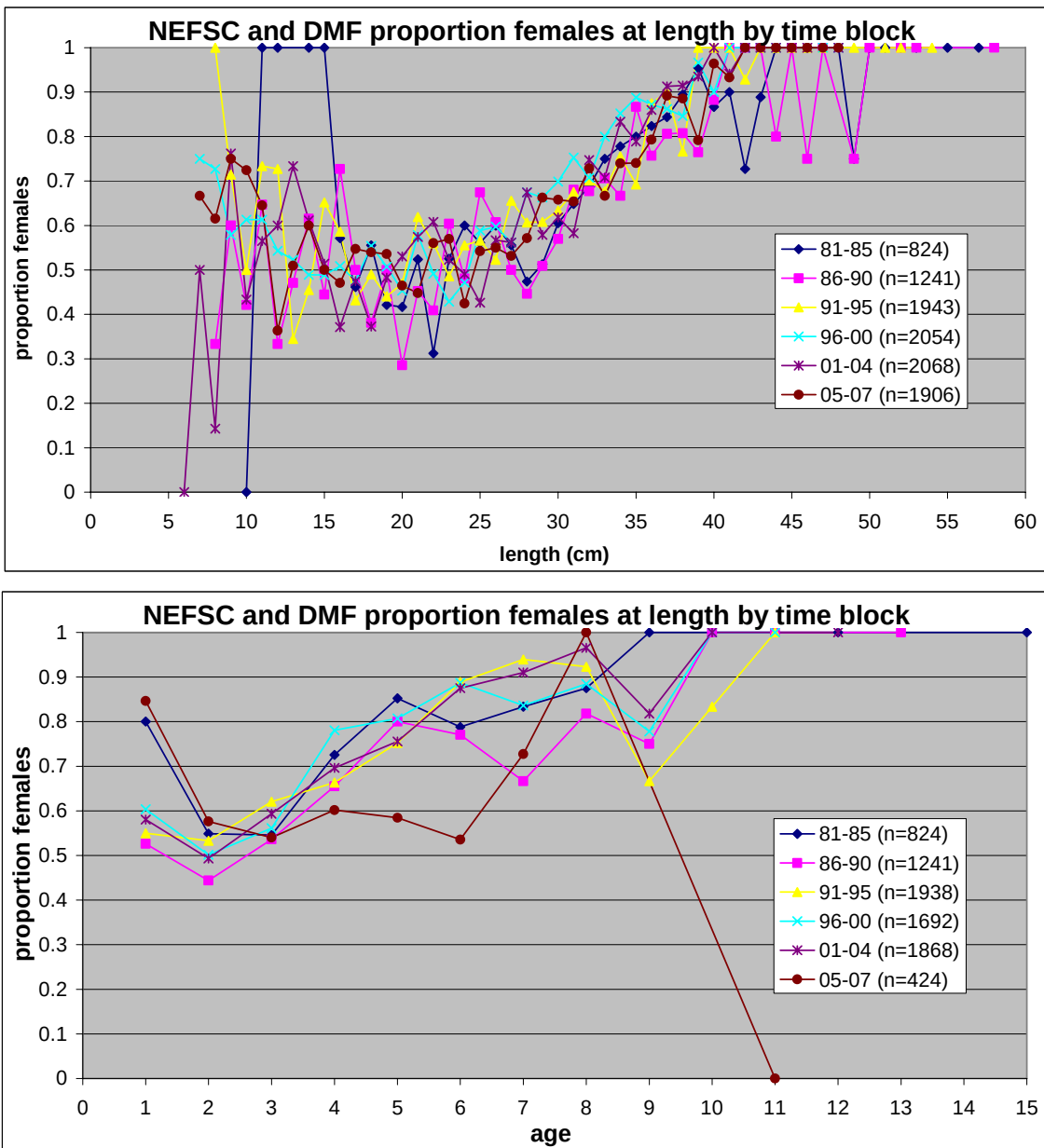


Figure I26. Proportion female by time block in the NEFSC and MDMF survey sample data.

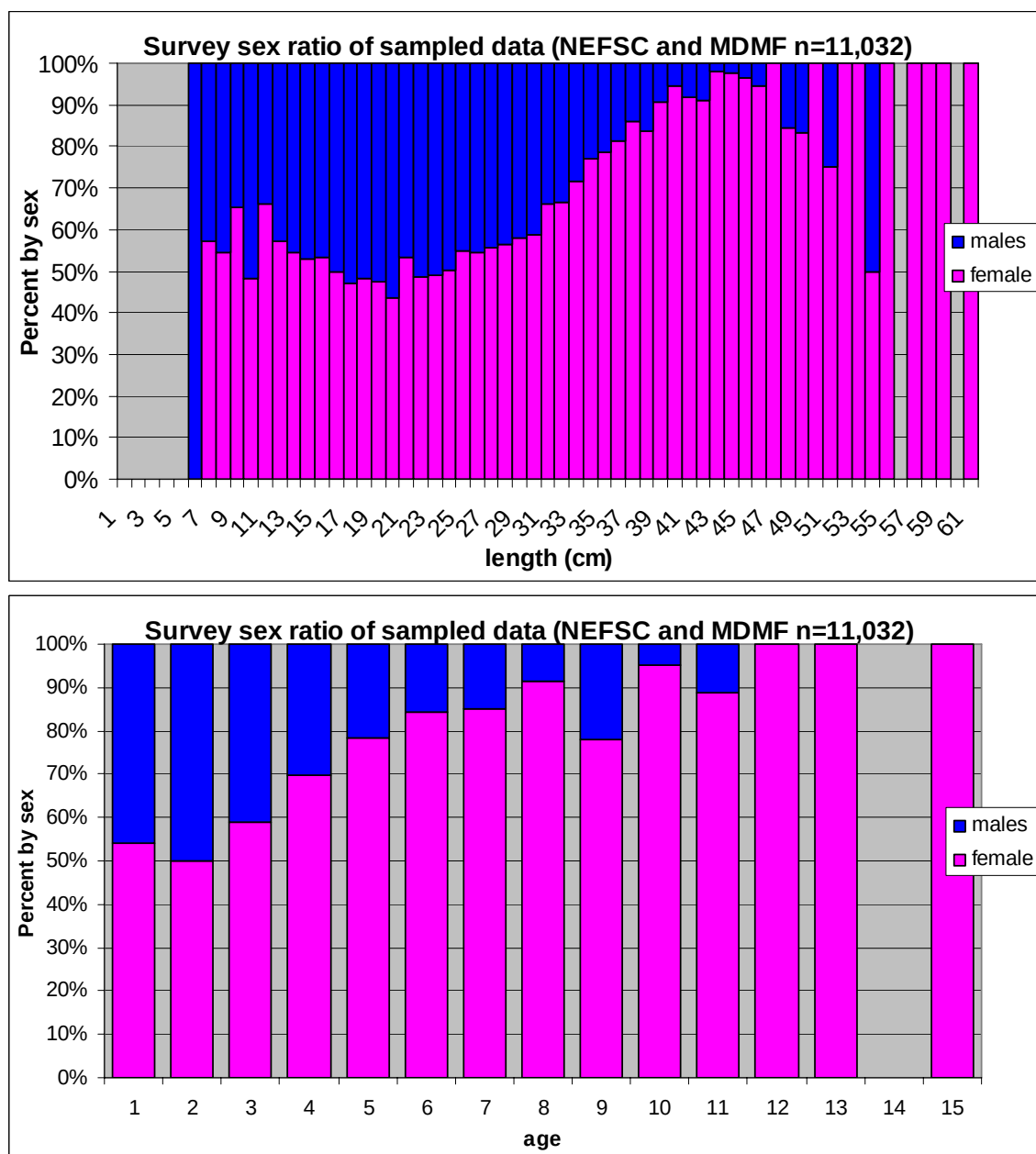


Figure I27. Sex ratio at length and age in the NEFSC and MDMF survey sample data with all year combined (1982-2007).

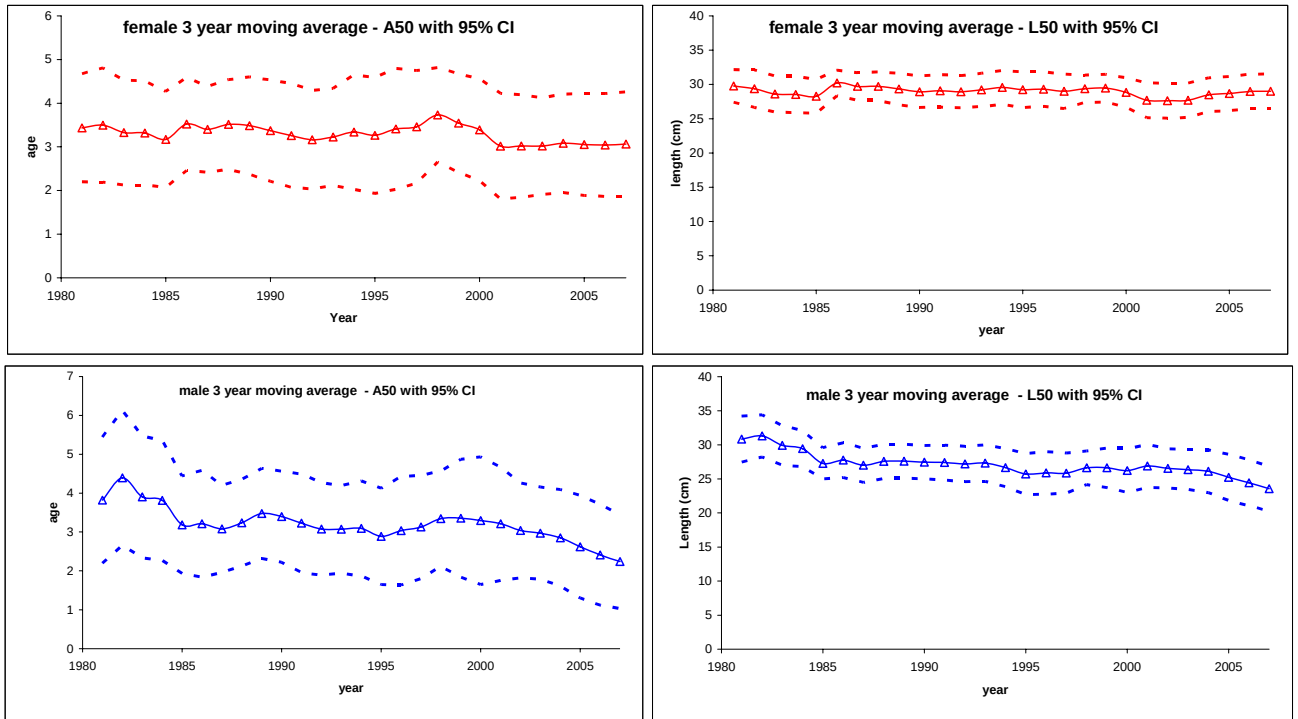


Figure I28. Gulf of Maine winter flounder female and male three year moving average of the A50 and L50 from the spring MDMF survey.

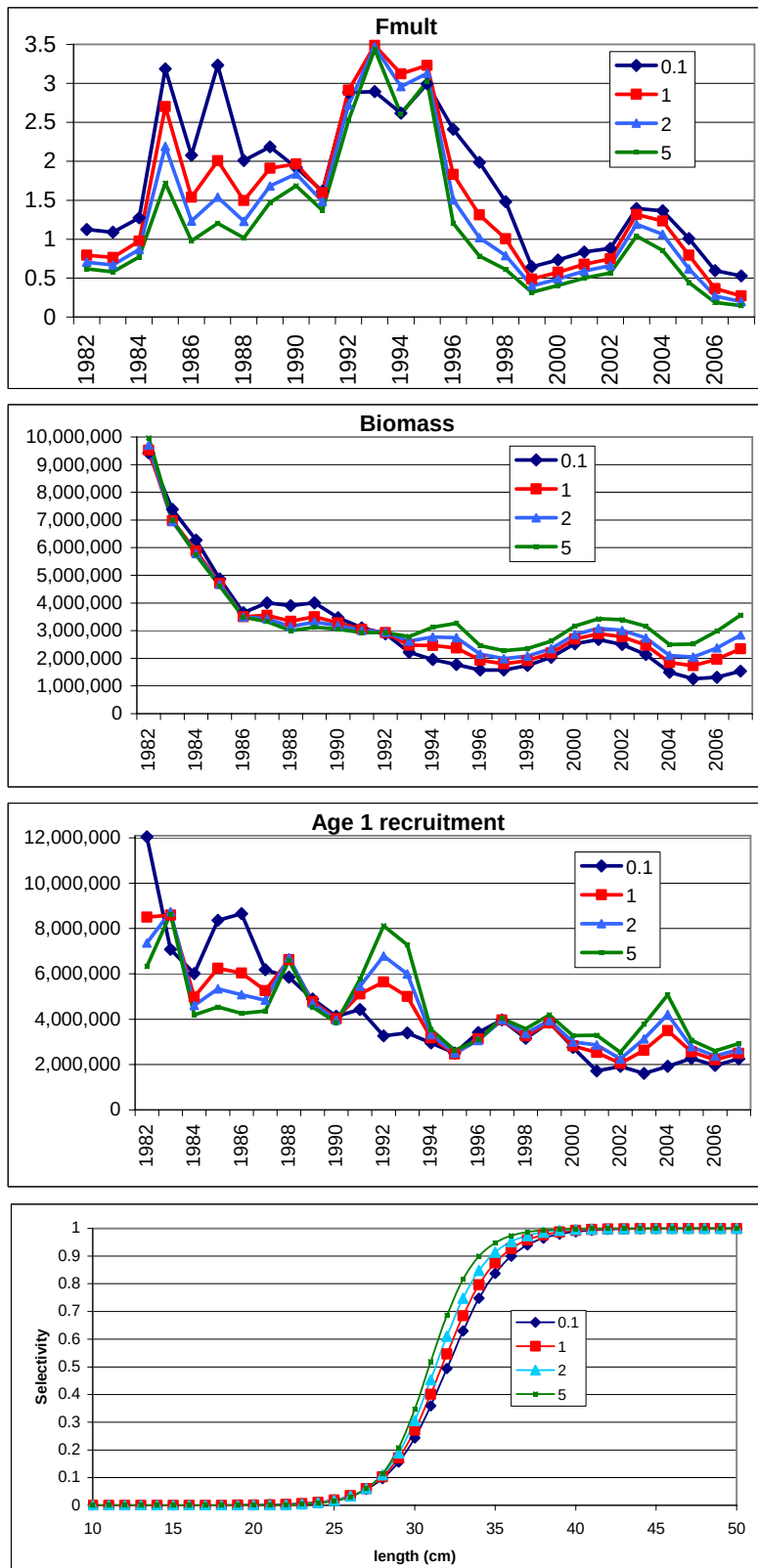


Figure I29. SCALE sensitivity to input weight on the recruitment indices.

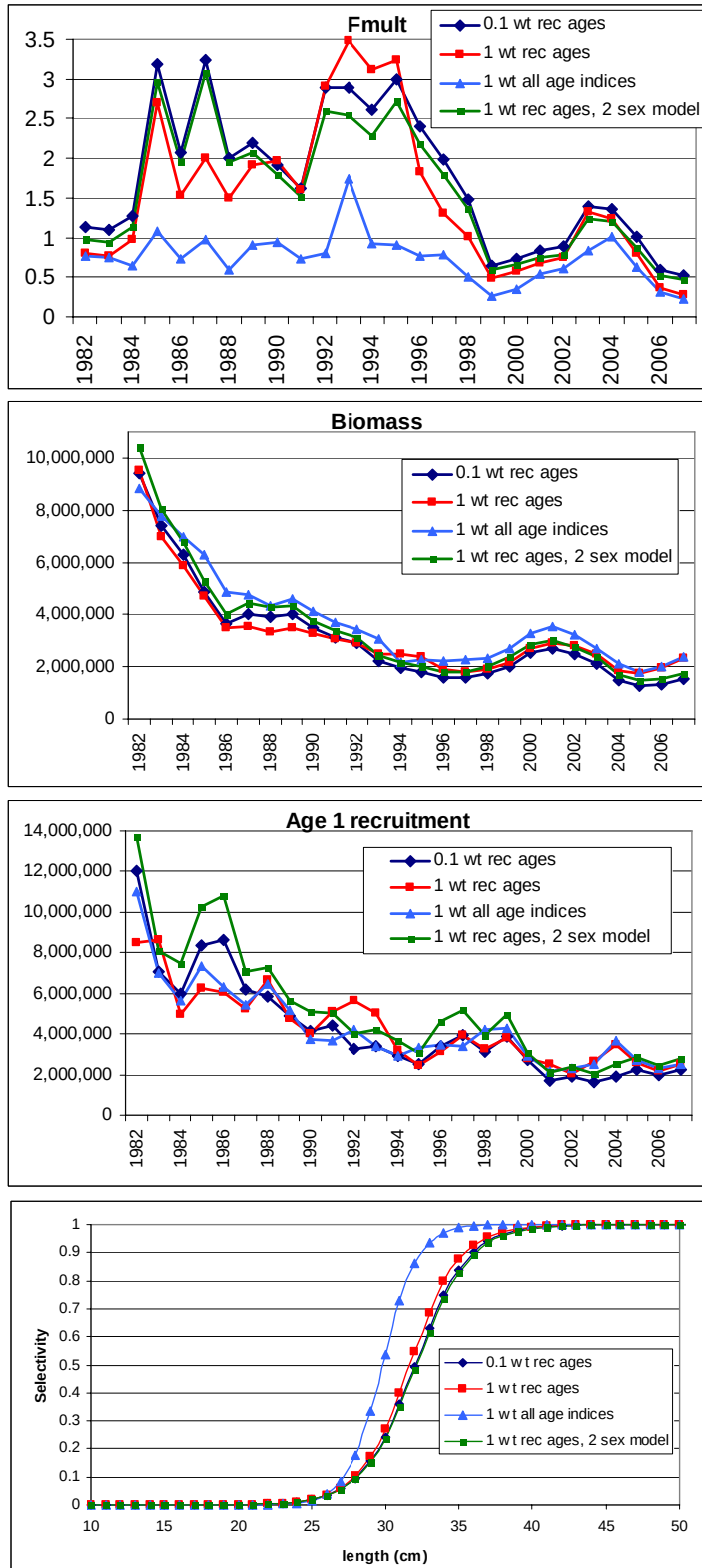


Figure I30. SCALE sensitivity to different model configurations.

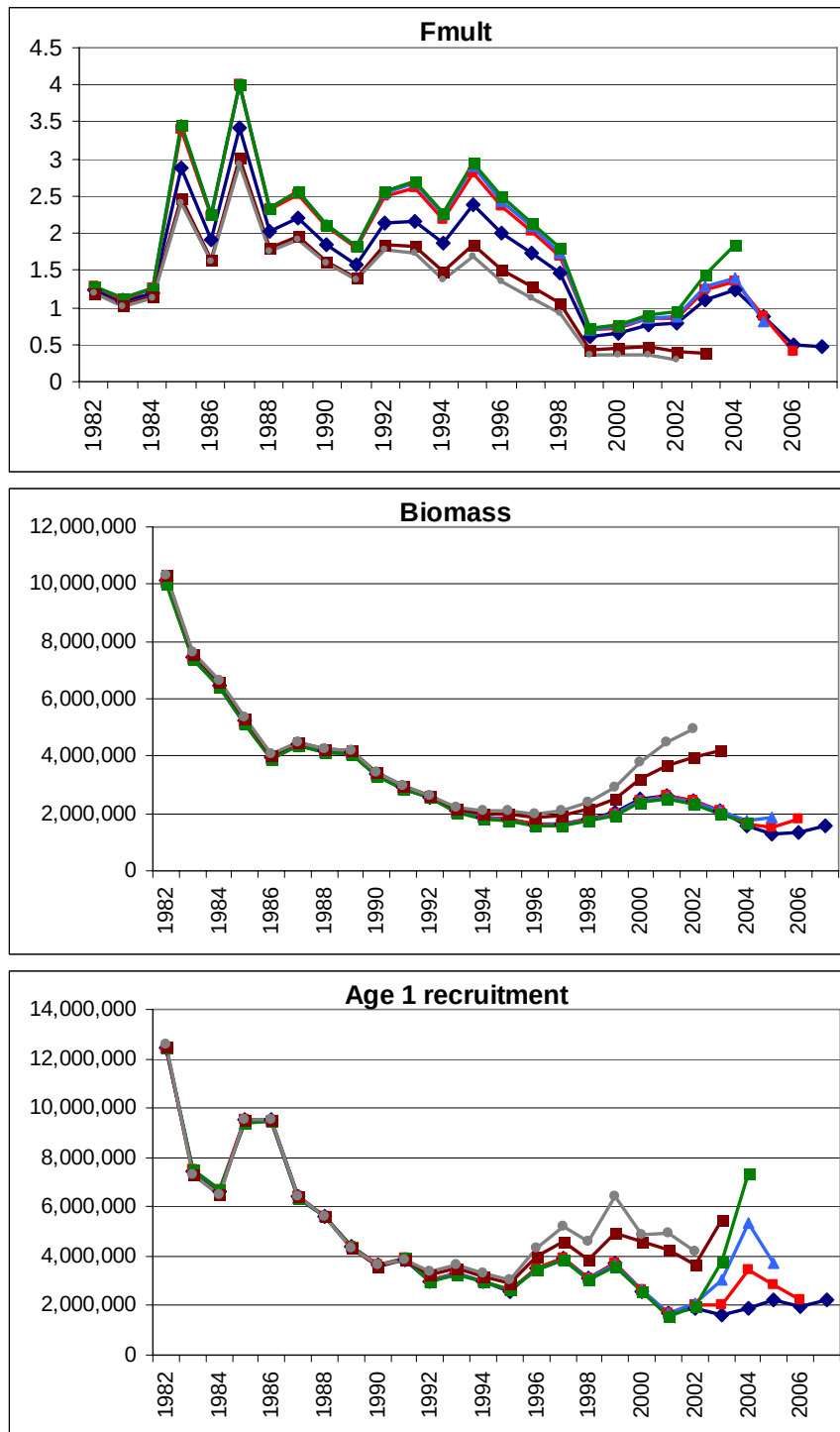


Figure I31. Gulf of Maine winter flounder split SCALE run 5 retrospective.

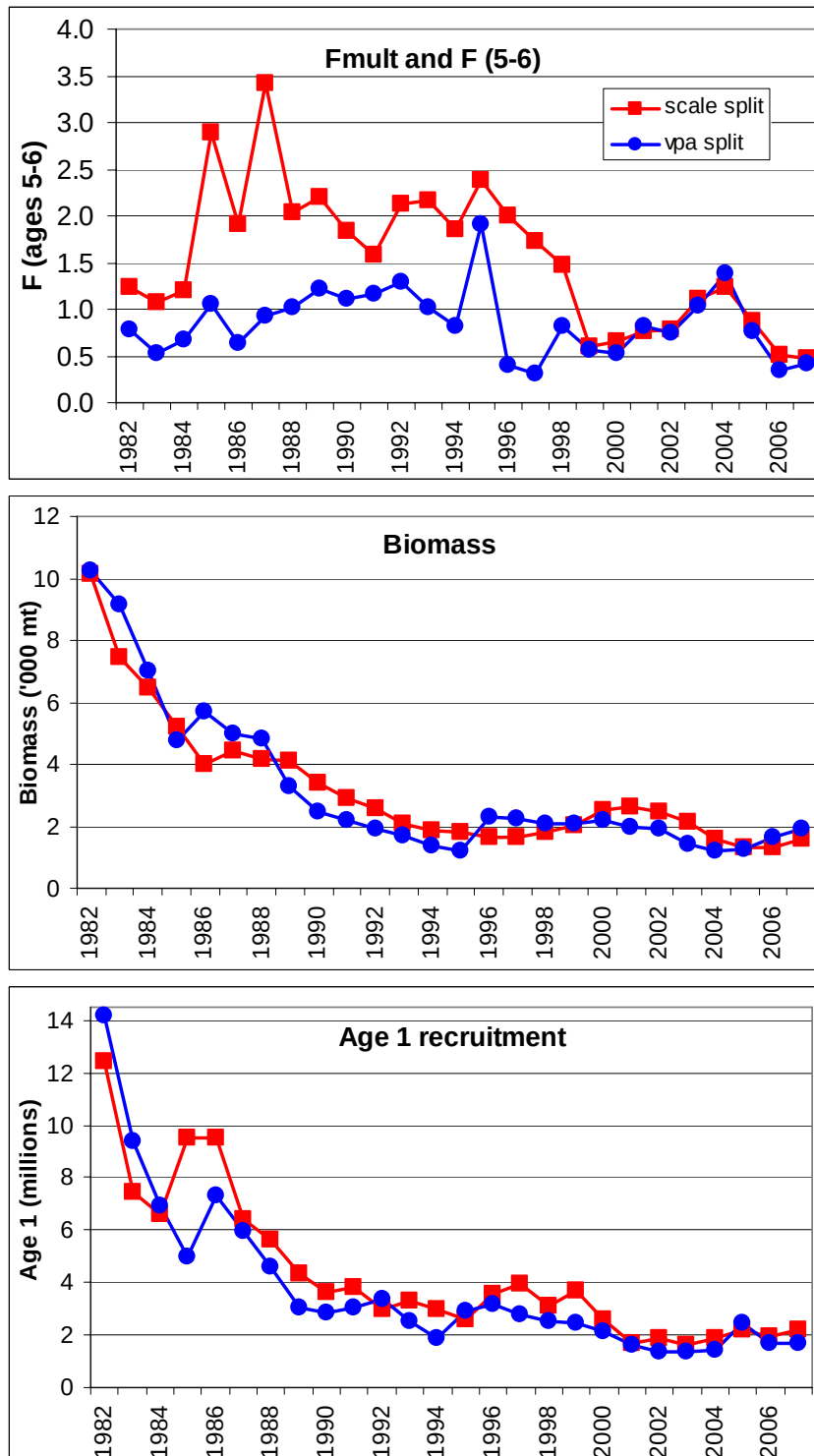


Figure I32. Comparison between the Split VPA run 2b and the split SCALE run 5.

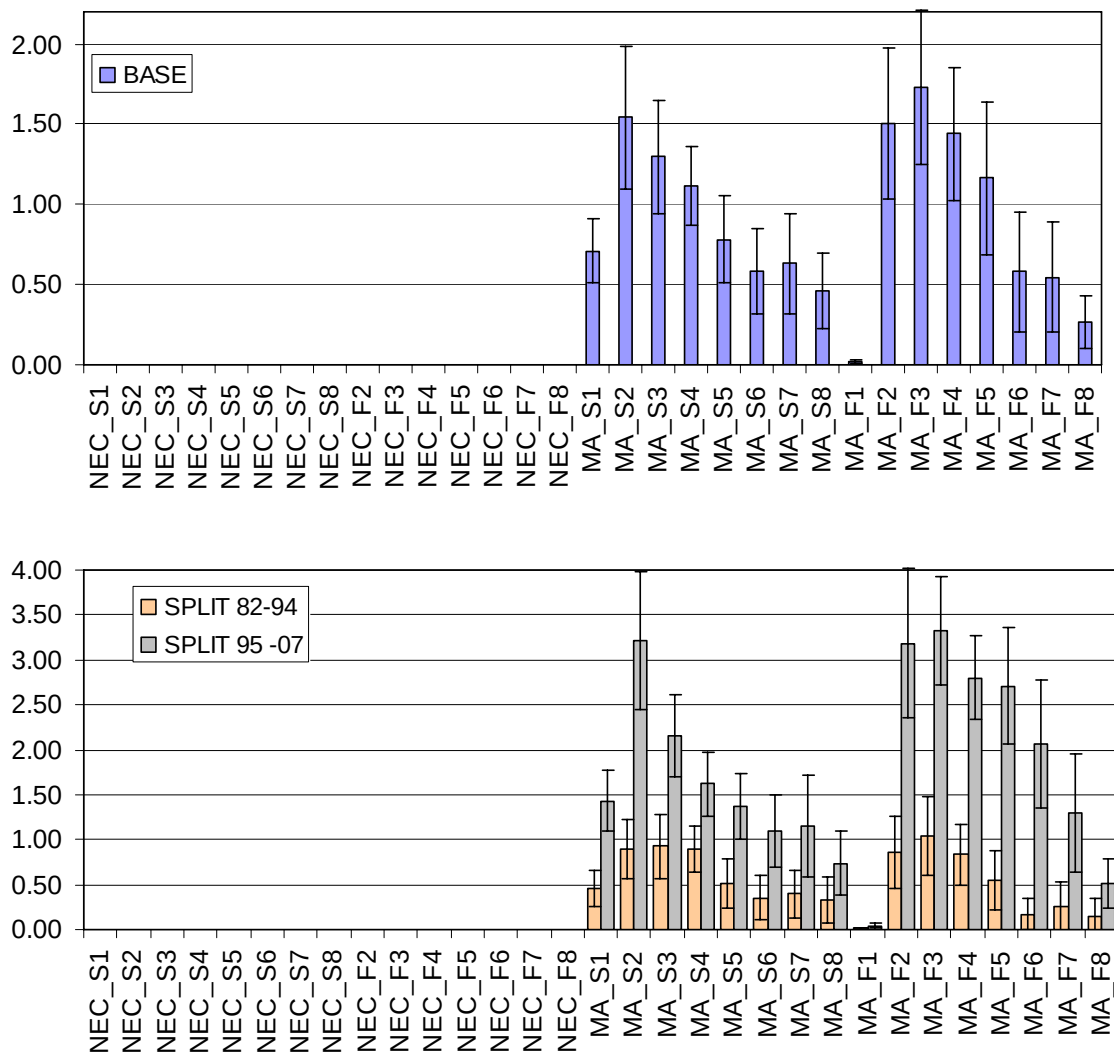


Figure I33. Gulf of Maine winter flounder Base and split VPA area swept Q estimates with standard deviations for run 5 and 6 which excludes the NEFSC surveys.

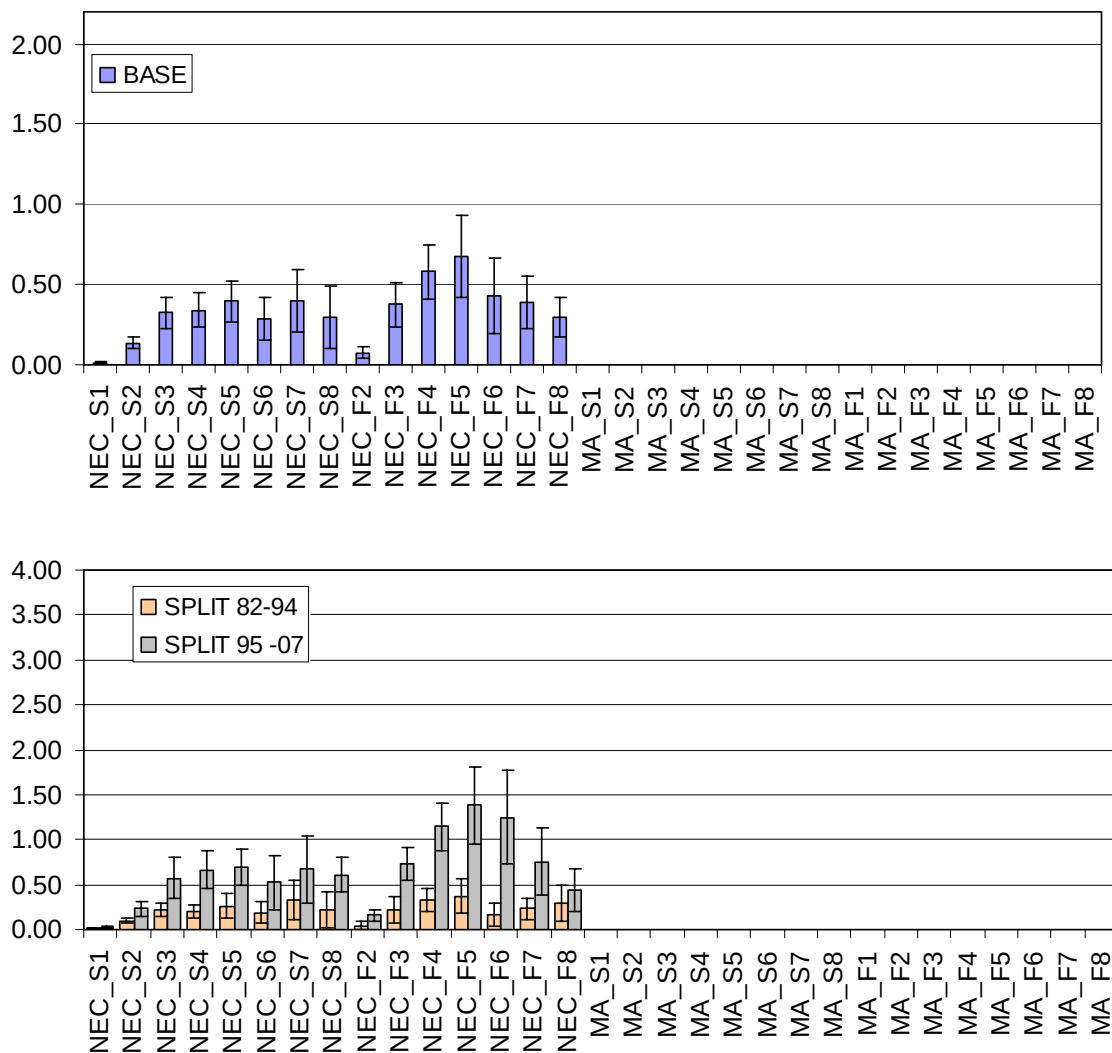


Figure I34. Gulf of Maine winter flounder Base and split VPA area swept Q estimates with standard deviations for run 7 and 8 which excludes the MDMF surveys.

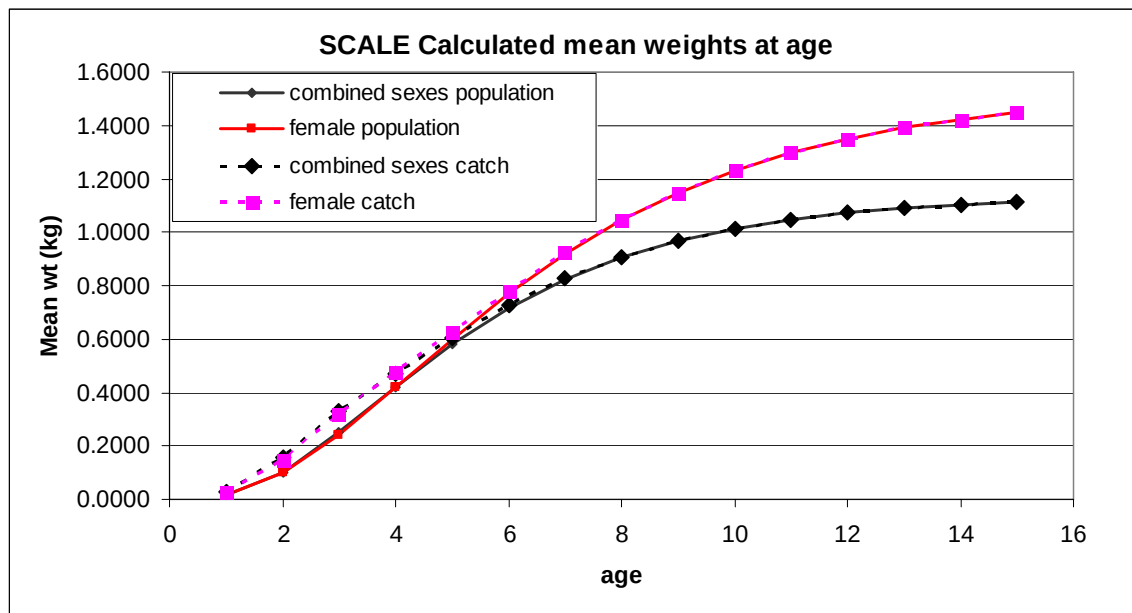


Figure I35. SCALE population and catch mean weight at age for females and for combined sexes.

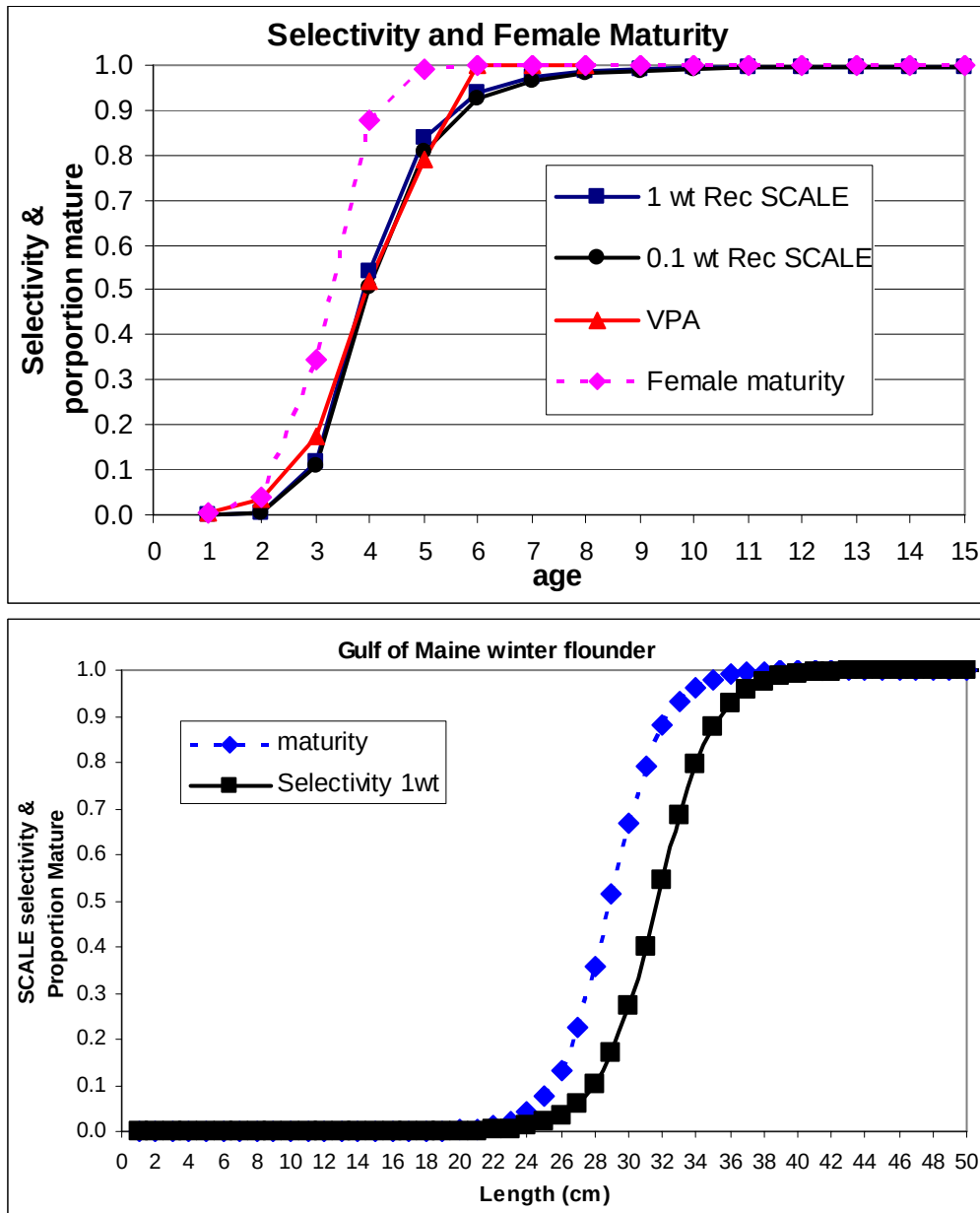


Figure I36. Comparison between estimated selectivity from the SCALE and VPA model. Maturity schedule is also shown.

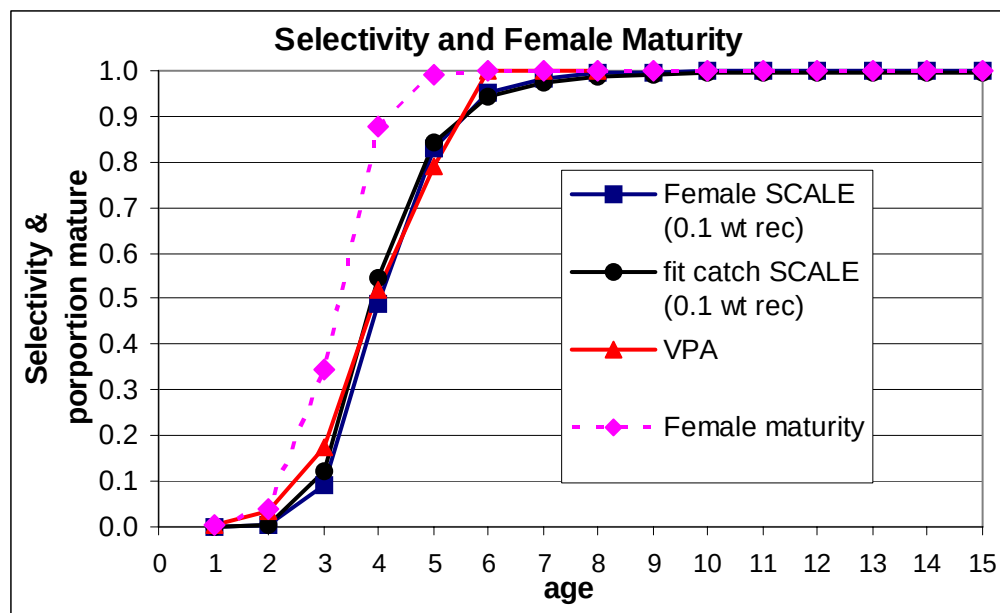


Figure I37. Comparison between estimated selectivity from the split SCALE sex specific run, sexes combined run and the split VPA model run. Maturity schedule is also shown.

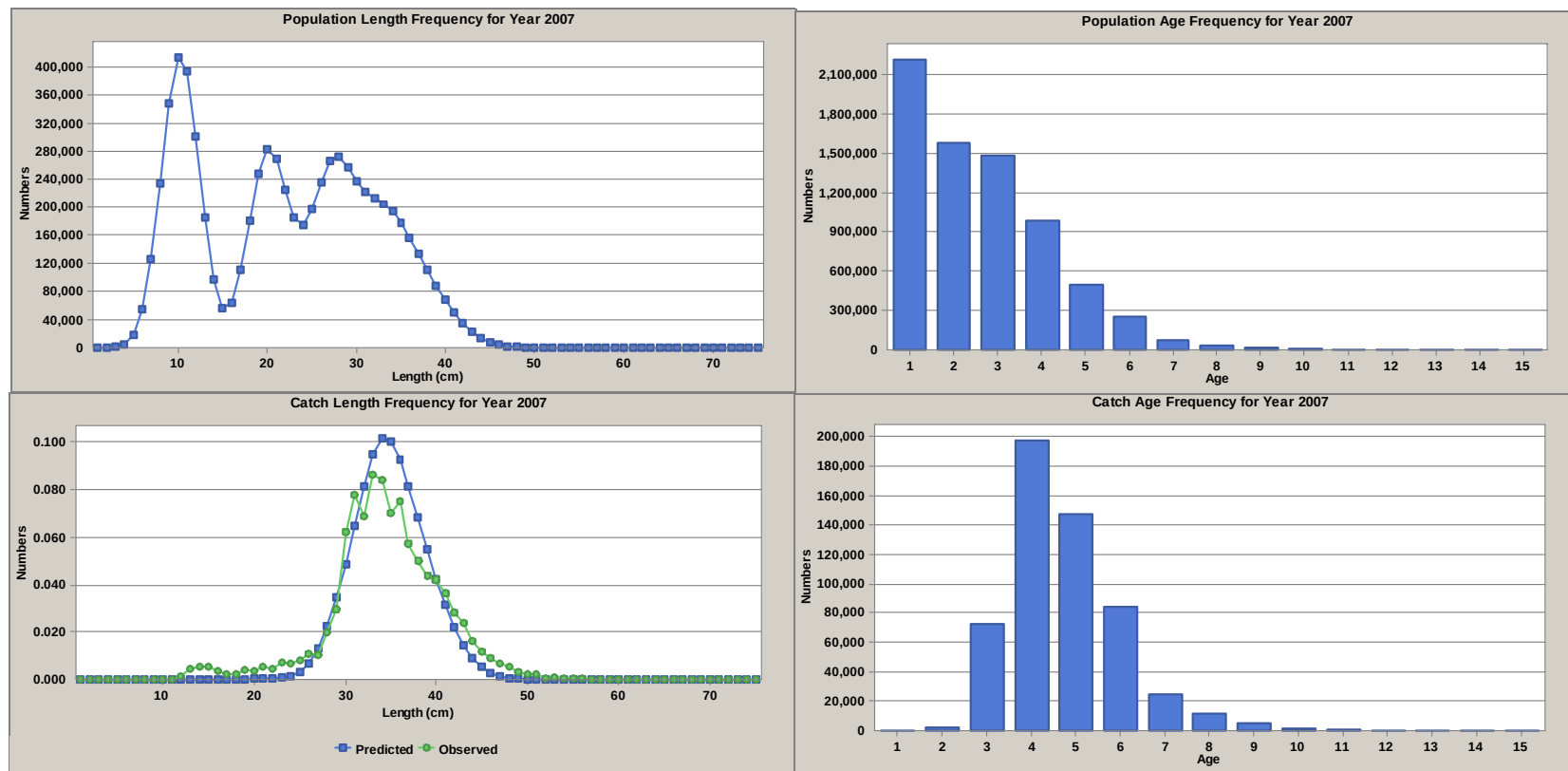


Figure I38. Split SCALE model (1982-1994, 1995-2006) population length and age frequency, predicted and observed catch length frequency and the predict age frequency in 2007 for run 5 (0.1 wt on recruitment indices and 20 wt on fitting the catch).

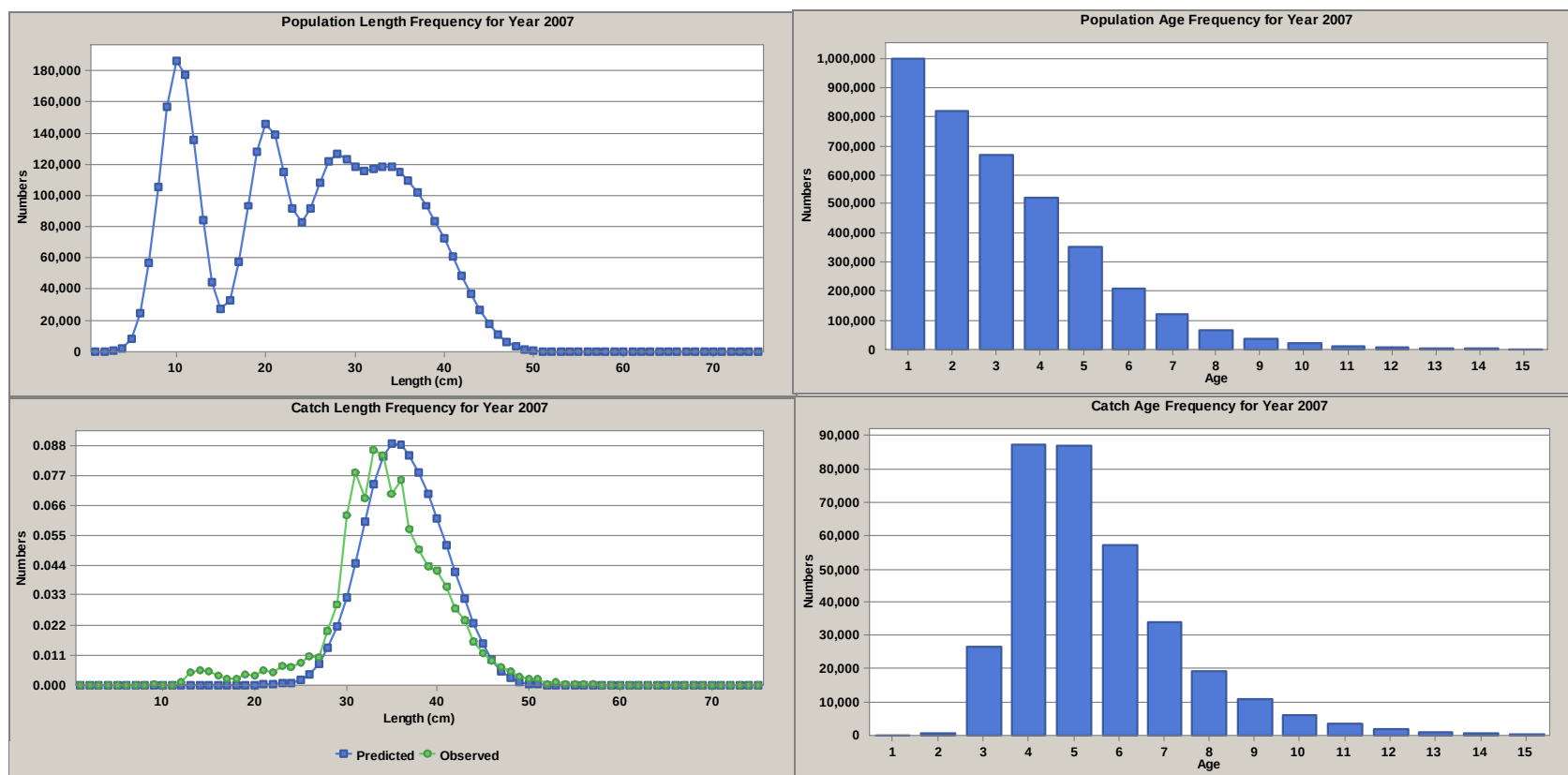


Figure I39. Split SCALE model (1982-1994, 1995-2006) predicted $F_{40} = 0.38$ population length and age frequency, predicted run 5 length frequency and observed catch length frequency at F_{40} and the predict age frequency at F_{40} .

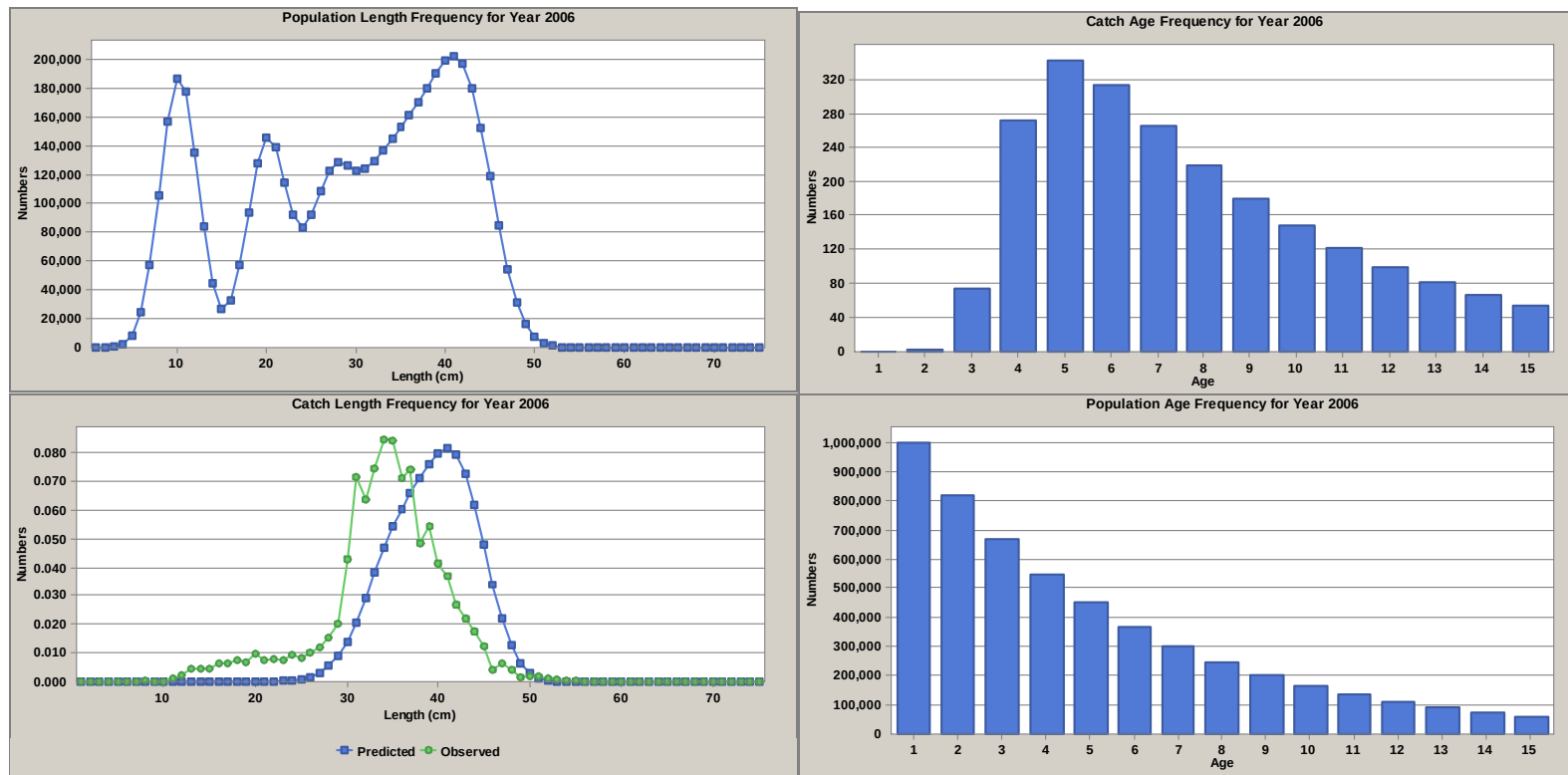


Figure I40. Split SCALE model (1982-1994, 1995-2006) predicted $F=0$ population length and age frequency, predicted run 5 length frequency and observed catch length frequency at $F=0$ and the predict age frequency at $F=0$

Appendix J. Southern New England/Mid-Atlantic winter flounder

By: Mark Terceiro

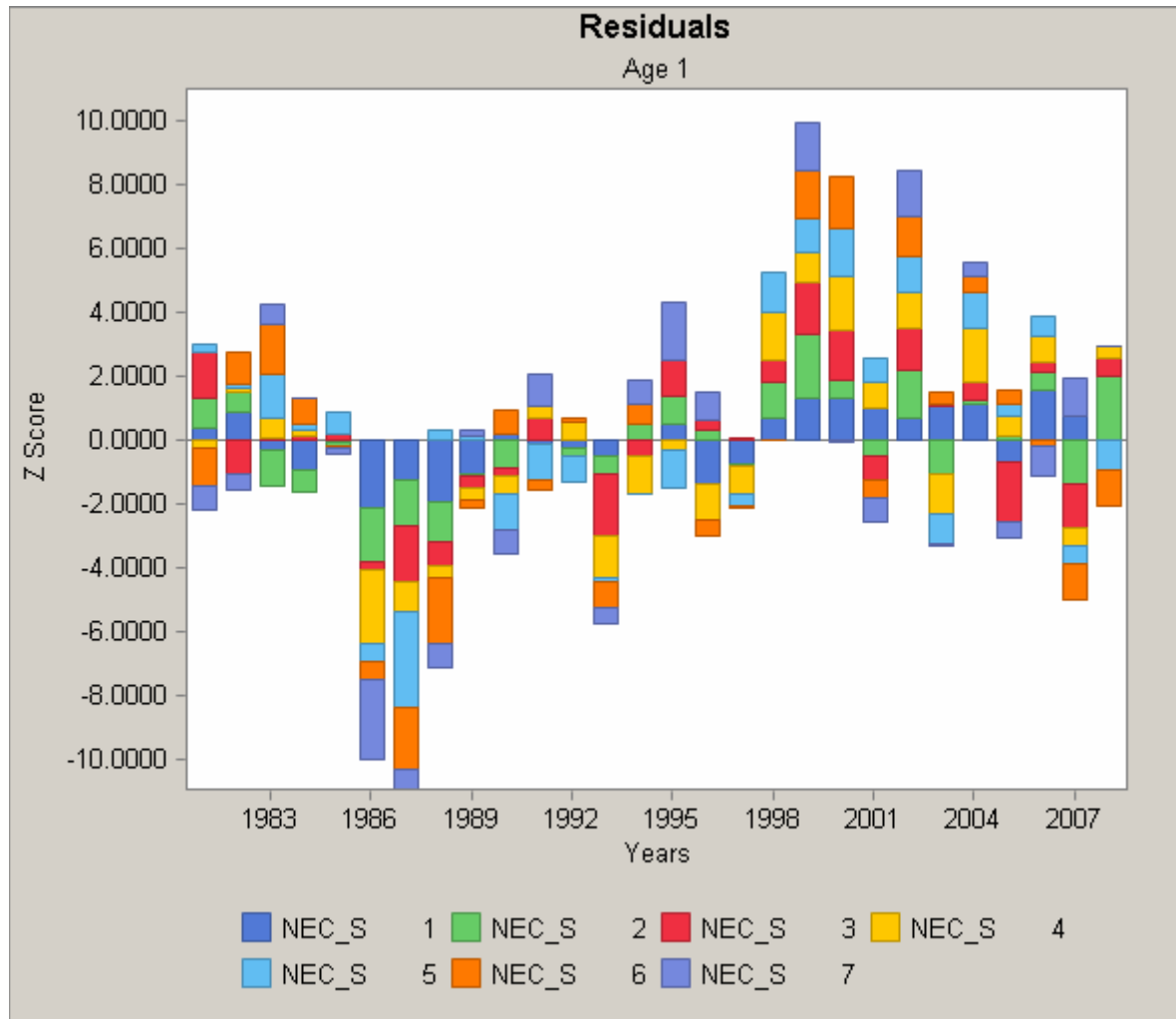


Figure 1. GARM3 ADAPT VPA BASE run survey index combined residuals: NEFSC Spring Survey ages 1-7.

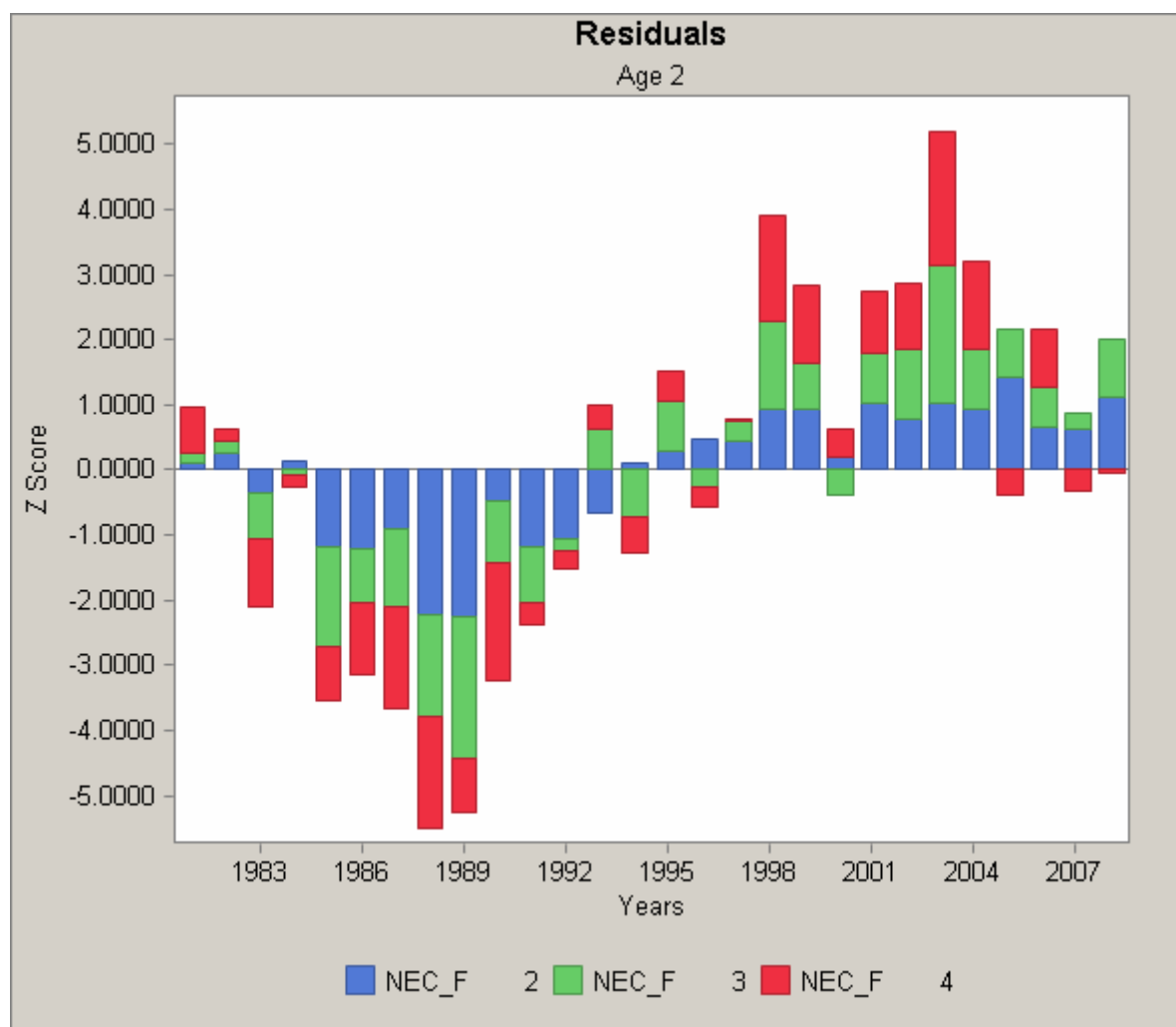


Figure 2. GARM3 ADAPT VPA BASE run survey index combined residuals:
NEFSC Fall Survey ages 1-3 (tuned to ages 2-4 in year+1).

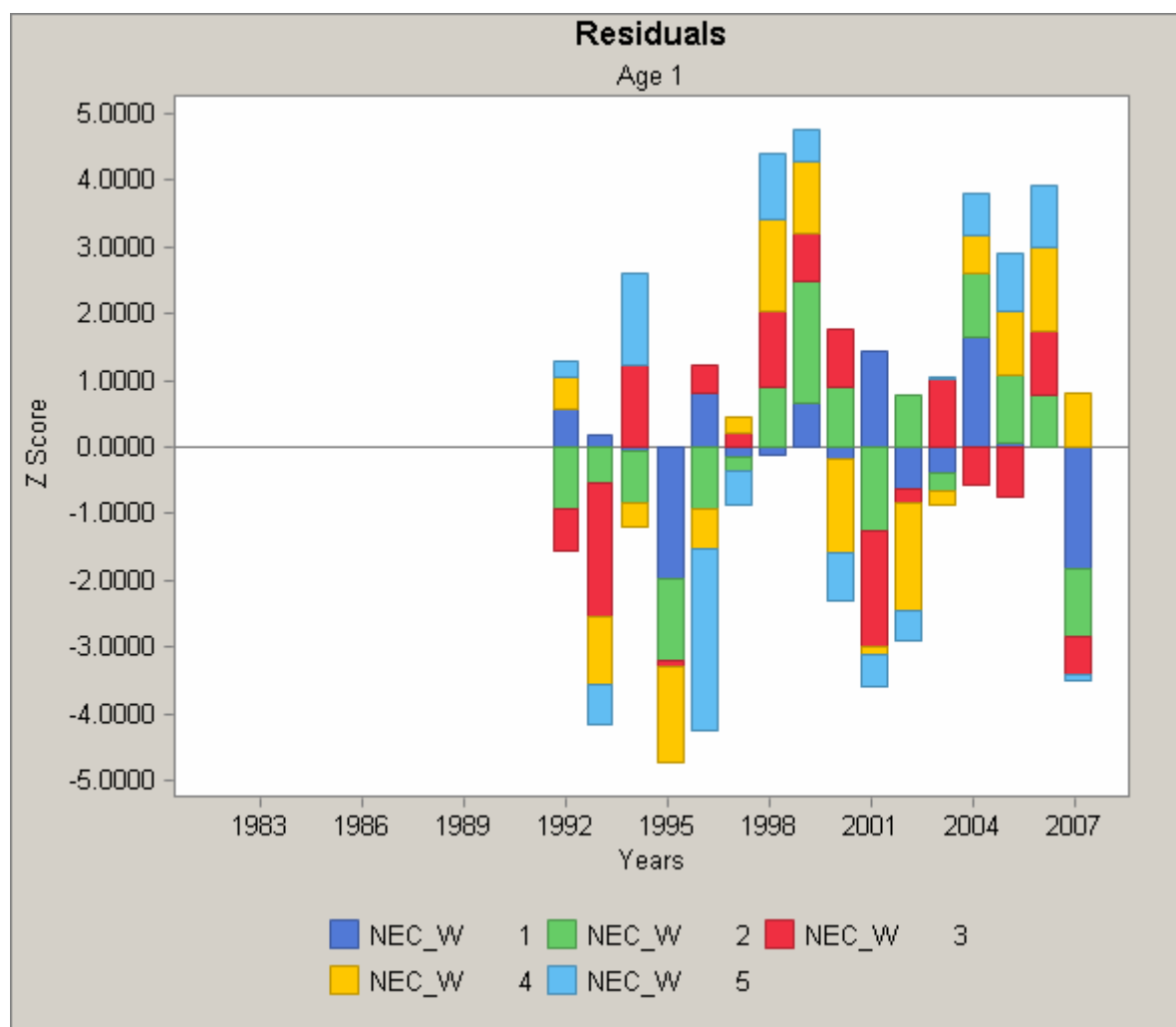


Figure 3. GARM3 ADAPT VPA BASE run survey index combined residuals:
NEFSC Winter Survey ages 1-5.

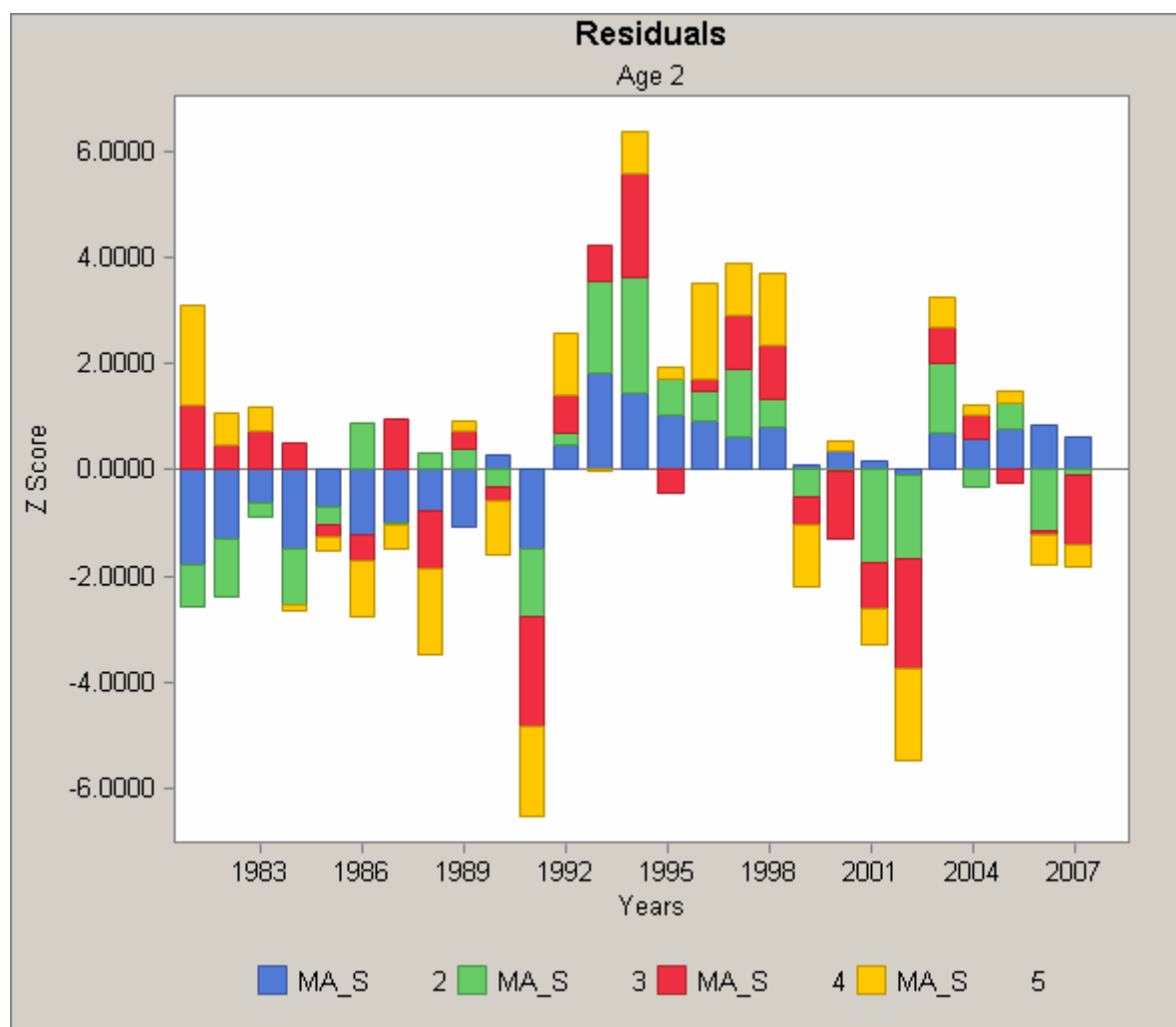


Figure 4. GARM3 ADAPT VPA BASE run survey index combined residuals: MADMF Spring Survey ages 2-5.

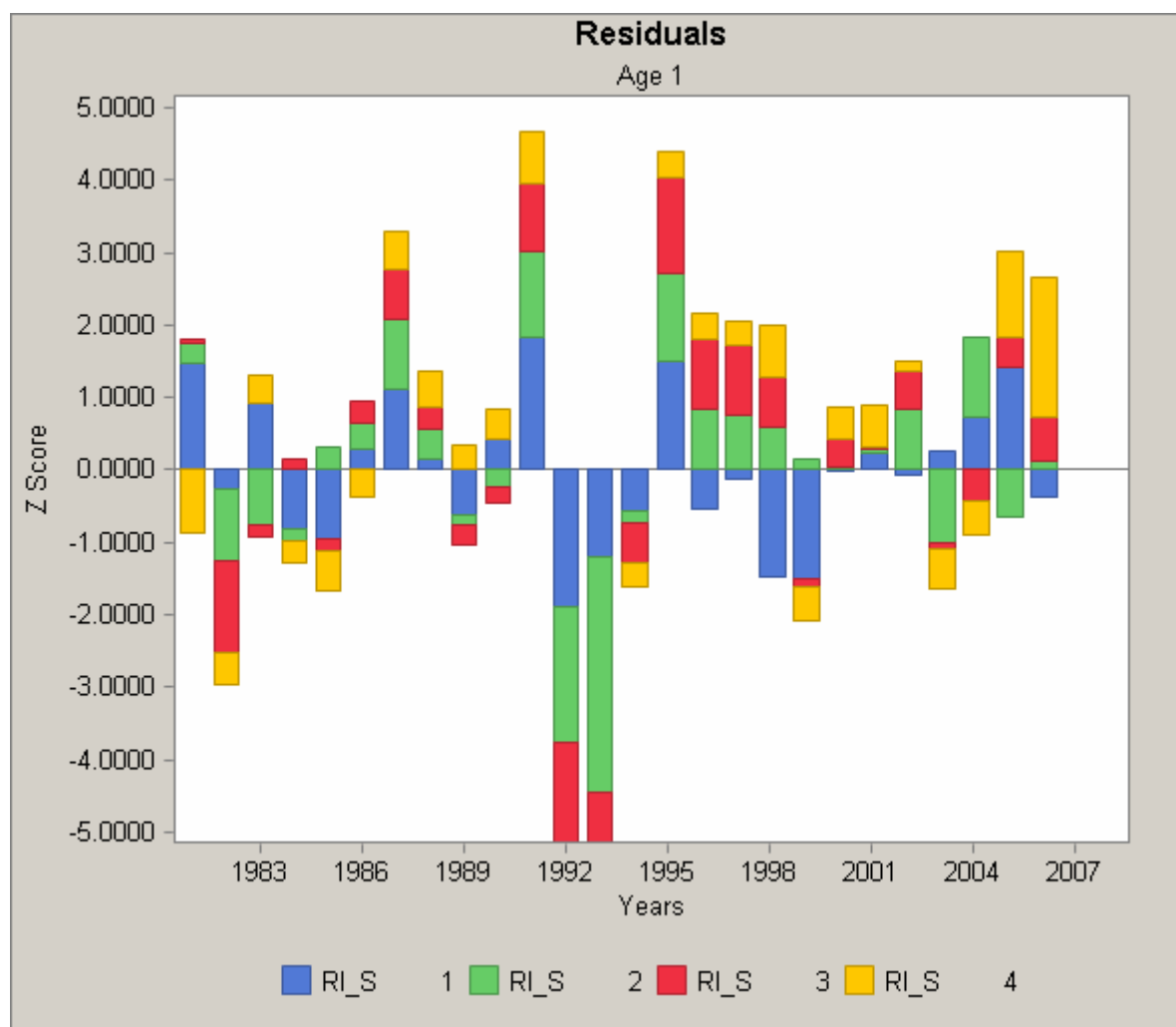


Figure 5. GARM3 ADAPT VPA BASE run survey index combined residuals: RIDFW Spring Survey ages 1-4.

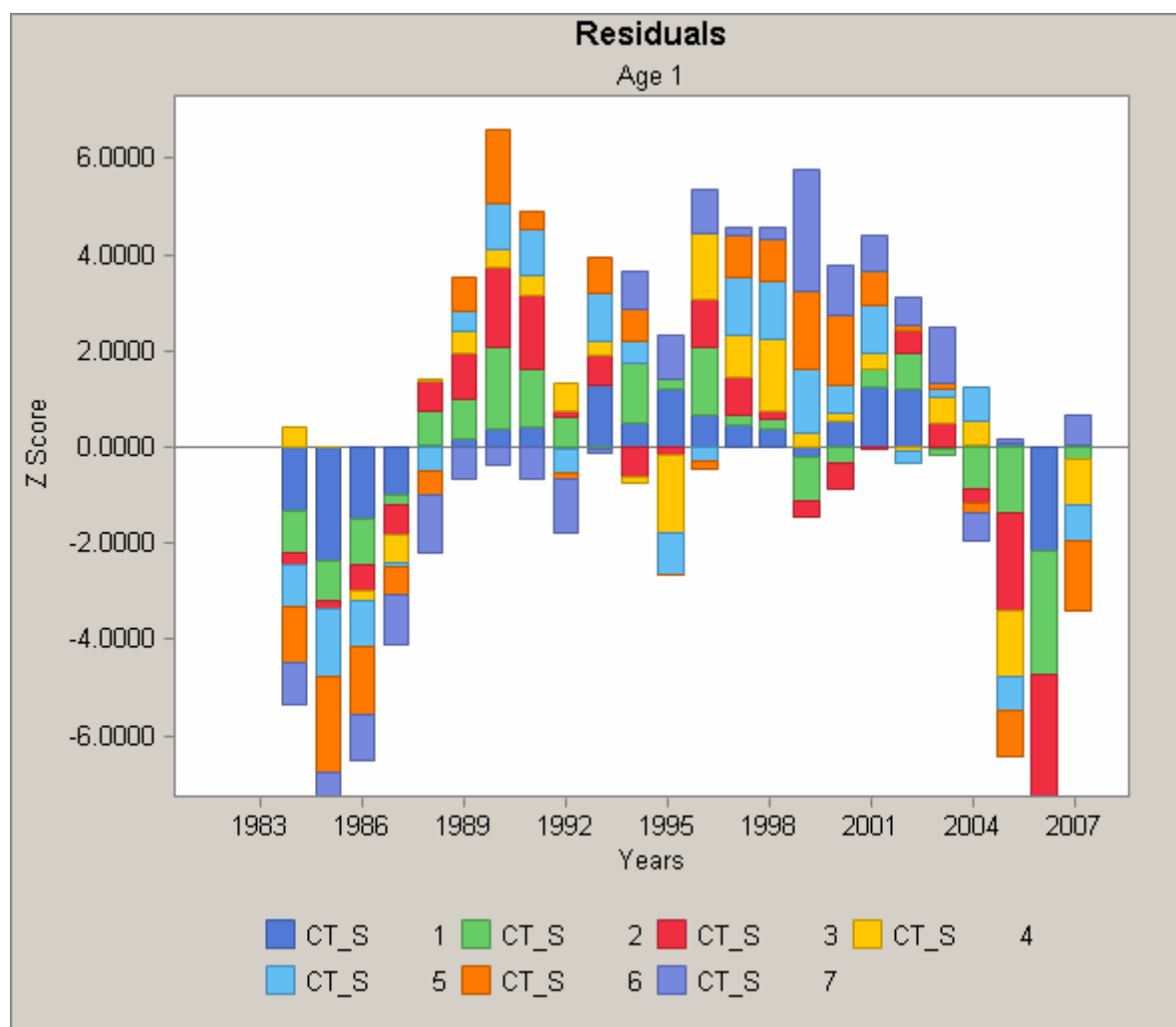


Figure 6. GARM3 ADAPT VPA BASE run survey index combined residuals:
CTDEP Spring Survey ages 1-7.

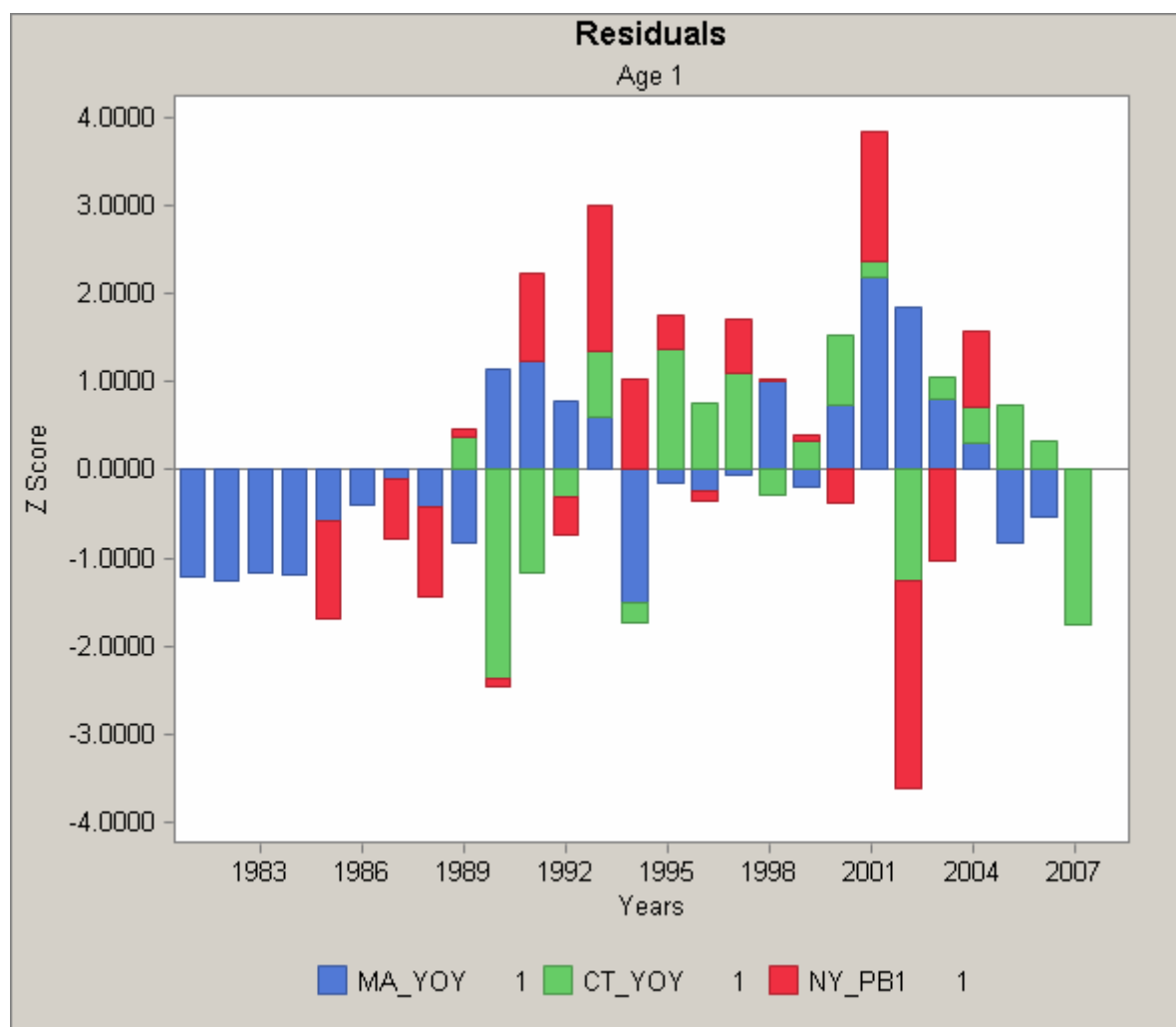


Figure 7. GARM3 ADAPT VPA BASE run survey index combined residuals: MADMF, CTDEP, and NYDEC age 1 indices (recruitment indices).

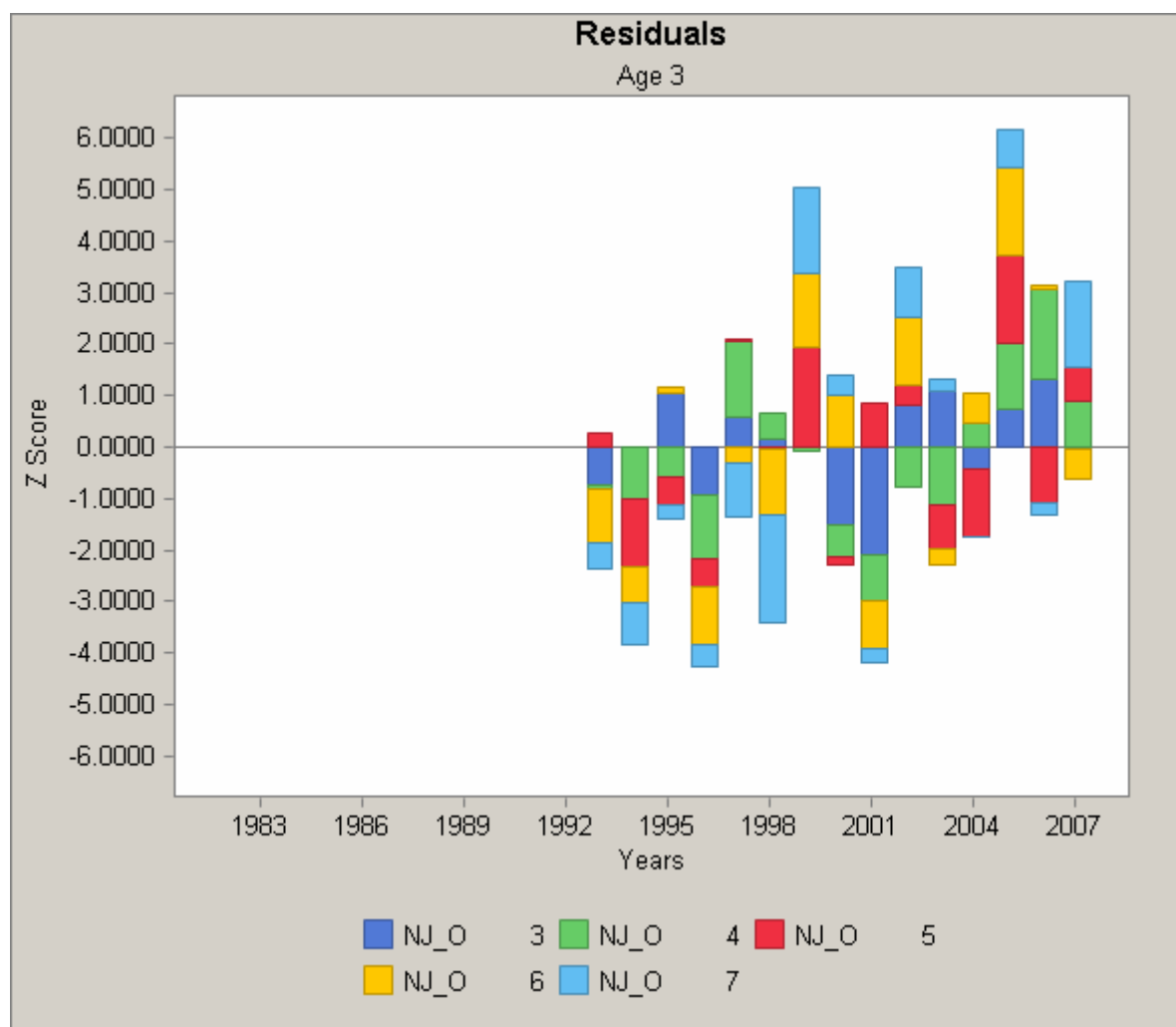


Figure 8. GARM3 ADAPT VPA BASE run survey index combined residuals:
NJDFW Ocean survey ages 3-7.

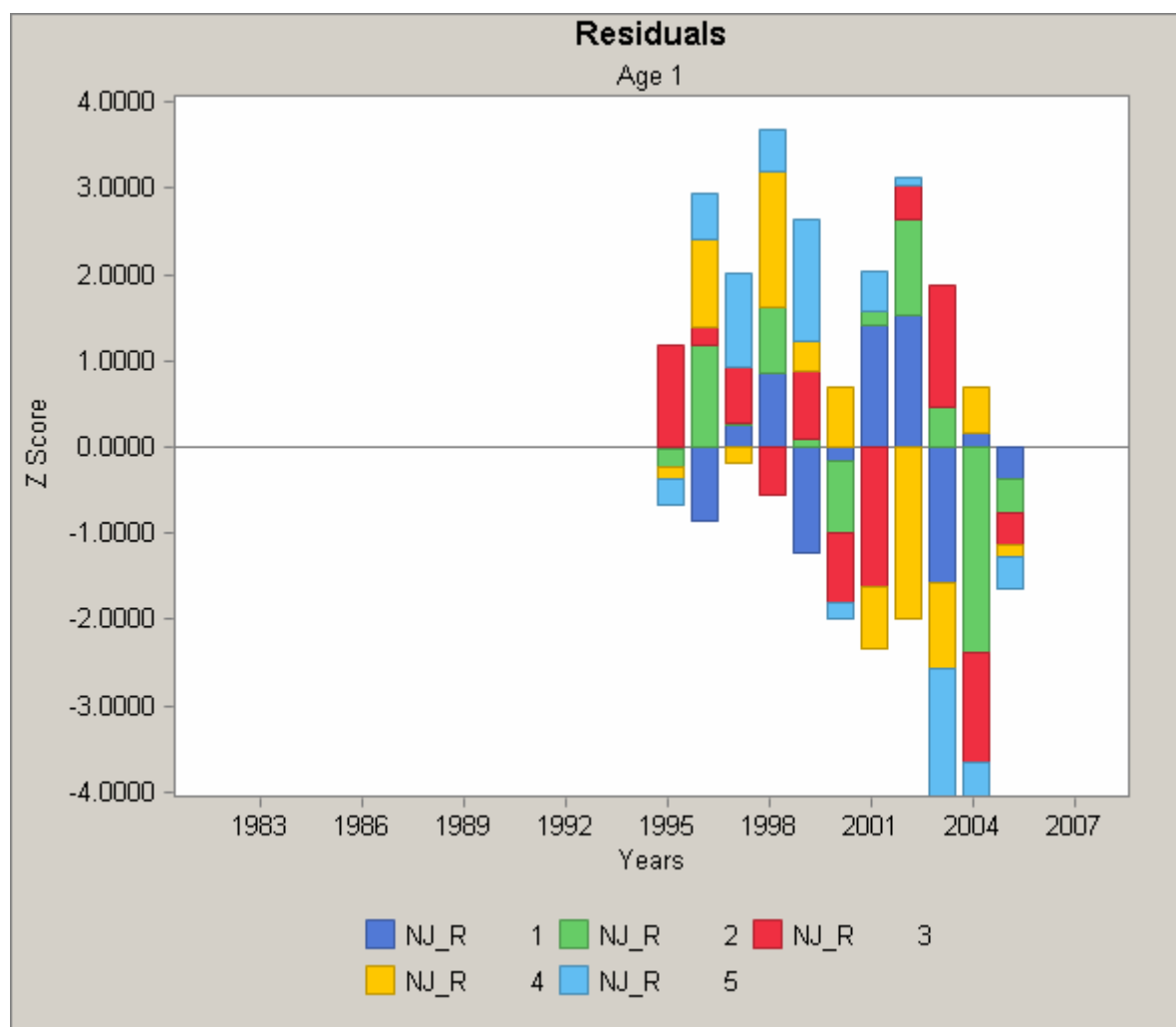


Figure 9. GARM3 ADAPT VPA BASE run survey index combined residuals: NJDFW Rivers survey ages 3-7.

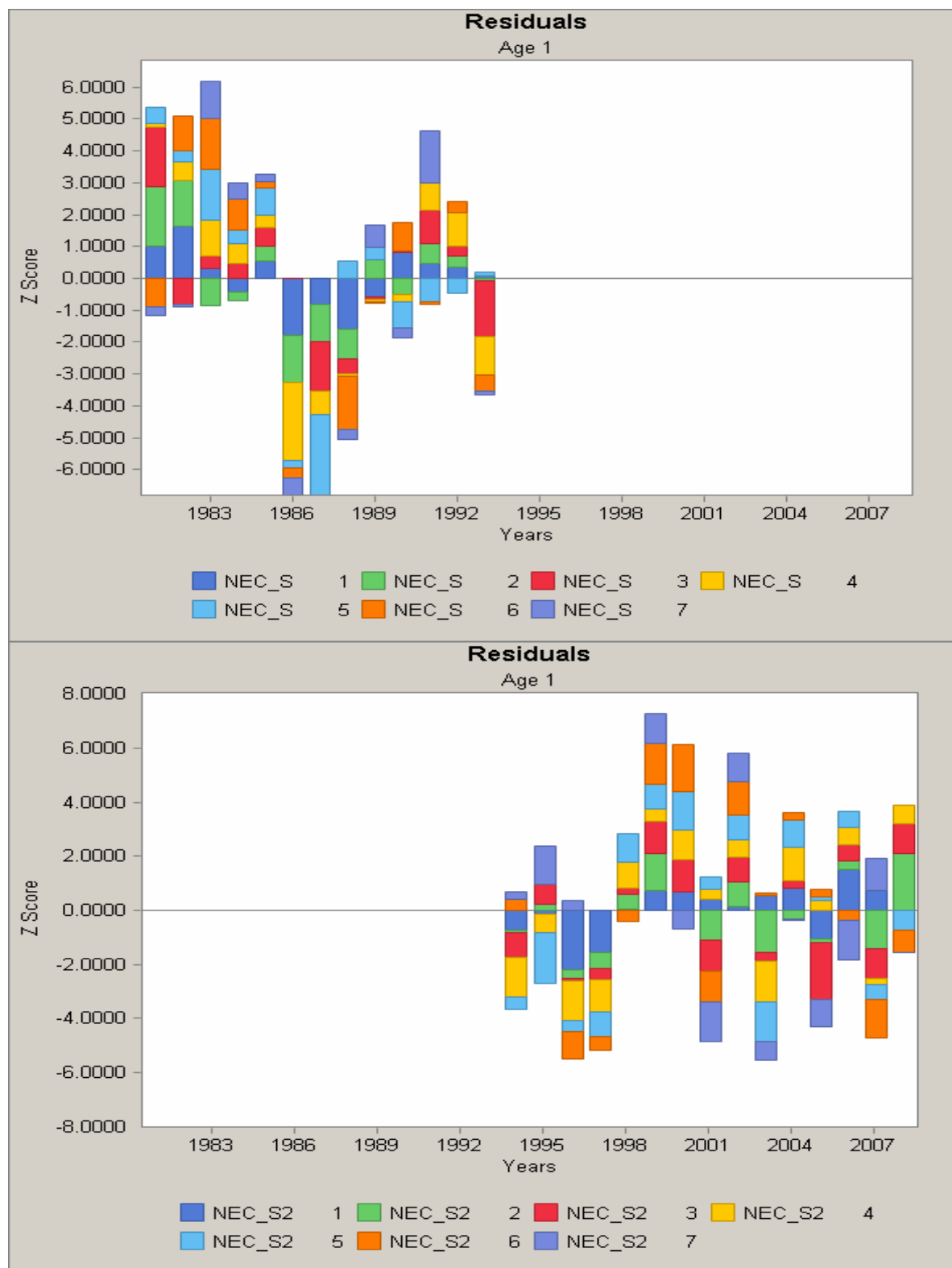


Figure 10. GARM3 ADAPT VPA SPLIT run survey index combined residuals: NEFSC Spring Survey ages 1-7.

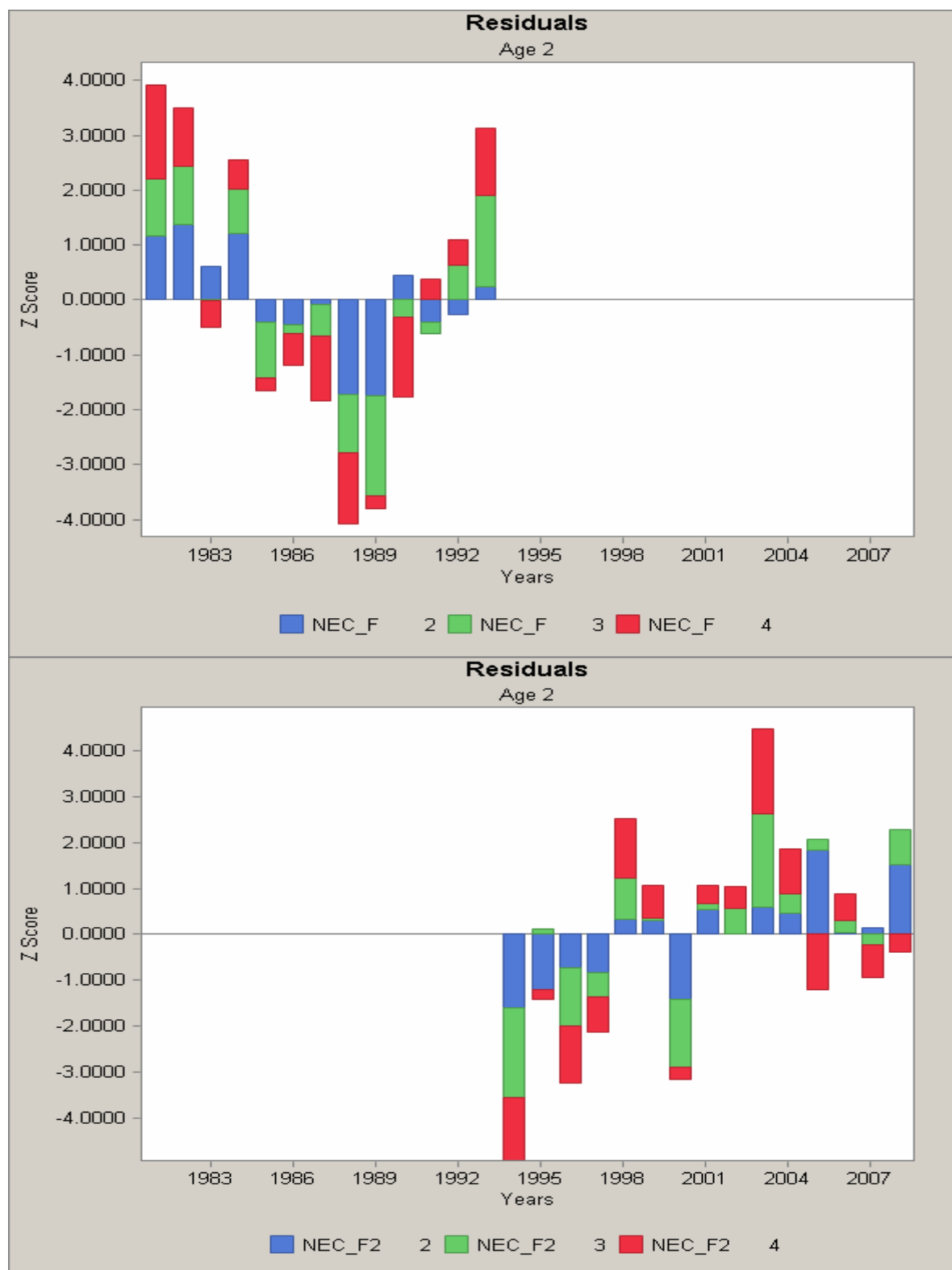


Figure 11. GARM3 ADAPT VPA SPLIT run survey index combined residuals: NEFSC Fall Survey ages 2-4.

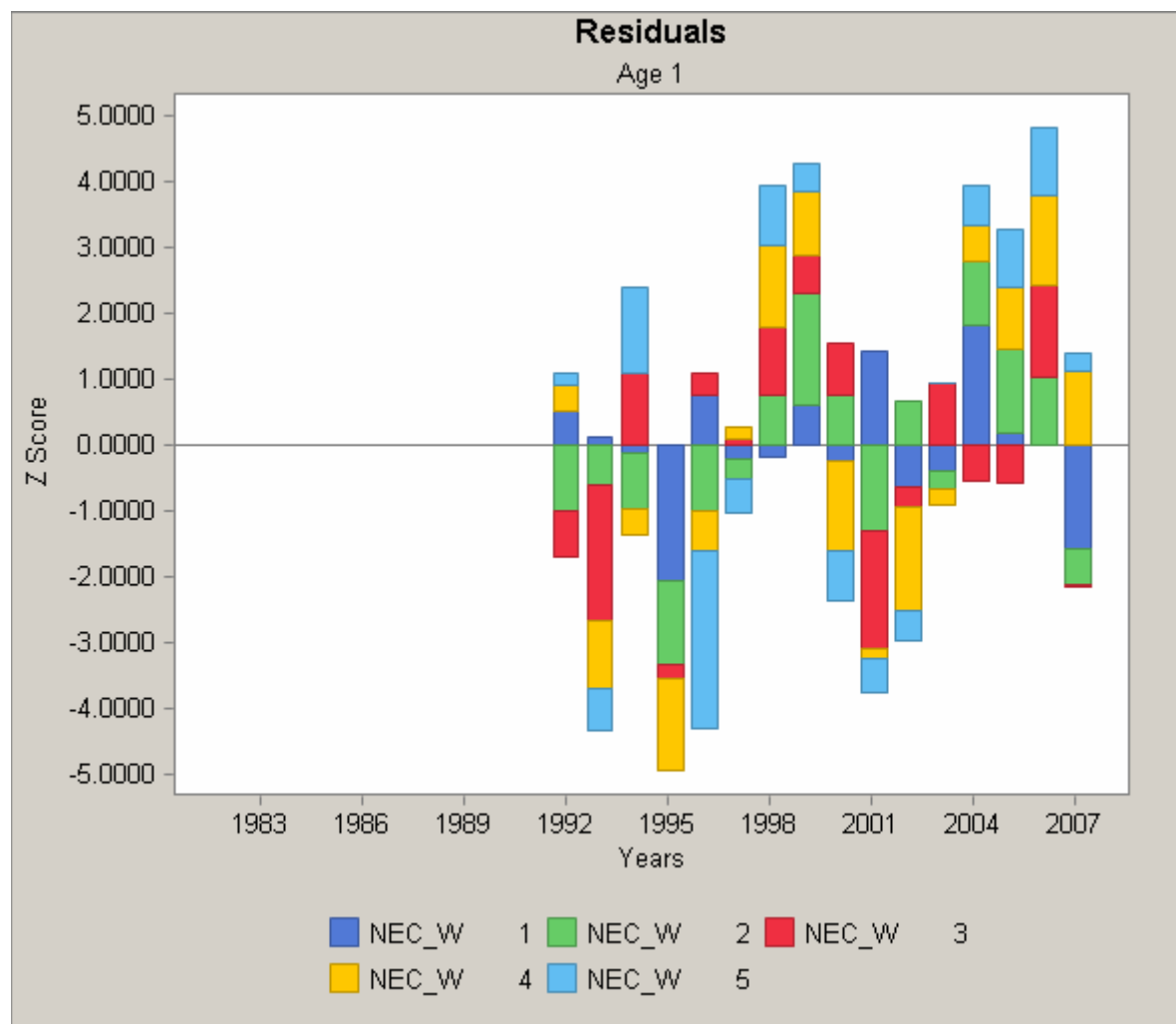


Figure 12. GARM3 ADAPT VPA SPLIT run survey index combined residuals:
NEFSC Winter Survey ages 1- 5.

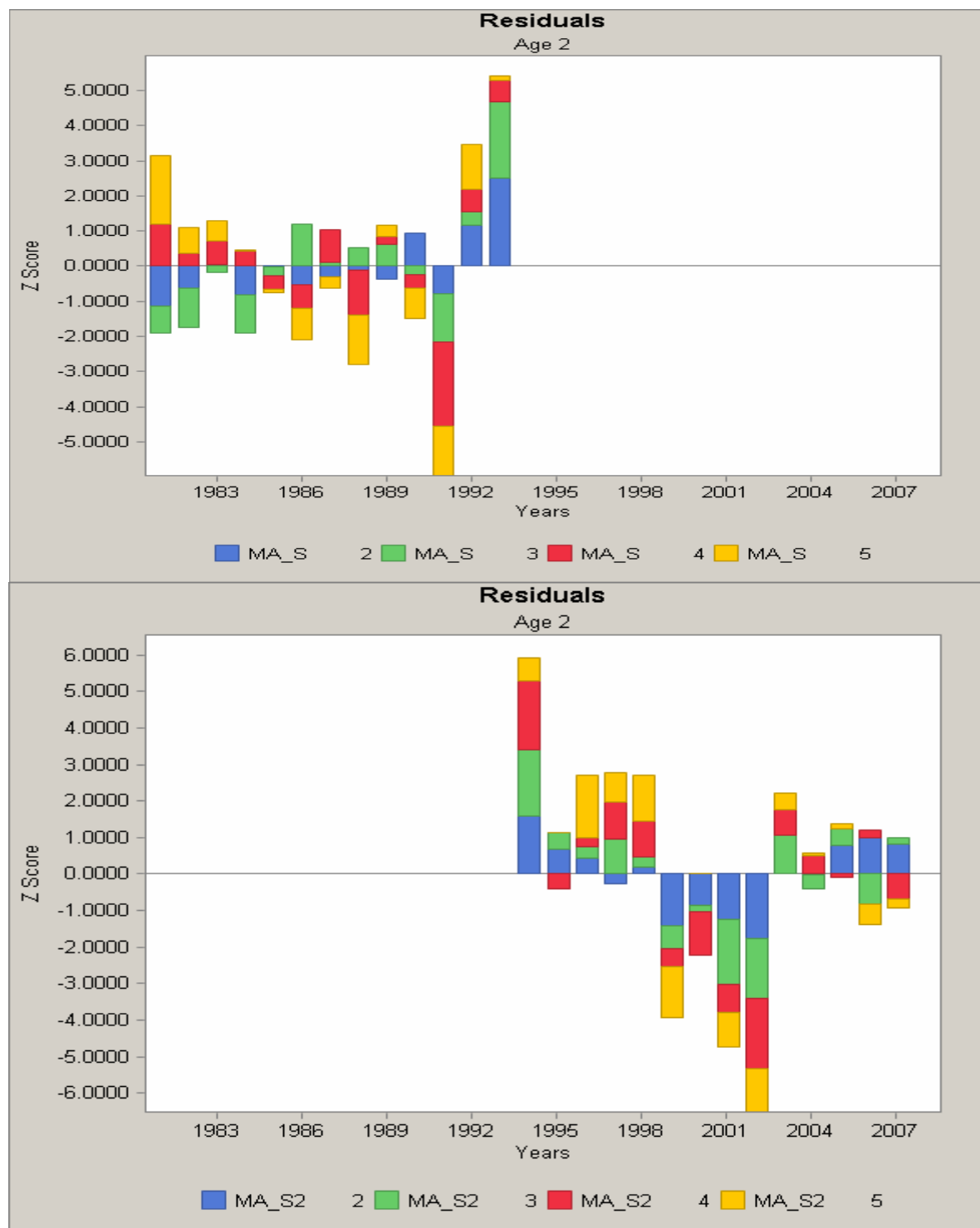


Figure 13. GARM3 ADAPT VPA SPLIT run survey index combined residuals: MDMF Spring Survey ages 2-5 .

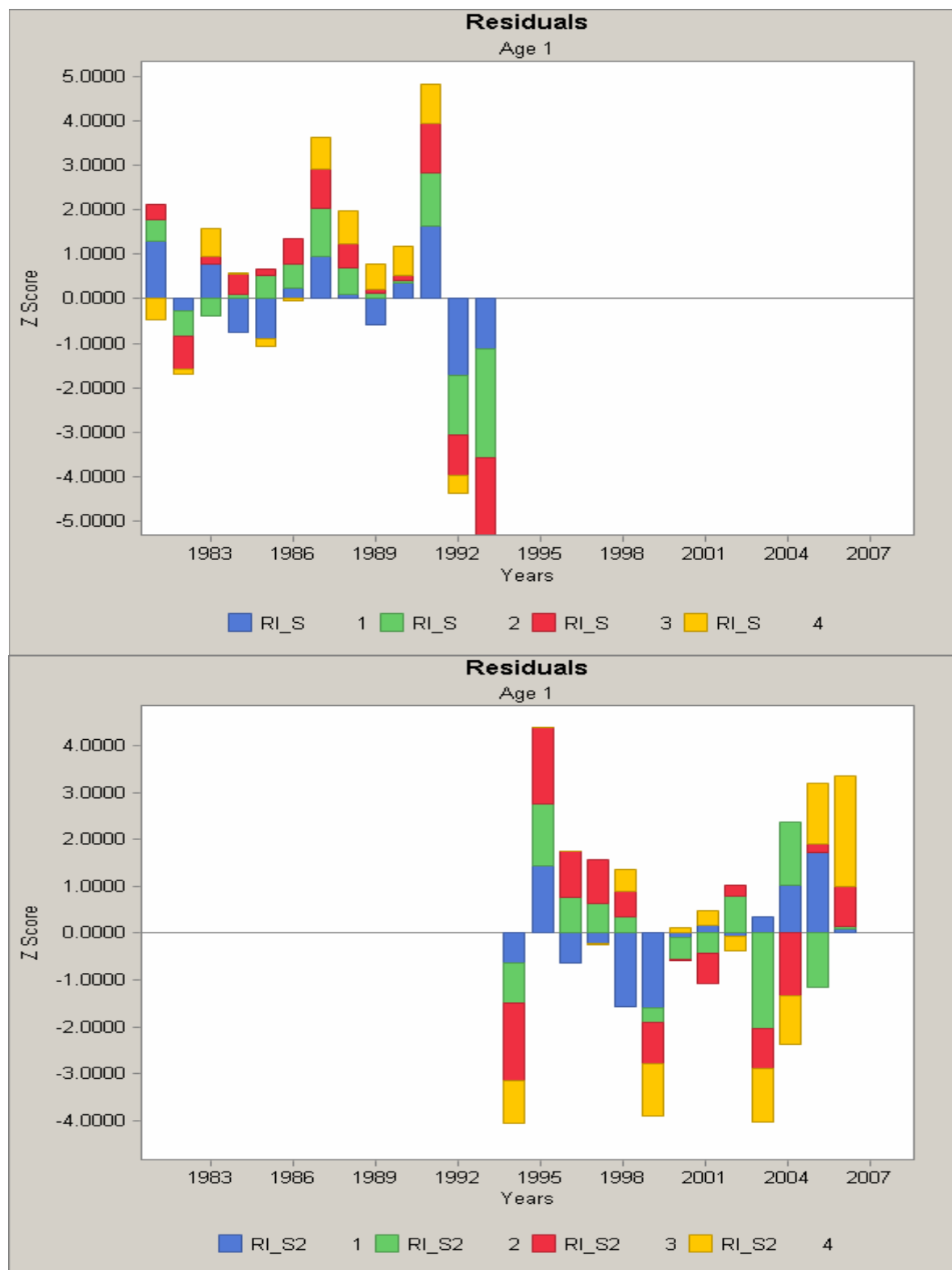


Figure 14. GARM3 ADAPT VPA SPLIT run survey index combined residuals: RIDFW Spring Survey ages 1-4 .

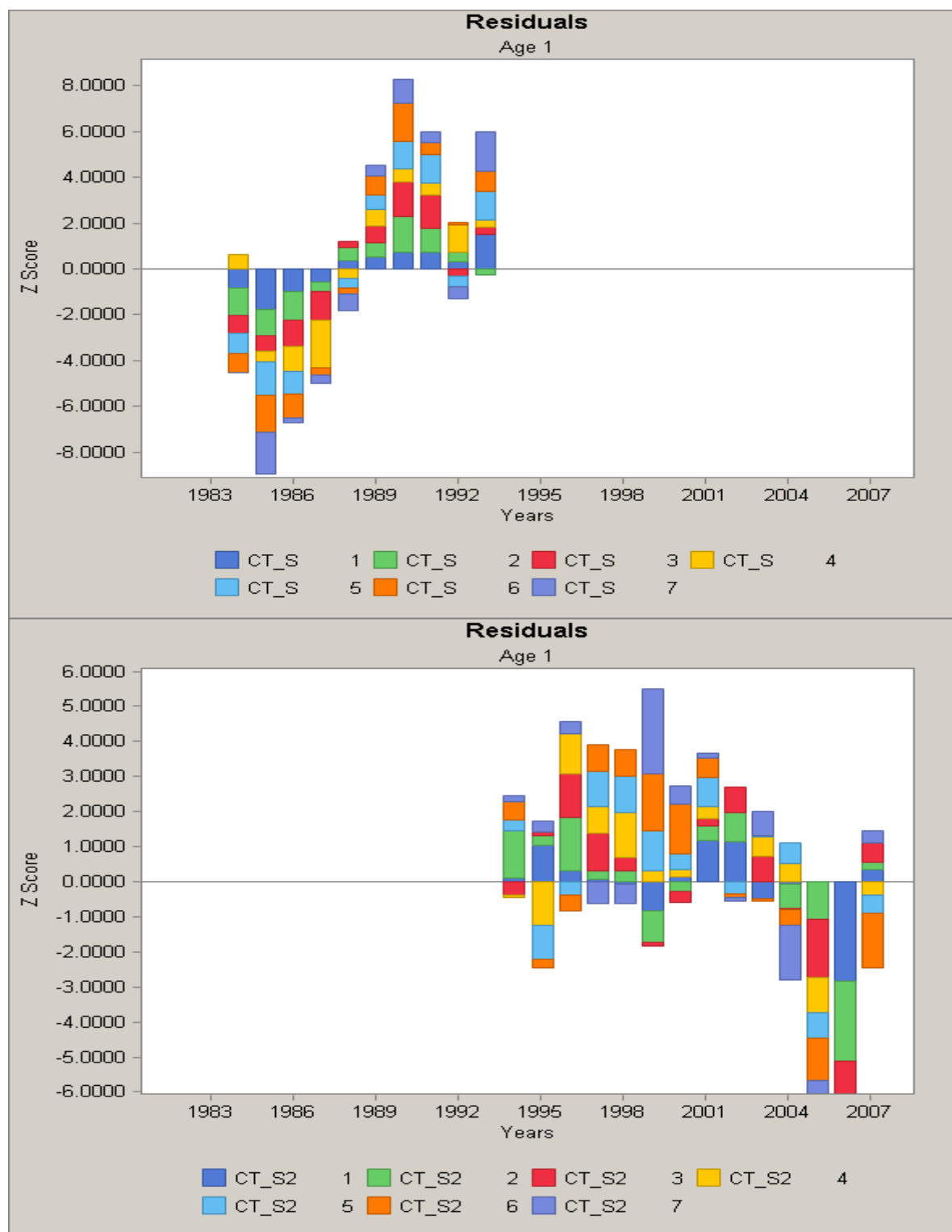


Figure 15. GARM3 ADAPT VPA SPLIT run survey index combined residuals: CTDEP Spring Survey ages 1-4.

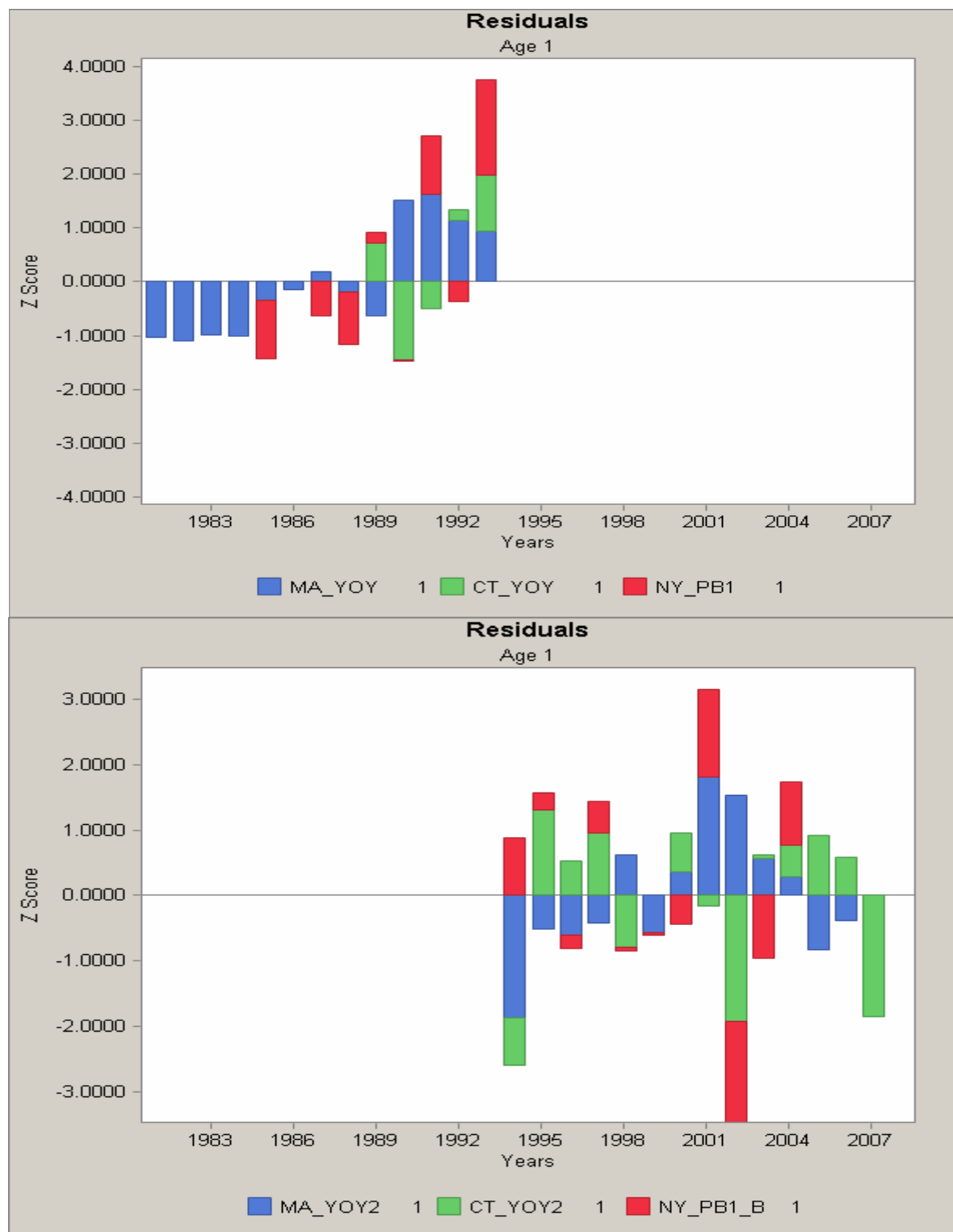


Figure 16. GARM3 ADAPT VPA PLIT run survey index combined residuals: MADMF, CTDEP, and NYDEC age 1 indices (recruitment indices).

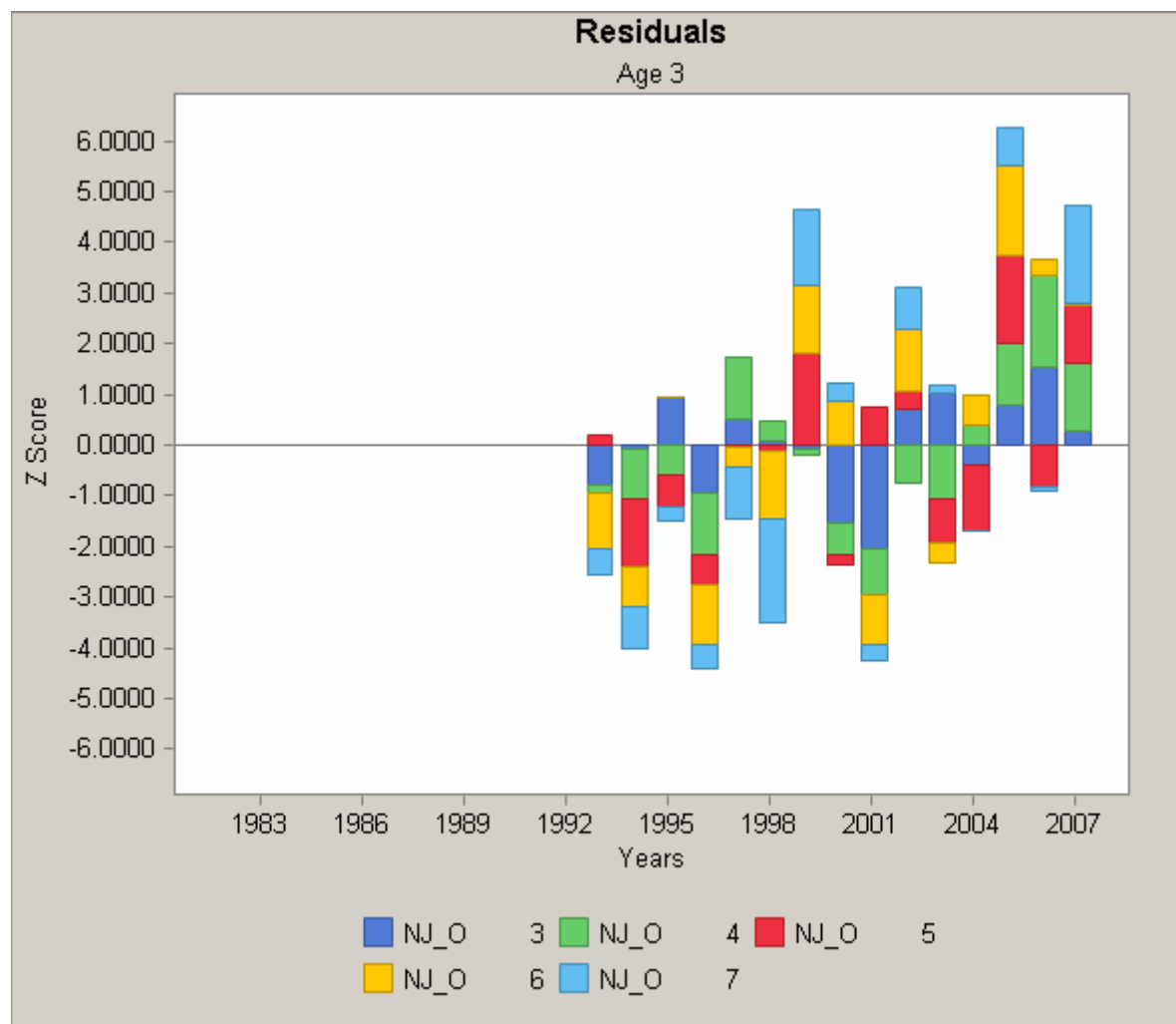


Figure 17. GARM3 ADAPT VPA SPLIT run survey index combined residuals: NJDFW Ocean survey ages 3-7.

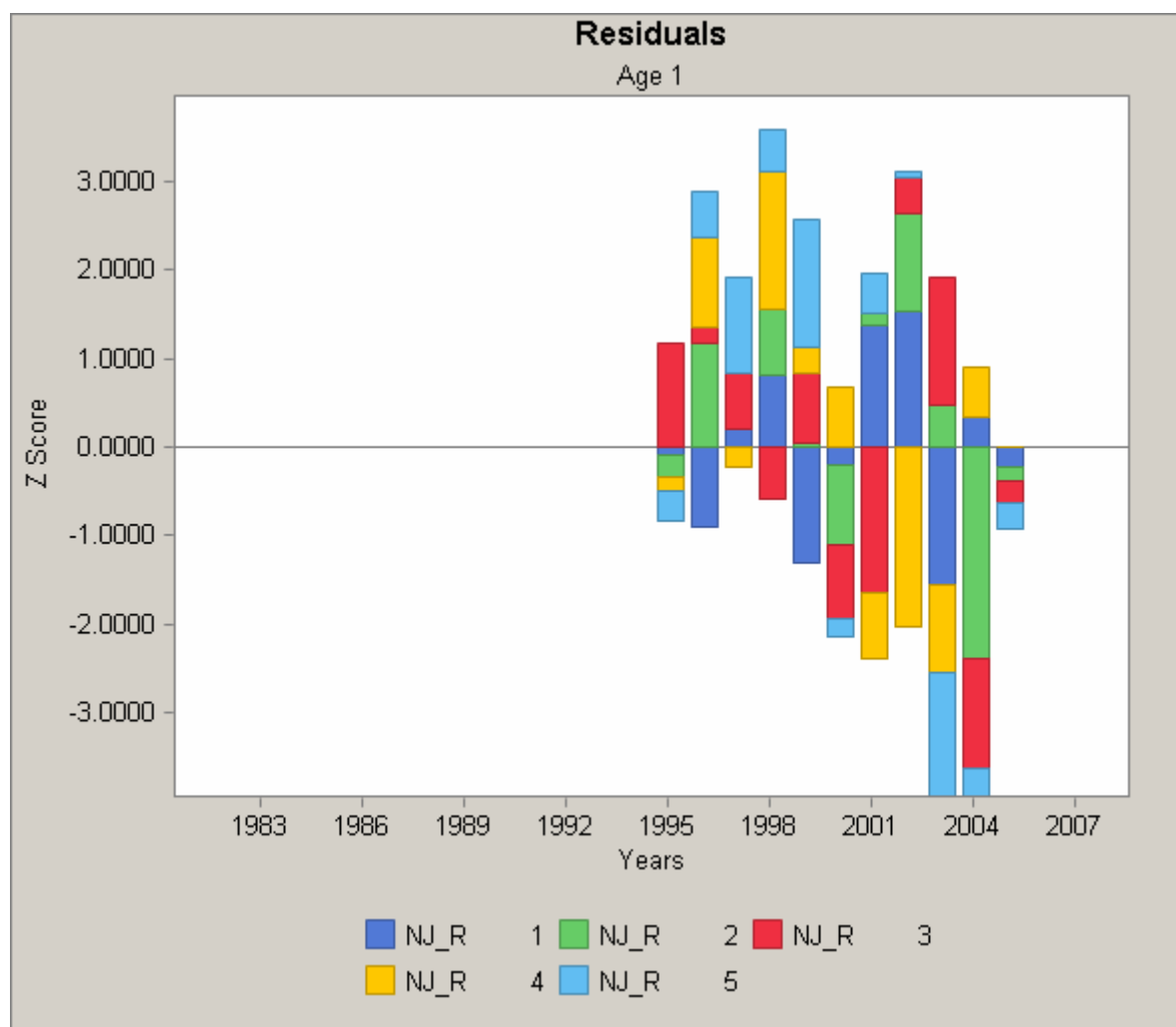


Figure 18. GARM3 ADAPT VPA SPLIT run survey index combined residuals: NJDFW Rivers survey ages 1-5.

Appendix K. Georges Bank winter flounder by Lisa Hendrickson

Table K1. Number of observed trips, by fleet and quarter, included in the discard estimates of GB winter flounder, 1989-2007.

Year	Large mesh otter trawl					Small mesh groundfish otter trawl					Scallop dredge/otter trawl				
	Q1	Q2	Q3	Q4	Total	Q1	Q2	Q3	Q4	Total	Q1	Q2	Q3	Q4	Total
1989	2	8	3	4	17		3	10	2	15					0
1990	4	3	4	2	13		2	6		8					0
1991	8	1	1	3	13	1		7		8				1	1
1992	9	4		3	16			5	1	6	1	2	1	2	6
1993	4	10		3	17			1		1	2	2	2	2	8
1994	10	6	3	3	22		1		1	2		1	1	3	5
1995	18	9	5	5	37	2		1		3	1		2		3
1996	3	9		1	13	1	1			2	1	1	1	1	4
1997	3		3		6		1			1	1	2	2	1	6
1998	3		2		5	1				1		2	1	1	4
1999		2	2	3	7	1				1		4	12	3	19
2000	4	2	5	6	17	3			2	5		25	64	90	179
2001	8	5	6	7	26	2	3	1	1	7	16				16
2002	5	6	15	22	48		1	2	4	7			4		4
2003	28	33	22	24	107	3	4	5	3	15			1	1	2
2004	32	36	43	43	154		5	8	4	17	2		3	25	30
2005	157	212	82	118	569	19	23	14	23	79	5	3	34	20	62
2006	95	87	91	30	303	8	3	4	3	18	6	8	40	14	68
2007	51	95	63	93	302	4	5	2	1	12	5	12	31	11	59

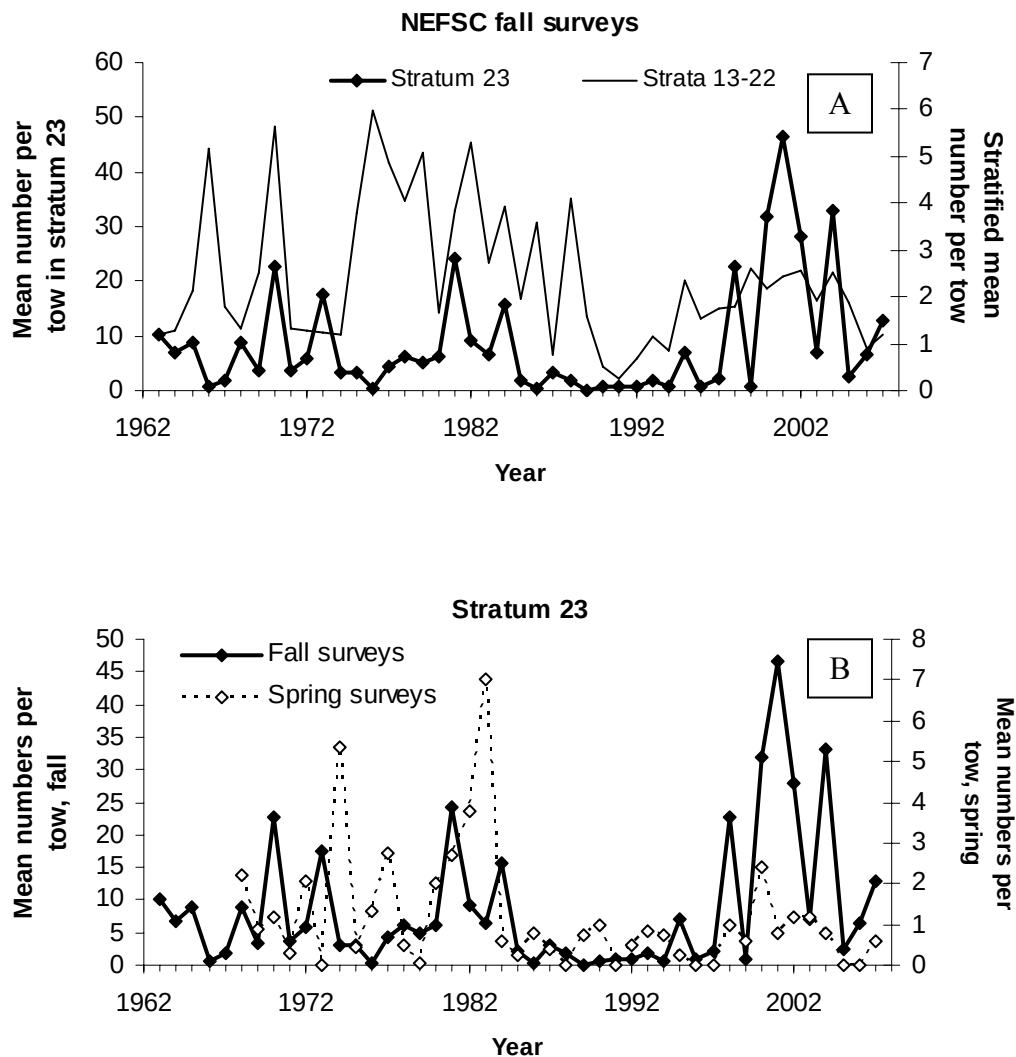


Figure K1. Trends in (A) relative abundance indices for winter flounder caught during NEFSC fall surveys in Georges Bank strata 13-22 versus stratum 23 and (B) relative abundance of winter flounder caught in stratum 23, during NEFSC fall and spring surveys, 1963-2007.

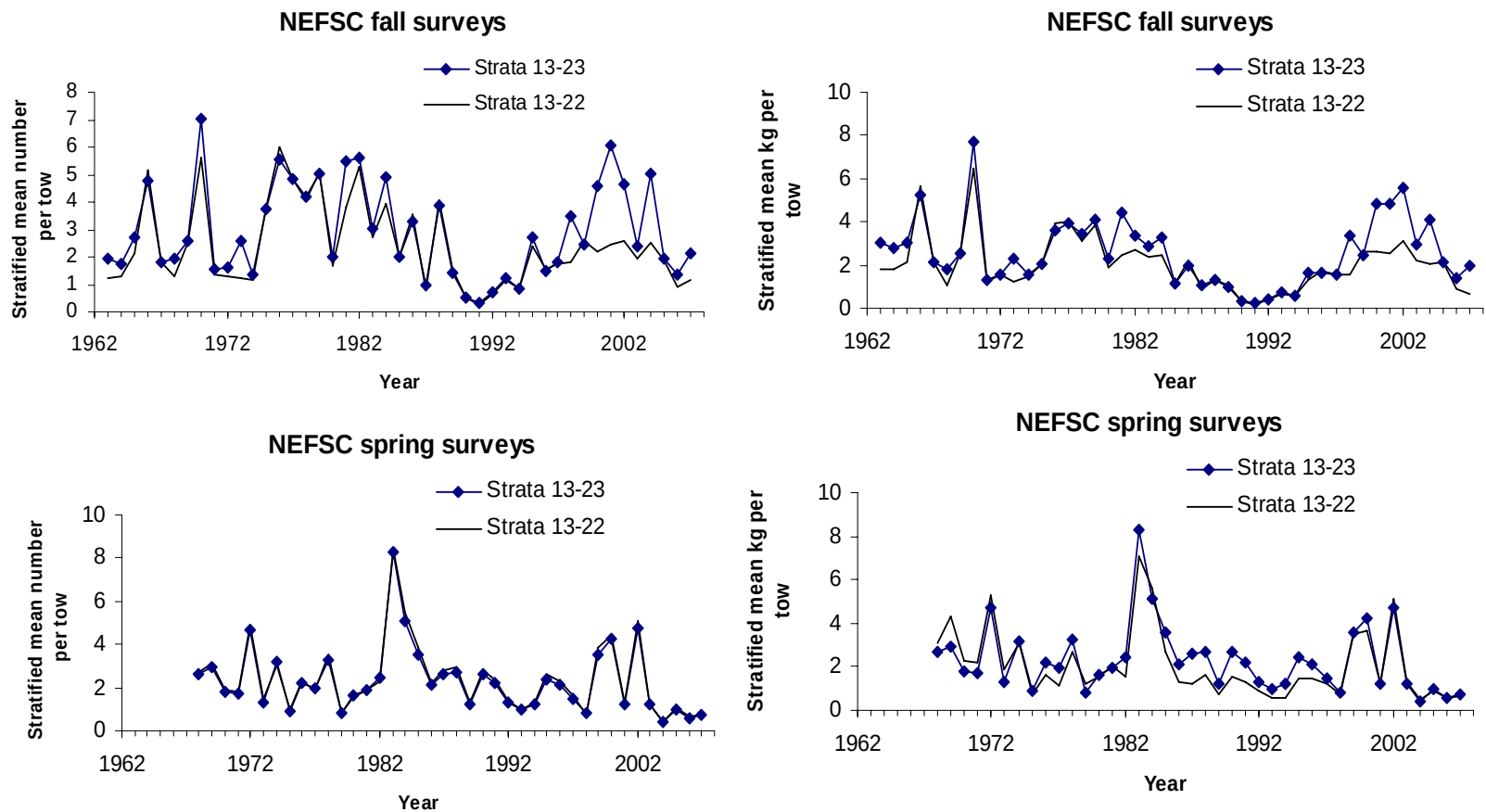


Figure K2. Relative biomass (stratified mean kg per tow) and abundance (stratified mean numbers per tow) indices for Georges Bank winter flounder caught during NEFSC spring (1968-2007) and autumn (1963-2007) bottom trawl surveys. Survey indices were computed using data from strata 13-23 versus strata 13-22 and standardization coefficients for gear changes (weight = 1.86 and numbers = 2.02) and trawl door changes (weight = 1.39 and numbers = 1.46) were applied to all sets of survey indices.

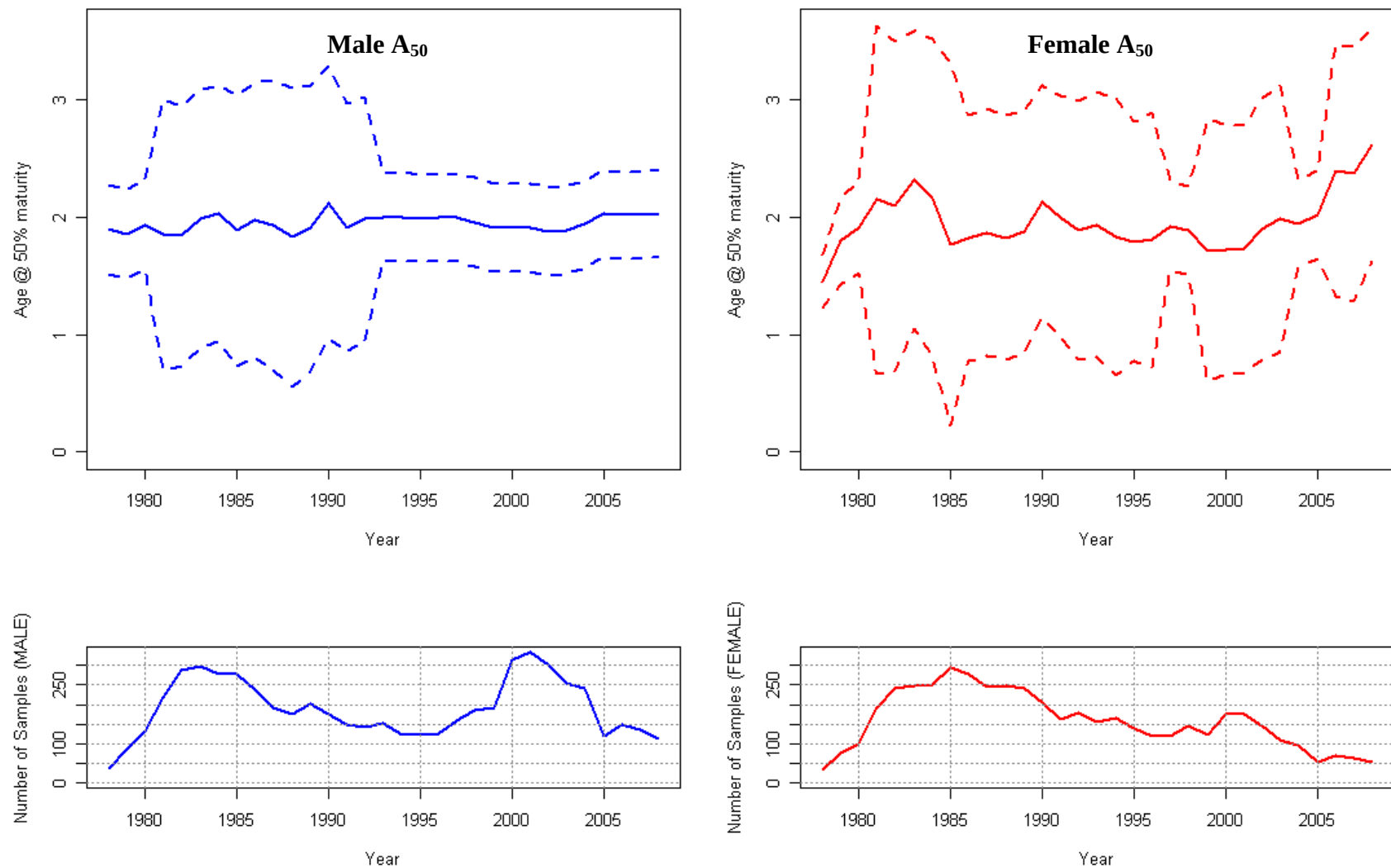


Figure K3. Trends in male and female ages at 50% maturity (A_{50}), and 95% confidence intervals, along with sample sizes for Georges Bank winter flounder based on catches from NEFSC spring bottom trawl surveys conducted during 1978-2008.

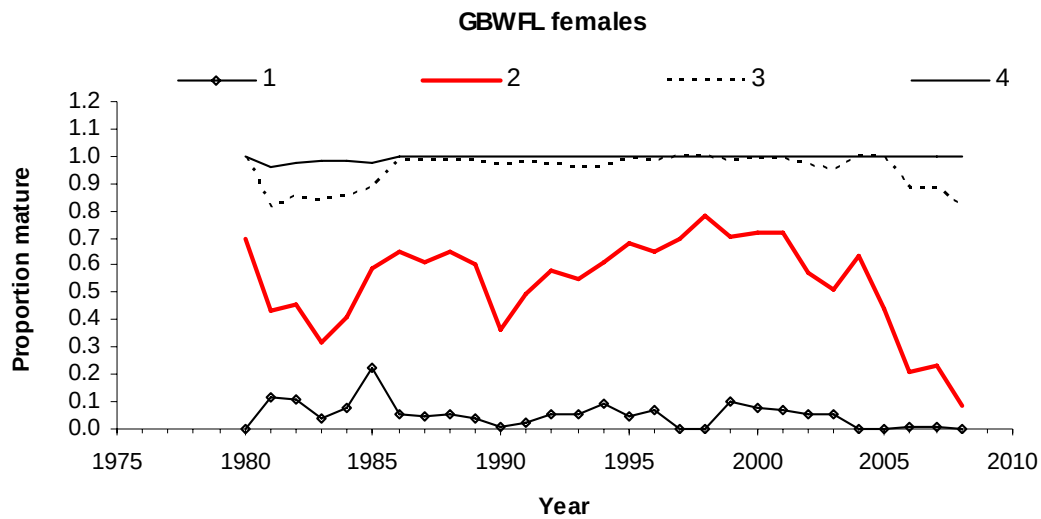


Figure K4. Trends in female proportion mature at age for ages 1-4 winter flounder caught on Georges Bank during NEFSC spring bottom trawl surveys conducted during 1980-2008.

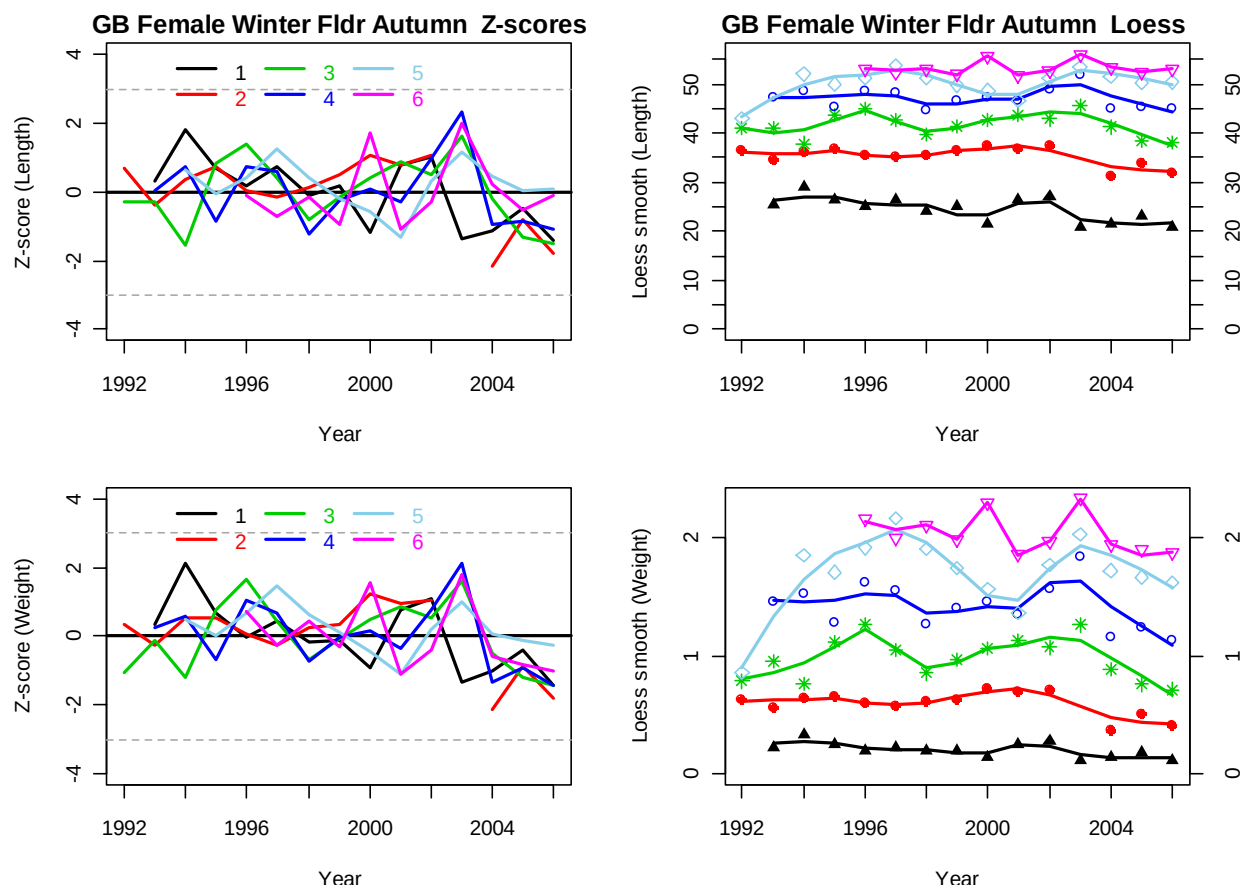


Figure K5. Trends in female mean length and mean weight for ages 1-6 winter flounder caught on Georges Bank during NEFSC fall bottom trawl surveys conducted during 1992-2006.

Appendix L. Georges Bank/Gulf of Maine white hake

by Katharine Sosebee, Doug Butterworth and Rebecca Rademeyer

This section does not have an appendix. The complete assessment is available in the Report of the 3rd Groundfish Assessment Review Meeting (GARM III), Center Reference Document 08-15.

Appendix M Pollock

by R Mayo, L Col, M Traver Catch per tow at age for Pollock in NEFSC spring and autumn bottom trawl surveys.

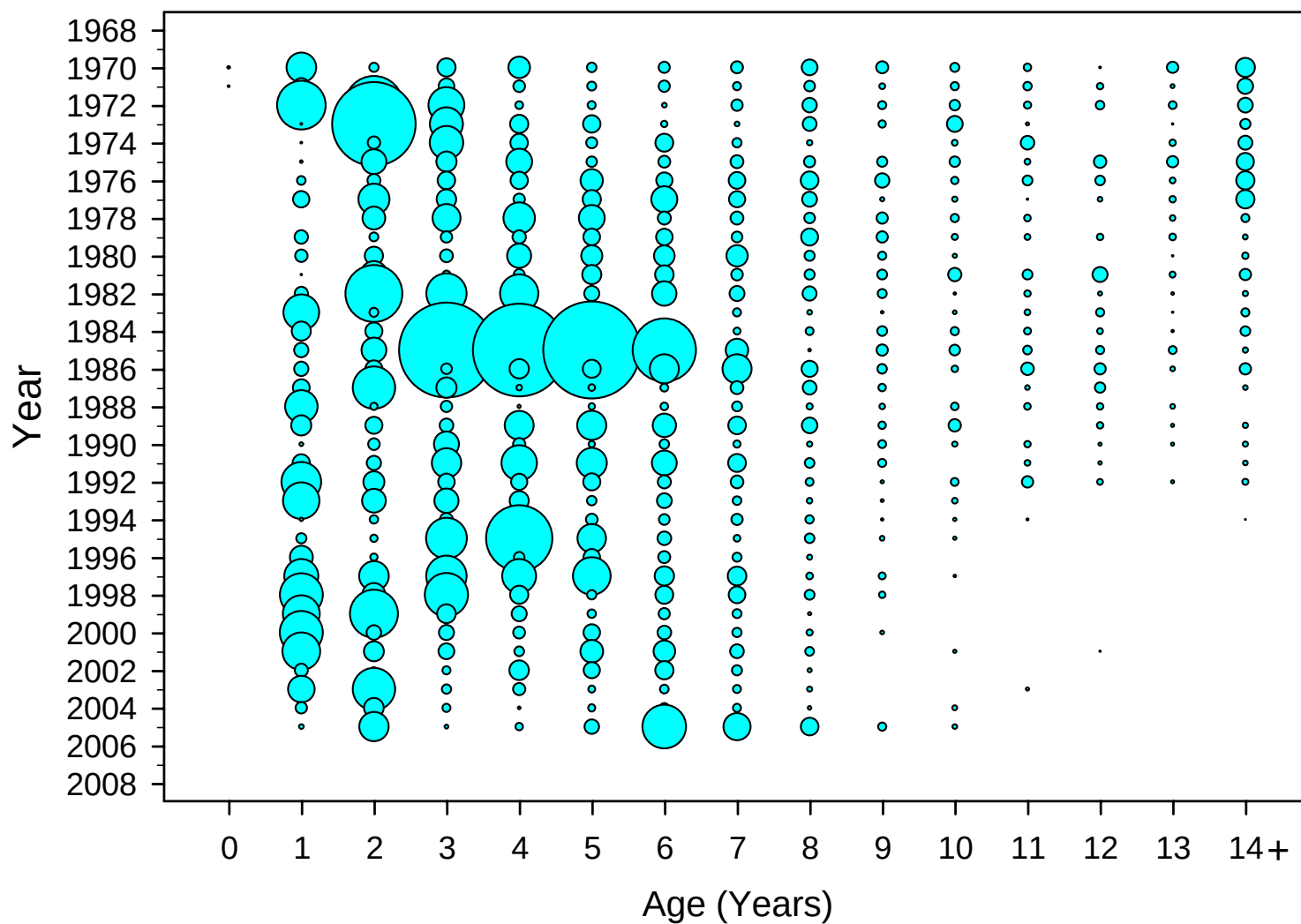
Spring	Linear	Pollock					Age		~lcol/survey/Pollock/polindices_ager.xls						
	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1970	0.0086	0.419	0.051	0.17	0.2345	0.0554	0.0732	0.0818	0.1324	0.0821	0.0499	0.0364	0.0063	0.0755	0.183
1971	0.0057	0.1366	0.1125	0.1291	0.0773	0.049	0.0727	0.0403	0.0666	0.0243	0.0412	0.0464	0.0277	0.0151	0.1287
1972	0	1.0853	1.5422	0.6085	0.0397	0.0418	0.0187	0.0722	0.1158	0.0431	0.0638	0.0352	0.0473	0.0385	0.1194
1973	0	0.0057	3.0894	0.5151	0.1722	0.1534	0.0274	0.0173	0.1053	0.0345	0.1306	0.0101	0	0.0055	0.0622
1974	0	0.006	0.0874	0.5265	0.1576	0.0686	0.1618	0.0528	0.0218	0	0.0245	0.1008	0	0.0299	0.1061
1975	0	0.0086	0.3018	0.2062	0.3276	0.0653	0.08	0.0918	0.0742	0.0606	0.0652	0.025	0.0855	0.0737	0.1555
1976	0	0.0466	0.0956	0.1571	0.1551	0.25	0.1355	0.1452	0.1677	0.1159	0.0355	0.0594	0.0535	0.0245	0.1699
1977	0	0.1419	0.4603	0.1975	0.0723	0.173	0.3276	0.1349	0.1201	0.0145	0.0214	0.0043	0.0194	0.0297	
1978	0	0	0.2605	0.3756	0.4696	0.3292	0.0923	0.0916	0.0668	0.0722	0.0423	0.0321	0	0.024	0.0414
1979	0	0.1025	0.0494	0.071	0.0971	0.1455	0.1447	0.0671	0.1508	0.0748	0.0268	0.0257	0.0288	0.0314	0.0202
1980	0	0.0861	0.171	0.0879	0.2841	0.2226	0.2145	0.2288	0.0616	0.044	0.0155	0	0	0.0044	0.0303
1981	0	0.0051	0.3445	0.0385	0.0664	0.1849	0.1772	0.0784	0.0615	0.0603	0.0975	0.06	0.1199	0.026	0.075
1982	0	0.0994	1.4502	0.7482	0.6801	0.1214	0.2943	0.1227	0.1082	0.0494	0.008	0.0277	0.0145	0.0082	0.0224
1983	0	0.6007	0.0497	0.0224	0.0205	0.0036	0	0.0416	0.0189	0.009	0.0139	0.025	0.0436	0.0055	0.0423
1984	0	0.1832	0.152	0.1206	0.1092	0.1498	0.0759	0.0332	0.0383	0.0585	0.0409	0.0336	0.0247	0.0075	0.0565
1985	0	0.1113	0.2993	3.9476	3.7598	4.1374	1.7813	0.2464	0.0086	0.0747	0.0675	0.0479	0.0443	0.0393	0.0214
1986	0	0.1141	0.1494	0.0656	0.1902	0.1682	0.4018	0.4063	0.1379	0.0553	0.0302	0.09	0.0713	0.0196	0.073
1987	0	0.1469	0.8294	0.2079	0.0235	0.0325	0.0383	0.0956	0.1037	0.0375	0	0.0189	0.0639	0	0.0178
1988	0	0.4955	0.0356	0.0734	0.0117	0.0291	0.0374	0.0592	0.0263	0.0228	0.0376	0.0318	0.0286	0.018	0
1989	0	0.2045	0.152	0.1025	0.3948	0.3992	0.2716	0.1581	0.1302	0.0368	0.0862	0	0.0281	0.0112	0.0223
1990	0	0.0142	0.0763	0.3089	0.0837	0.0298	0.0568	0.0358	0.0222	0.0398	0.0213	0.0274	0.0116	0.0104	0.0221
1991	0	0.1547	0.1075	0.4132	0.5857	0.4284	0.2992	0.1614	0.0541	0.0411	0	0.0253	0.0129	0	0.0196
1992	0	0.7278	0.2214	0.1416	0.1389	0.1529	0.0917	0.0898	0.0385	0.0119	0.0385	0.0719	0.0242	0.0121	0.0262
1993	0	0.6247	0.2723	0.2922	0.1835	0.0556	0.1169	0.0468	0.0232	0.0098	0.0232	0	0	0	0
1994	0	0.0125	0.0447	0.0912	0.1226	0.0765	0.0665	0.0738	0.0447	0.0077	0.0113	0.0068	0	0	0.0032
1995	0	0.0627	0.0349	0.7764	1.9524	0.3867	0.1025	0.0311	0.054	0.0195	0.0113	0	0	0	0
1996	0	0.2516	0.0352	0.0052	0.0648	0.1416	0.0823	0.0492	0.0199	0	0	0	0	0	0
1997	0	0.5384	0.4224	0.7541	0.5494	0.6651	0.1879	0.1783	0.0323	0.0336	0.0075	0	0	0	0
1998	0	0.8484	0.2697	0.866	0.1725	0.053	0.1625	0.1477	0.0584	0.0305	0	0	0	0	0

1999	0	0.6332	1.0499	0.1803	0.123	0.0449	0.0736	0.0488	0.0116	0	0	0	0	0	0
2000	0	0.8535	0.1098	0.1216	0.0805	0.1425	0.1024	0.0511	0.0262	0.0142	0	0	0	0	0
2001	0	0.6668	0.2016	0.1326	0.0562	0.2597	0.2333	0.1048	0.0466	0	0.0118	0	0.005	0	0
2002	0	0.0934	0.0265	0.0427	0.1979	0.1349	0.1697	0.0613	0.0152	0	0	0	0	0	0
2003	0	0.3387	0.8167	0.0527	0.0826	0.0341	0.0474	0.0408	0.0208	0	0	0.0121	0	0	0
2004	0	0.0772	0.1962	0.0426	0.0085	0.0358	0.0578	0.0424	0.0128	0	0.0209	0	0	0	0
2005	0	0.0174	0.4148	0.0142	0.0371	0.1133	0.8795	0.3521	0.1578	0.0428	0.0173	0	0	0	0

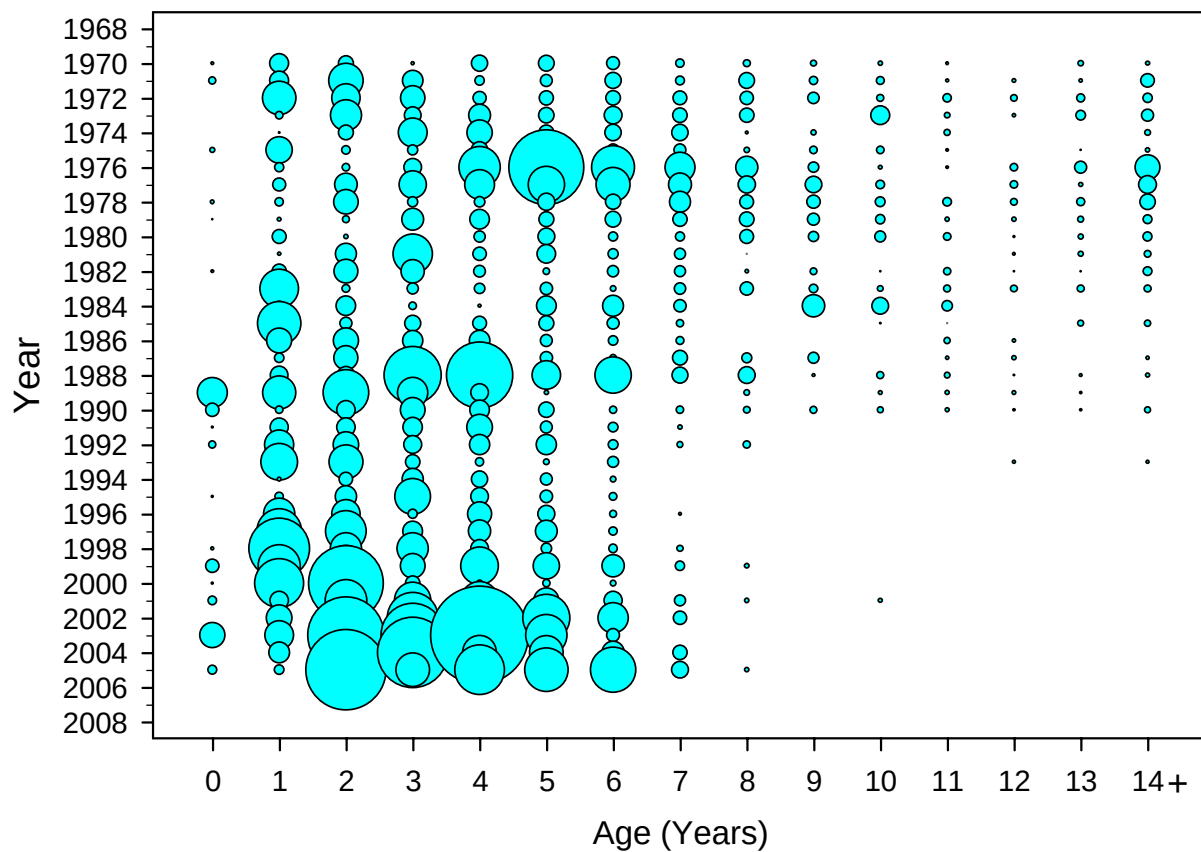
Autumn	Linear	Pollock					Age			~lcol/survey/Pollock/polindices_age.tr.xls					
	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1970	0.006	0.131	0.0883	0.0071	0.0991	0.0934	0.0678	0.032	0.0232	0.0179	0.0113	0.006	0	0.0158	0.0099
1971	0.0247	0.1308	0.4066	0.1537	0.0389	0.0597	0.0986	0.0346	0.0947	0.0305	0.0288	0.0074	0.0088	0.0081	0.0744
1972	0	0.3839	0.2812	0.2119	0.0683	0.0773	0.0834	0.0757	0.0697	0.053	0.0229	0.0312	0.0208	0.0299	0.0392
1973	0	0.0276	0.3318	0.1073	0.1711	0.0916	0.12	0.0829	0.0792	0	0.1316	0.0168	0.0078	0.0401	0.0592
1974	0	0.0029	0.0857	0.2918	0.226	0.0864	0.1017	0.1011	0.0058	0.0144	0	0.0203	0	0	0.0171
1975	0.0135	0.2487	0.0321	0.0437	0.1051	0.0732	0.0576	0.0571	0.0155	0.0272	0.0254	0.0051	0	0.0025	0.0115
1976	0	0.0377	0.0267	0.1149	0.5738	1.8192	0.616	0.3119	0.174	0.0452	0.0096	0.0051	0.026	0.0568	0.2211
1977	0	0.0668	0.1853	0.2615	0.3053	0.4529	0.4017	0.1882	0.1132	0.1056	0.0328	0	0.0267	0.0105	0.1213
1978	0.0096	0.0316	0.2118	0.0432	0.0457	0.1104	0.0897	0.1592	0.0768	0.0685	0.0416	0.0323	0.0219	0.0293	0.0921
1979	0.0025	0.0095	0.0228	0.1713	0.1442	0.0861	0.0949	0.0771	0.0828	0.0599	0.0389	0.0121	0.0119	0.0174	0.0336
1980	0	0.0766	0.012	0.009	0.0515	0.1063	0.0368	0.0371	0.0768	0.0439	0.0503	0.0257	0.0038	0.0147	0.0362
1981	0	0.0081	0.1607	0.5275	0.0722	0.1283	0.0426	0.0495	0.0013	0.0006	0	0	0.0057	0.0143	0.0226
1982	0.0057	0.0783	0.2017	0.1965	0.0562	0.0206	0.0527	0.0499	0.0085	0.0216	0.0025	0.025	0.0023	0.0023	0.0347
1983	0	0.5078	0.0281	0.0527	0.0456	0.0604	0.0164	0.0533	0.0722	0.0323	0.0164	0.0229	0.022	0.0228	0.0228
1984	0	0.0363	0.1424	0.0276	0.0066	0.1443	0.1588	0.0612	0	0.1766	0.1081	0.0469	0	0	0
1985	0	0.6378	0.0573	0.0957	0.0753	0.0874	0.0589	0.0242	0	0	0.0028	0.0013	0	0.0192	0.0197
1986	0	0.221	0.2236	0.1494	0.1524	0.0579	0.0379	0.0285	0	0	0	0.0193	0.0082	0	0
1987	0	0.039	0.21	0.0602	0	0.0605	0.0214	0.0869	0.0422	0.0494	0	0.0082	0.0113	0	0.0082
1988	0	0.1193	0.1131	1.084	1.4345	0.2868	0.4487	0.0976	0.1058	0.0057	0.0234	0.0162	0.0033	0.006	0.01
1989	0.3121	0.3775	0.6935	0.321	0.1148	0.0113	0	0	0.0164	0	0.0098	0.0118	0.0098	0.005	0
1990	0.07	0.0254	0.1271	0.2151	0.1396	0.0915	0.0239	0.0262	0.0226	0.0227	0.0192	0.0101	0.005	0.005	0.0192
1991	0.0036	0.1228	0.1255	0.1365	0.2313	0.0574	0.0397	0.0113	0	0	0	0	0	0	0
1992	0.024	0.2958	0.2318	0.1198	0.1486	0.1496	0.0395	0.0175	0.0243	0	0	0	0	0	0
1993	0	0.4554	0.3943	0.0811	0.0313	0.0166	0.0505	0	0	0	0	0	0.0071	0	0.0071

1994	0	0.0094	0.0727	0.1643	0.1003	0.0589	0.0163	0	0	0	0	0	0	0	0
1995	0.0041	0.0305	0.1655	0.4329	0.1141	0.0643	0.0288	0	0	0	0	0	0	0	0
1996	0	0.3433	0.2826	0.0371	0.2063	0.1104	0.0237	0.0057	0	0	0	0	0	0	0
1997	0	0.6759	0.5626	0.1475	0.1775	0.1723	0.0306	0	0	0	0	0	0	0	0
1998	0.0076	1.2064	0.3386	0.3354	0.1161	0.0468	0.0326	0.0199	0	0	0	0	0	0	0
1999	0.07	0.6034	0.5628	0.2154	0.4835	0.2453	0.1825	0.0382	0.0126	0	0	0	0	0	0
2000	0.0041	0.8003	1.8248	0.0811	0.0187	0.0247	0.0162	0	0	0	0	0	0	0	0
2001	0.0325	0.1249	0.5812	0.4545	0.4854	0.219	0.1244	0.0497	0.0118	0	0.0099	0	0	0	0
2002	0	0.236	0.1753	0.8632	0.6586	0.7452	0.3193	0.0711	0	0	0	0	0	0	0
2003	0.2231	0.2901	1.9049	1.3269	3.0857	0.5745	0.0675	0	0	0	0	0	0	0	0
2004	0	0.1545	0.4166	1.6252	0.3926	0.3879	0.1828	0.0797	0	0	0	0	0	0	0
2005	0.0349	0.04	2.095	0.3912	0.8209	0.6295	0.6874	0.1076	0.0113	0	0	0	0	0	0

Pollock Number at Age Indices from NEFSC Spring Survey



Pollock Number at Age Indices from NEFSC Autumn Survey



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N. Acadian redfish

N. Acadian redfish

N. Acadian redfish

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0.000	0.000	0.000	0.000	0.000	0.0014	0.0376	0.0859	0.0298	0.1533	0.0536	0.1261
0.0599	0.0827	0.0713	0.0561	0.0428	0.0536	0.0261	0.0225	0.0109	0.0203	0.0108	0.0055
0.0027	0.0473	20034.0									
0.000	0.000	0.000	0.000	0.000	0.000	0.0196	0.0692	0.1554	0.036	0.1592	0.0584
0.0606	0.0419	0.0742	0.0514	0.0253	0.0268	0.0471	0.0154	0.0212	0.0246	0.0151	0.0113
0.0269	0.0604	19095.0									
0.000	0.000	0.000	0.000	0.000	0.000	0.005	0.0523	0.1685	0.1781	0.0467	0.1558
0.0441	0.0658	0.0504	0.043	0.0382	0.0293	0.0183	0.0198	0.0087	0.0125	0.009	0.0063
0.0061	0.042	17360.0									
0.000	0.000	0.0122	0.0042	0.000	0.0007	0.0003	0.0069	0.0748	0.1874	0.1168	0.0966
0.0678	0.0442	0.0517	0.0371	0.0577	0.0361	0.0254	0.0262	0.0234	0.029	0.0108	0.0113
0.0099	0.0696	10471.0									
0.000	0.000	0.0002	0.0294	0.003	0.0005	0.000	0.0013	0.0052	0.0822	0.1844	0.0911
0.0817	0.061	0.0427	0.0569	0.0575	0.0522	0.040	0.0472	0.0257	0.0375	0.0208	0.0124
0.0126	0.0542	10572.0									
0.000	0.000	0.000	0.0065	0.2986	0.0146	0.000	0.000	0.0007	0.0016	0.0156	0.0902
0.1125	0.0567	0.0575	0.0463	0.0411	0.0389	0.0475	0.0203	0.0256	0.0227	0.0108	0.0224
0.0031	0.067	10696.0									
0.000	0.000	0.000	0.000	0.0061	0.4335	0.0081	0.000	0.000	0.000	0.0021	0.0551
0.0327	0.1039	0.0472	0.0711	0.0379	0.0308	0.0275	0.0119	0.0183	0.014	0.003	0.0148
0.0262	0.0558	13223.0									
0.000	0.000	0.000	0.000	0.000	0.0064	0.5767	0.005	0.000	0.0008	0.0008	0.0043
0.0396	0.0348	0.0692	0.041	0.0307	0.0203	0.0211	0.0301	0.021	0.0172	0.0117	0.0045
0.0124	0.0521	14083.0									
0.000	0.000	0.000	0.000	0.0006	0.0051	0.0211	0.5911	0.0038	0.0029	0.0012	0.0042
0.0135	0.0306	0.0491	0.0324	0.0394	0.0245	0.021	0.0251	0.0199	0.0148	0.0133	0.0134
0.0106	0.0624	14755.0									
0.000	0.000	0.000	0.000	0.000	0.0049	0.0065	0.0412	0.6266	0.0077	0.0016	0.0017
0.008	0.0182	0.0308	0.0453	0.0319	0.0246	0.0209	0.0168	0.0175	0.0137	0.0129	0.0109
0.0098	0.0485	10183.0									
0.000	0.000	0.0012	0.000	0.0039	0.002	0.0029	0.0024	0.0114	0.6313	0.0043	0.0011
0.000	0.0022	0.0162	0.0186	0.065	0.0258	0.0272	0.0202	0.0162	0.0194	0.0156	0.0166
0.0178	0.0785	7915.0									
0.000	0.000	0.0002	0.019	0.0086	0.0042	0.0064	0.0021	0.000	0.0011	0.5091	0.0039
0.0022	0.0015	0.009	0.013	0.0408	0.0317	0.0588	0.0227	0.0351	0.0339	0.0211	0.0094
0.0073	0.159	6903.0									
0.000	0.000	0.000	0.001	0.1464	0.0138	0.004	0.0037	0.0075	0.0043	0.0122	0.4302
0.005	0.0092	0.0056	0.0036	0.0074	0.0277	0.0234	0.0478	0.0147	0.0194	0.0272	0.0169
0.0114	0.1576	5328.0									
0.000	0.000	0.0033	0.0008	0.0037	0.4813	0.000	0.0014	0.0029	0.000	0.0025	0.0011
0.2575	0.000	0.0032	0.0035	0.0025	0.0066	0.0151	0.012	0.0234	0.0155	0.0104	0.0113
0.0117	0.1303	4793.0									
0.000	0.000	0.0026	0.0143	0.0032	0.003	0.3734	0.000	0.0027	0.0011	0.0013	0.0039
0.0012	0.3131	0.000	0.0024	0.0011	0.0099	0.0113	0.0254	0.0225	0.0183	0.0193	0.0139
0.0105	0.1456	4282.0									
0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
2929.0											
0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
1894.0											
0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
1177.0											
0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
669.427											
0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
638.655											
0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
2039.117											
0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
977.965											
0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
1045.675											
0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
545.862											
0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
630.859											
0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
688.715											
0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
431.629											
0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
586.094											
0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
382.944											
0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
487.886											
0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
727.67											

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1972	44988.7839427438	0.186808667406035	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
1973	31117.446960034	0.179111628330722	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
1974	44137.5879464286	0.302663031640376	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
1975	72978.806459042	0.285549050194399	0.0000	0.0001	0.0085	0.2724	0.0023	0.0025	0.0000	0.0000	0.0000
0.0000	0.0000	0.0135	0.0173	0.0996	0.0382	0.0829	0.0436	0.0461	0.0298	0.0176	0.0216
0.0120	0.0529	0.0195	0.0231	0.0271	0.0181	0.1514	100				
1976	27933.7897321429	0.38676100913081	0.0000	0.0000	0.0020	0.0168	0.3159	0.0048	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0311	0.0049	0.0880	0.0449	0.0415	0.0576	0.0358	0.0341	0.0285
0.0206	0.0029	0.0586	0.0000	0.0106	0.0155	0.1859	100				
1977	31515.4773629149	0.154789125889299	0.0000	0.0020	0.0007	0.0006	0.0319	0.5005	0.0014	0.0014	0.0014
0.0000	0.0000	0.0000	0.0000	0.0201	0.0259	0.0774	0.0366	0.0301	0.0146	0.0147	0.0127
0.0151	0.0166	0.0083	0.0314	0.0087	0.1509	0.0000	100				
1978	37883.3319733169	0.157740389262214	0.0003	0.0001	0.0041	0.0020	0.0069	0.0732	0.5333	0.0000	0.0000
0.0032	0.0000	0.0015	0.0023	0.0126	0.0616	0.0434	0.0318	0.0269	0.0207	0.0100	0.0237
0.0160	0.0113	0.0114	0.0227	0.0088	0.0131	0.0589	100				
1979	29189.315702255	0.211500272707986	0.0033	0.0000	0.0022	0.0069	0.0022	0.0095	0.0387	0.0000	0.0000
0.5368	0.0012	0.0013	0.0012	0.0062	0.0123	0.0222	0.0453	0.0614	0.0238	0.0323	0.0223
0.0155	0.0290	0.0187	0.0128	0.0050	0.0039	0.0860	100				
1980	23073.9150191327	0.308889115123398	0.0014	0.0403	0.0019	0.0049	0.0208	0.0145	0.0078	0.0000	0.0000
0.0222	0.4781	0.0026	0.0000	0.0000	0.0026	0.0020	0.0142	0.0691	0.0365	0.0258	0.0382
0.0184	0.0115	0.0303	0.0137	0.0153	0.0213	0.1066	100				
1981	22352.3353528912	0.31898624119992	0.0000	0.0062	0.0431	0.0123	0.0015	0.0124	0.0042	0.0000	0.0000
0.0074	0.0416	0.2958	0.0084	0.0183	0.0231	0.0239	0.0187	0.0468	0.0282	0.1701	0.0123
0.0339	0.0252	0.0198	0.0166	0.0153	0.0208	0.0940	100				
1982	6349.98487811791	0.271856209535326	0.0000	0.0033	0.0064	0.4456	0.0451	0.0000	0.0000	0.0000	0.0000
0.0020	0.0133	0.0183	0.2467	0.0105	0.0089	0.0039	0.0066	0.0166	0.0378	0.0188	0.0331
0.0038	0.0077	0.0096	0.0077	0.0096	0.0052	0.0394	100				
1983	7535.29475623583	0.231020715463835	0.0015	0.0250	0.0308	0.0343	0.4121	0.0163	0.0052	0.0000	0.0000
0.0076	0.0120	0.0238	0.0250	0.2443	0.0058	0.0055	0.0073	0.0121	0.0141	0.0120	0.0177
0.0031	0.0056	0.0142	0.0121	0.0095	0.0072	0.0360	100				
1984	7188.51019345238	0.377813593850363	0.0052	0.0509	0.0330	0.0274	0.0035	0.3223	0.0043	0.0000	0.0000
0.0070	0.0027	0.0035	0.0039	0.0000	0.4073	0.0000	0.0039	0.0000	0.0099	0.0041	0.0023
0.0000	0.0097	0.0000	0.0017	0.0023	0.0017	0.0137	100				
1985	10396.7651254252	0.309738389127771	0.0000	0.0140	0.1024	0.1178	0.0277	0.0242	0.2419	0.0000	0.0000
0.0139	0.0000	0.0303	0.0000	0.0541	0.0033	0.2339	0.0015	0.0109	0.0000	0.0111	0.0022
0.0049	0.0043	0.0830	0.0000	0.0106	0.0000	0.0080	100				
1986	14629.1905718537	0.336070857570531	0.0000	0.0000	0.0108	0.2161	0.3510	0.0197	0.0000	0.0000	0.0000
0.1921	0.0034	0.0004	0.0057	0.0025	0.0057	0.0047	0.1472	0.0000	0.0008	0.0000	0.0010
0.0027	0.0000	0.0000	0.0268	0.0000	0.0007	0.0087	100				
1987	9968.57141794218	0.323399316864771	0.0000	0.0119	0.0461	0.0502	0.2591	0.1388	0.0057	0.0000	0.0000
0.0061	0.1637	0.0000	0.0027	0.0066	0.0037	0.0023	0.2074	0.0036	0.0037	0.0000	0.0000
0.0021	0.0016	0.0055	0.0030	0.0634	0.0000	0.0092	100				
1988	11559.7036139456	0.569417368265127	0.0299	0.0904	0.0334	0.0595	0.0198	0.1900	0.1144	0.0000	0.0000
0.0063	0.0000	0.1856	0.0000	0.0000	0.0051	0.0102	0.0041	0.0092	0.1856	0.0000	0.0000
0.0012	0.0000	0.0000	0.0000	0.0000	0.0392	0.0160	100				
1989	12447.9070684524	0.300597549345325	0.0031	0.0450	0.1682	0.1314	0.0440	0.0274	0.0242	0.2423	0.0000
0.0503	0.0000	0.0063	0.1317	0.0000	0.0000	0.0018	0.0092	0.0027	0.0028	0.0630	0.0000
0.0018	0.0076	0.0110	0.0064	0.0000	0.0015	0.0423	100				
1990	22206.2899447279	0.331332133463519	0.0063	0.0070	0.0253	0.1055	0.3132	0.1092	0.0454	0.0000	0.0000
0.0759	0.0695	0.0223	0.0014	0.0819	0.0000	0.0000	0.0090	0.0048	0.0070	0.0015	0.0587
0.0000	0.0073	0.0010	0.0035	0.0000	0.0034	0.0409	100				
1991	15275.9560161565	0.446909525624668	0.0106	0.0059	0.0184	0.0558	0.2403	0.1495	0.0614	0.0000	0.0000
0.0379	0.0965	0.0432	0.0240	0.0000	0.1097	0.0051	0.0059	0.0000	0.0121	0.0101	0.0037
0.0666	0.0000	0.0051	0.0000	0.0089	0.0000	0.0294	100				
1992	14786.4635629252	0.291798723284711	0.0089	0.0100	0.0256	0.0881	0.1258	0.1779	0.1768	0.0000	0.0000
0.0519	0.0335	0.0557	0.0392	0.0143	0.0168	0.0861	0.0000	0.0112	0.0027	0.0081	0.0099
0.0000	0.0317	0.0000	0.0041	0.0025	0.0000	0.0190	100				
1993	20458.0521896259	0.325839928890841	0.0101	0.0294	0.0531	0.1174	0.1520	0.1935	0.1263	0.0000	0.0000
0.1162	0.0252	0.0255	0.0345	0.0156	0.0177	0.0000	0.0407	0.0018	0.0000	0.0019	0.0030
0.0014	0.0000	0.0175	0.0000	0.0000	0.0000	0.0173	100				
1994	10850.3763818027	0.433564933414897	0.0184	0.0466	0.0949	0.1340	0.1052	0.1212	0.1074	0.0000	0.0000
0.1308	0.0725	0.0306	0.0198	0.0374	0.0106	0.0016	0.0000	0.0427	0.0000	0.0000	0.0009
0.0008	0.0015	0.0000	0.0176	0.0000	0.0000	0.0056	100				
1995	8499.75251204649	0.239522466024601	0.0061	0.0299	0.1631	0.5279	0.0875	0.0570	0.0280	0.0000	0.0000
0.0221	0.0298	0.0073	0.0074	0.0026	0.0027	0.0086	0.0000	0.0120	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0028	0.0000	0.0051	100				
1996	55962.3741390306	0.332323577778657	0.0003	0.0006	0.0114	0.3269	0.4075	0.0770	0.0695	0.0000	0.0000
0.0504	0.0048	0.0110	0.0189	0.0027	0.0028	0.0029	0.0038	0.0000	0.0052	0.0000	0.0000
0.0003	0.0007	0.0000	0.0000	0.0000	0.0015	0.0017	100				
1997	34605.1963329082	0.392660463626439	0.0051	0.0015	0.0216	0.0725	0.2734	0.2226	0.0642	0.0000	0.0000
0.0540	0.0576	0.0373	0.0276	0.0760	0.0047	0.0177	0.0111	0.0091	0.0050	0.0021	0.0185
0.0009	0.0000	0.0025	0.0001	0.0024	0.0000	0.0126	100				
1998	57948.1060171228	0.446158535880193	0.0022	0.0007	0.0079	0.0274	0.1177	0.3412	0.2411	0.0000	0.0000
0.0717	0.0602	0.0458	0.0337	0.0074	0.0215	0.0000	0.0029	0.0069	0.0015	0.0000	0.0000
0.0078	0.0000	0.0004	0.0006	0.0000	0.0000	0.0014	100				
1999	41769.3885770975	0.235075767171274	0.0219	0.0100	0.0062	0.0217	0.0970	0.1553	0.2282	0.0000	0.0000
0.1878	0.0822	0.0521	0.0618	0.0145	0.0034	0.0420	0.0000	0.0014	0.0004	0.0021	0.0003
0.0000	0.0015	0.0000	0.0000	0.0004	0.0008	0.0091	100				
2000	47793.5371811224	0.287312588423261	0.0029	0.0157	0.0375	0.0557	0.0773	0.1372	0.1710	0.0000	0.0000
0.2676	0.1115	0.0160	0.0097	0.0469	0.0059	0.0064	0.0302	0.0008	0.0008	0.0026	0.0009
0.0000	0.0000	0.0009	0.0000	0.0000	0.0000	0.0023	100				
2001	51463.0304101828	0.24749107362391	0.0161	0.0084	0.0140	0.0255	0.0288	0.0539	0.0905	0.0000	0.0000
0.0997	0.2999	0.1934	0.0119	0.0329	0.0436	0.0054	0.0010	0.0528	0.0000	0.0022	0.0000
0.0054	0.0000	0.0000	0.0107	0.0000	0.0000	0.0039	100				
2002	76505.0088679847	0.333909931262869	0.0014	0.0105	0.0736	0.0758	0.0928	0.0793	0.0974	0.0000	0.0000
0.1269	0.1034	0.1788	0.1101	0.0109	0.0089	0.0077	0.0019	0.0000	0.0167	0.0000	0.0000

Appendix to the GARM III Report

Appendix to the GARM III Report

2001	69361.8980600553	0.538636517557833	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
2002	111816.589645302	0.631168862430275	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
2003	60899.523953125	0.425057707393348	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
2004	101702.498581739	0.426975267155812	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
2005	84513.6894034864	0.52556976471304	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
2006	18873.6882891865	0.340864500133323	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
2007	64115.3795633503	0.35375956066862	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
# Phase Control Data											
# Phase for F mult in 1st Year											
2											
# Phase for F mult Deviations											
4											
# Phase for Recruitment Deviations											
3											
# Phase for N in 1st Year											
4											
# Phase for Catchability in 1st Year											
1											
# Phase for Catchability Deviations											
-5											
# Phase for Stock Recruitment Relationship											
1											
# Phase for Steepness											
5											
# Recruitment CV by Year											
0.1											
0.1											
0.1											
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[illegible]

Discard Total CV by Year and Fleet


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0
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0
0
0
0
0
0
0
0
# Lambda for F mult in first year by fleet
0
# CV for F mult in first year by fleet
1
# Lambda for F mult Deviations by Fleet
0
# CV for F mult deviations by Fleet
1
# Lambda for N in 1st Year Deviations
1
# CV for N in 1st Year Deviations
0.01
# Lambda for Recruitment Deviations
1
# Lambda for Catchability in first year by index
0 0
# CV for Catchability in first year by index
1 1
# Lambda for Catchability Deviations by Index
0 0
# CV for Catchability Deviations by Index
1 1
# Lambda for Deviation from Initial Steepness
0
# CV for Deviation from Initial Steepness
0.2
# Lambda for Deviation from Initial unexploited Stock Size
1
# CV for Deviation from Initial unexploited Stock Size
0.6
# NAA for Year 1
2.6e+07 2.5e+07 2.4e+07 2.3e+07 2.2e+07 2.1e+07 2e+07 1.9e+07 1.8e+07 1.7e+07 1.6e+07 1.5e+07 1.4e+07 1.3e+07
1.2e+07 1.1e+07 1e+07 9e+06 8e+06 7e+06 6e+06 5e+06 4e+06 3e+06 2e+06 1e+06
# F mult in 1st year by Fleet
0.001
# Catchability in 1st year by index
1e-09 1e-09
# Initial unexploited Stock Size
2e+05
# Initial Steepness
0.65
# Maximum F
0.8
# Ignore Guesses
0
# Projection Control Data
```

```

# Do Projections? (1=yes, 0=no), still need to enter values even if not doing projections
1
# Fleet Directed Flag
1
# Final Year of Projections
2008
# Year Projected Recruits, What Projected, Target, non- directed F mult
2008      -1      3      -99      0
# MCMC info
# doMCMC (1=yes)
1
# MCMCnyear option (0=use final year values of NAA, 1=use final year + 1 values of NAA)
1
# MCMCnboot
100
# MCMCnthin
200
# MCMCseed
1415963
# R in agepro.bsn file (enter 0 to use NAA, 1 to use stock-recruit relationship, 2 to used geometric mean of previous years)
1
# Starting year for calculation of R
1990
# Starting year for calculation of R
2007
# Test Value
-23456
#####
# ---- FINIS ----

```

#c:\work\redfish\garm3\asap_2_0\garm3_final_model_1913_2007\discards_revised_mat_waa\red_1913_2007.rep

Age Structured Assessment Program (ASAP) Version 2.0
Start time for run: Thu Jul 10 09:21:29 2008

obj_fun = 5847.54

Component	Lambda	obj_fun
Catch_Fleet_1	1	433.777
Catch_Fleet_Total	1	433.777
Discard_Fleet_Total	0	0
__Index_Fit_1	1	513.52
__Index_Fit_2	1	471.303
Index_Fit_Total	2	984.823
Catch_Age_Comps	see_below	893.235
Discard_Age_Comps	see_below	0
Survey_Age_Comps	see_below	2034.91
__Sel_Param_1	1	28.1528
__Sel_Param_2	1	28.3867
__Sel_Param_3	1	26.755
__Sel_Param_4	1	19.9076
__Sel_Param_5	1	4.88645
__Sel_Param_6	1	1.05695
__Sel_Param_7	1	0.646849
__Sel_Param_8	1	0.235195
__Sel_Param_9	1	0.168969
Sel_Params_Total	9	110.197
__Index_Sel_Param_1	1	0.168969
__Index_Sel_Param_2	1	0.281511
__Index_Sel_Param_3	1	0.223825
__Index_Sel_Param_4	1	0.168969
__Index_Sel_Param_5	1	0.168969
__Index_Sel_Param_6	1	0.168969
__Index_Sel_Param_7	1	0.168969
__Index_Sel_Param_8	1	0.192309
__Index_Sel_Param_9	1	0.235404
__Index_Sel_Param_27	1	0.441013
__Index_Sel_Param_28	1	0.650305
__Index_Sel_Param_29	1	0.356215
__Index_Sel_Param_30	1	0.412965
__Index_Sel_Param_31	1	1.11904
__Index_Sel_Param_32	1	0.463146
__Index_Sel_Param_33	1	0.205532
__Index_Sel_Param_34	1	0.333029
__Index_Sel_Param_35	1	0.399088
Index_Sel_Params_Total	18	6.15823
q_year1_Total	0	0
q_devs_Total	0	0
__Fmult_year1_fleet_1	0	0
Fmult_year1_fleet_Total	0	0
Fmult_devs_fleet_Total	0	0
N_year_1	1	265.035
Recruit_devs	1	1104.2
SRR_steepness	0	-0
SRR_unexpl_stock	1	14.7494
Fmult_Max_penalty	1000	0.451968
F_penalty	0	0

Input and Estimated effective sample sizes for fleet 1

1913	0	5.16987
1914	0	5.17033
1915	0	5.1708
1916	0	5.17132
1917	0	5.1721
1918	0	5.17473
1919	0	5.17967
1920	0	5.18516
1921	0	5.19172
1922	0	5.19889
1923	0	5.20598
1924	0	5.21298
1925	0	5.21991
1926	0	5.22675
1927	0	5.2335
1928	0	5.24018
1929	0	5.24677
1930	0	5.25327
1931	0	5.2597
1932	0	5.26605
1933	0	5.27227
1934	0	5.27857
1935	0	5.28787
1936	0	5.30976
1937	0	5.34636
1938	0	5.39161
1939	0	5.44671
1940	0	5.52318
1941	0	5.63576
1942	0	5.81102
1943	0	6.0475
1944	0	6.34934
1945	0	6.72165
1946	0	7.15714
1947	0	7.68057
1948	0	8.29468

1949	0	8.97539
1950	0	9.67956
1951	0	10.425
1952	0	11.1183
1953	0	11.7171
1954	0	12.2133
1955	0	12.6508
1956	0	13.0698
1957	0	13.6111
1958	0	14.0295
1959	0	14.4208
1960	0	14.5098
1961	0	14.61
1962	0	14.7363
1963	0	14.7342
1964	0	15.0675
1965	0	14.97
1966	0	15.1908
1967	0	14.9297
1968	0	15.1156
1969	200	39.1796
1970	200	60.0522
1971	200	58.5578
1972	200	99.4896
1973	200	74.8004
1974	200	91.3737
1975	200	67.9365
1976	200	205.273
1977	200	135.924
1978	200	214.267
1979	200	469.428
1980	200	488.111
1981	200	186.531
1982	200	37.4877
1983	200	55.3494
1984	200	30.3489
1985	200	45.8613
1986	0	3.0473
1987	0	4.10773
1988	0	4.86413
1989	0	5.81336
1990	0	6.54031
1991	0	6.50771
1992	0	6.74486
1993	0	7.625
1994	0	8.51066
1995	0	9.87511
1996	0	7.61265
1997	0	4.77622
1998	0	4.21546
1999	0	4.77621
2000	0	5.23416
2001	0	5.87283
2002	0	7.37043
2003	0	8.78809
2004	0	9.80004
2005	0	8.45614
2006	0	8.87488
2007	0	7.96235
Total	3400	2973.83

Input and Estimated effective Discard sample sizes for fleet 1

1913	0	1e+15
1914	0	1e+15
1915	0	1e+15
1916	0	1e+15
1917	0	1e+15
1918	0	1e+15
1919	0	1e+15
1920	0	1e+15
1921	0	1e+15
1922	0	1e+15
1923	0	1e+15
1924	0	1e+15
1925	0	1e+15
1926	0	1e+15
1927	0	1e+15
1928	0	1e+15
1929	0	1e+15
1930	0	1e+15
1931	0	1e+15
1932	0	1e+15
1933	0	1e+15
1934	0	1e+15
1935	0	1e+15
1936	0	1e+15
1937	0	1e+15
1938	0	1e+15
1939	0	1e+15
1940	0	1e+15
1941	0	1e+15
1942	0	1e+15
1943	0	1e+15
1944	0	1e+15
1945	0	1e+15

```

1946 0 1e+15
1947 0 1e+15
1948 0 1e+15
1949 0 1e+15
1950 0 1e+15
1951 0 1e+15
1952 0 1e+15
1953 0 1e+15
1954 0 1e+15
1955 0 1e+15
1956 0 1e+15
1957 0 1e+15
1958 0 1e+15
1959 0 1e+15
1960 0 1e+15
1961 0 1e+15
1962 0 1e+15
1963 0 1e+15
1964 0 1e+15
1965 0 1e+15
1966 0 1e+15
1967 0 1e+15
1968 0 1e+15
1969 0 1e+15
1970 0 1e+15
1971 0 1e+15
1972 0 1e+15
1973 0 1e+15
1974 0 1e+15
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1990 0 1e+15
1991 0 1e+15
1992 0 1e+15
1993 0 1e+15
1994 0 1e+15
1995 0 1e+15
1996 0 1e+15
1997 0 1e+15
1998 0 1e+15
1999 0 1e+15
2000 0 1e+15
2001 0 1e+15
2002 0 1e+15
2003 0 1e+15
2004 0 1e+15
2005 0 1e+15
2006 0 1e+15
2007 0 1e+15
Total 0 9.5e+16

```

Observed and predicted total fleet catch by year and standardized residual
 fleet 1 total catches

```

1913 7.24 7.24 -1.1839e-05
1914 29.8 29.8 4.14824e-06
1915 40.23 40.23 5.92513e-06
1916 53.17 53.17 8.26824e-06
1917 82.48 82.48 1.35392e-05
1918 72.98 72.98 1.26364e-05
1919 24.8 24.8 4.52402e-06
1920 30.67 30.67 5.90157e-06
1921 12.54 12.54 2.54283e-06
1922 8.6 8.6 1.8331e-06
1923 6.92 6.92 1.55075e-06
1924 39.74 39.74 9.37301e-06
1925 24.77 24.77 6.13474e-06
1926 29.76 29.76 7.72995e-06
1927 30.06 30.06 8.19543e-06
1928 57.07 57.07 1.63163e-05
1929 33.85 33.85 1.01334e-05
1930 53.8 53.8 1.68515e-05
1931 107.62 107.62 3.52387e-05
1932 59.94 59.94 2.04888e-05
1933 119.89 119.89 4.27482e-05
1934 519 518.999 0.000192816
1935 7549 7548.78 0.00291776
1936 23162 23159.8 0.0093026
1937 14823 14822.1 0.00618519
1938 20640 20638.2 0.00893661
1939 25406 25403.1 0.0114044
1940 26762 26758.7 0.0124459
1941 50796 50783.6 0.0244457

```

1942	55892	55876.4	0.0278543
1943	48348	48335.9	0.0249823
1944	50439	50425.4	0.0270644
1945	37912	37903.9	0.0213414
1946	42423	42412.5	0.0247457
1947	40160	40150.6	0.0235276
1948	43631	43619.7	0.0259189
1949	30743	30737.3	0.018589
1950	34307	34300	0.0203559
1951	30077	30071.4	0.0186122
1952	21377	21374.9	0.00993788
1953	16791	16790.3	0.00416061
1954	12988	12988.2	-0.00135078
1955	13914	13914.5	-0.00335346
1956	14388	14388.7	-0.005191
1957	18490	18491.8	-0.0096077
1958	16047	16047.3	-0.00212329
1959	15521	15521	8.37354e-05
1960	11375	11374.1	0.00760518
1961	14101	14099.6	0.0100519
1962	14134	14131.2	0.0197551
1963	10046	10044.8	0.0118109
1964	8313	8312.04	0.0115344
1965	8057	8055.48	0.0189059
1966	8569	8566.3	0.0314785
1967	10864	10858.3	0.0525444
1968	6777	6774.14	0.0422041
1969	12455	12443.1	0.0956155
1970	16741	16718	0.137425
1971	20034	20000.8	0.165962
1972	19095	19064.1	0.162041
1973	17360	17335	0.144051
1974	10471	10461.5	0.0908746
1975	10572	10561.9	0.0952384
1976	10696	10685.4	0.098931
1977	13223	13206.4	0.125608
1978	14083	14061.9	0.149969
1979	14755	14740.9	0.0959291
1980	10183	10184.1	-0.0107329
1981	7915	7918.53	-0.044607
1982	6903	6906.57	-0.0517195
1983	5328	5326.69	0.0245985
1984	4793	4790.3	0.0563814
1985	4282	4282.15	-0.00348379
1986	2929	2931.14	-0.0728875
1987	1894	1895.29	-0.0681718
1988	1177	1177.48	-0.0407916
1989	669.427	670.178	-0.0374051
1990	638.655	639.339	-0.0368992
1991	2039.12	7903.43	-2.62692
1992	977.965	985.496	-0.191864
1993	1045.67	1141.74	-0.700271
1994	545.862	8123.59	-5.66537
1995	630.859	680.507	-0.536163
1996	688.715	741.812	-0.378725
1997	431.629	444.577	-0.163729
1998	586.094	731.752	-0.52762
1999	382.944	383.294	-0.0228475
2000	487.886	495.95	-0.098839
2001	727.67	741.883	-0.115268
2002	493.573	495.301	-0.0368743
2003	564.253	565.146	-0.0229354
2004	522.55	522.782	-0.0105585
2005	664.651	664.73	-0.00513963
2006	647.908	648.123	-0.0060345
2007	1160.39	1161.13	-0.00591422
Observed and predicted total fleet Discards by year and standardized residual			
fleet 1 total Discards			
1913	0	0	0
1914	0	0	0
1915	0	0	0
1916	0	0	0
1917	0	0	0
1918	0	0	0
1919	0	0	0
1920	0	0	0
1921	0	0	0
1922	0	0	0
1923	0	0	0
1924	0	0	0
1925	0	0	0
1926	0	0	0
1927	0	0	0
1928	0	0	0
1929	0	0	0
1930	0	0	0
1931	0	0	0
1932	0	0	0
1933	0	0	0
1934	0	0	0
1935	0	0	0
1936	0	0	0
1937	0	0	0
1938	0	0	0
1939	0	0	0

1940 0 0 0
 1941 0 0 0
 1942 0 0 0
 1943 0 0 0
 1944 0 0 0
 1945 0 0 0
 1946 0 0 0
 1947 0 0 0
 1948 0 0 0
 1949 0 0 0
 1950 0 0 0
 1951 0 0 0
 1952 0 0 0
 1953 0 0 0
 1954 0 0 0
 1955 0 0 0
 1956 0 0 0
 1957 0 0 0
 1958 0 0 0
 1959 0 0 0
 1960 0 0 0
 1961 0 0 0
 1962 0 0 0
 1963 0 0 0
 1964 0 0 0
 1965 0 0 0
 1966 0 0 0
 1967 0 0 0
 1968 0 0 0
 1969 0 0 0
 1970 0 0 0
 1971 0 0 0
 1972 0 0 0
 1973 0 0 0
 1974 0 0 0
 1975 0 0 0
 1976 0 0 0
 1977 0 0 0
 1978 0 0 0
 1979 0 0 0
 1980 0 0 0
 1981 0 0 0
 1982 0 0 0
 1983 0 0 0
 1984 0 0 0
 1985 0 0 0
 1986 0 0 0
 1987 0 0 0
 1988 0 0 0
 1989 0 0 0
 1990 0 0 0
 1991 0 0 0
 1992 0 0 0
 1993 0 0 0
 1994 0 0 0
 1995 0 0 0
 1996 0 0 0
 1997 0 0 0
 1998 0 0 0
 1999 0 0 0
 2000 0 0 0
 2001 0 0 0
 2002 0 0 0
 2003 0 0 0
 2004 0 0 0
 2005 0 0 0
 2006 0 0 0
 2007 0 0 0

Index data
 index number 1
 units = 1
 month = 10.5
 starting and ending ages for selectivity = 1 26
 selectivity choice = -1
 year, obs index, pred index, standardized residual
 1963 44046 69771.8 -1.56696
 1964 97988.4 71148.1 0.479684
 1965 24120.4 72847.8 -3.09824
 1966 53479.2 74453.4 -0.774278
 1967 44522.2 74995.4 -1.46608
 1968 73869.4 76642.1 -0.0888415
 1969 43404.5 75589 -2.17307
 1970 60207 70816.9 -0.875408
 1971 42779.2 63113.6 -1.75497
 1972 44988.8 54529.7 -1.03846
 1973 31117.4 47237.3 -2.34899
 1974 44137.6 43684.1 0.0348819
 1975 72978.8 41759.9 1.99389
 1976 27933.8 39192.1 -0.906995
 1977 31515.5 35180.3 -0.714916
 1978 37883.3 29851.9 1.5198
 1979 29189.3 22429.7 1.25922
 1980 23073.9 17166.8 0.979617
 1981 22352.3 14931.8 1.29601


```

1982 6349.98 12059.1 -2.4019
1983 7535.29 9874.63 -1.18571
1984 7188.51 8098.38 -0.326267
1985 10396.8 6638.59 1.48211
1986 14629.2 5750.24 2.85453
1987 9968.57 5619.57 1.81737
1988 11559.7 6410.91 1.11244
1989 12447.9 7488.63 1.72775
1990 22206.3 8784.34 2.87351
1991 15276 7003.77 1.82748
1992 14786.5 7791.21 2.24138
1993 20458.1 9402.61 2.44727
1994 10850.4 8502.97 0.587384
1995 8499.75 11549.6 -1.29818
1996 55962.4 16540.9 3.76582
1997 34605.2 22484 1.13872
1998 57948.1 29231.9 1.60605
1999 41769.4 36252.2 0.610829
2000 47793.5 43629.9 0.323636
2001 51463 53724.1 -0.176349
2002 76505 67283.5 0.395051
2003 119647 82830.1 0.795561
2004 66915.6 100522 -1.38624
2005 85779 120127 -1.47084
2006 91753.2 140006 -1.42132
2007 92058.2 159541 -2.25613
index number 2
units = 1
month = 4.5
starting and ending ages for selectivity = 1 26
selectivity choice = -1
year, obs index, pred index, standardized residual
1968 31214.9 68719.3 -2.40556
1969 35969.3 69575.2 -2.35079
1970 34585.9 67271.9 -1.33833
1971 130737 62005.4 2.53648
1972 81045.3 54303.7 0.850713
1973 46216.4 47658.1 -0.0982659
1974 34412.1 42837 -0.365445
1975 32173.4 39917 -0.626359
1976 47852.9 34977.3 0.620384
1977 21170 32725 -1.68173
1978 22226.8 29953.8 -1.49113
1979 58848.5 22926.9 2.94102
1980 37165.8 17223.5 2.31782
1981 33443.9 15848.1 1.20233
1982 17186 12648.8 0.861693
1983 11086.5 9665.73 0.350157
1984 4895.68 8035.46 -1.56131
1985 12068.1 6806.6 1.48638
1986 5876.66 5286.55 0.339266
1987 23615 4748.11 2.18573
1988 5967.39 5559.1 0.157343
1989 5448.57 6264.59 -0.402926
1990 12449.1 6940.98 1.43049
1991 7786.54 7052.14 0.269869
1992 19495 6281.7 2.89115
1993 31966.8 7592.94 3.04775
1994 7161.56 8325.64 -0.259348
1995 3501.44 8913.52 -2.41499
1996 21716.4 11869.2 1.03385
1997 62182.3 15752.4 2.16164
1998 14319.2 21987.5 -1.32265
1999 34744.6 28242.2 0.722226
2000 102320 34457.5 2.0152
2001 69361.9 44016.4 0.901045
2002 111817 56334.9 1.1839
2003 60899.5 68382.8 -0.284381
2004 101702 81526.4 0.540344
2005 84513.7 98469.6 -0.309463
2006 18873.7 115875 -5.47366
2007 64115.4 133541 -2.13675

Input and Estimated effective sample sizes for index 1
1963 0 0
1964 0 0
1965 0 0
1966 0 0
1967 0 0
1968 0 0
1969 0 0
1970 0 0
1971 0 0
1972 0 0
1973 0 0
1974 0 0
1975 100 43.5838
1976 100 47.0108
1977 100 13.4821
1978 100 29.4016
1979 100 57.7553
1980 100 159.191
1981 100 13.9383
1982 100 4.56135
1983 100 8.86103

```

Total 3300 2110.31
Input and Estimated effective sample sizes for index 2

Total	1300	770.209
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Index number 1

```
Year 1969 Obs = 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
```

N. Acadian redfish

Year 1988 Pred = 0.00418344 0.0247584 0.070048 0.0442769 0.0405849 0.175366 0.140196 0.023238 0.00943079 0.228991 0.00665757
 0.00388147 0.00461583 0.00349494 0.00413265 0.00661732 0.134605 0.00165102 0.0012424 0.000828415 0.00141846 0.00157084 0.00509342
 0.00757599 0.00996861 0.0455724
 Year 1989 Obs = 0.00310062 0.045009 0.168234 0.131426 0.0440088 0.0274055 0.242348 0.0503101 0.0.00630126 0.131726 0.0
 0.00180036 0.00920184 0.00270054 0.00280056 0.0630126 0.0.00180036 0.00760152 0.0110022 0.00640128 0.0.0015003 0.0423085
 Year 1989 Pred = 0.00416507 0.0135501 0.0548281 0.124948 0.0561825 0.045042 0.177685 0.119506 0.0193121 0.00962688 0.191916
 0.00546929 0.00313752 0.00368209 0.00275769 0.00323147 0.00513531 0.103798 0.00126635 0.000948635 0.000630112 0.0010754
 0.00118762 0.00384173 0.00570265 0.0413743
 Year 1990 Obs = 0.0063 0.007 0.0253 0.1055 0.3132 0.1092 0.0454 0.0759 0.0695 0.0223 0.0014 0.0819 0.0.009 0.0048 0.007
 0.0015 0.0587 0.0.0073 0.001 0.0035 0.0.0034 0.0409
 Year 1990 Pred = 0.00322051 0.0134449 0.0299065 0.097501 0.15848 0.0627391 0.0461855 0.153924 0.10146 0.0201872 0.00826206
 0.161449 0.00452718 0.00256294 0.00297514 0.00220813 0.00256799 0.0040551 0.0815263 0.000990143 0.000738885 0.000489192
 0.000832577 0.000917285 0.00296123 0.0358892
 Year 1991 Obs = 0.0105989 0.00589941 0.0183982 0.0557944 0.240276 0.149485 0.0613939 0.0378962 0.0964904 0.0431957 0.0239976 0
 0.109689 0.00509949 0.00589941 0.0.0120988 0.010099 0.00369963 0.0665933 0.0.00509949 0.0.00889911 0.0.0293971
 Year 1991 Pred = 0.00467856 0.0150371 0.042842 0.0758989 0.158319 0.189854 0.0652023 0.0357644 0.106425 0.0864184 0.0141171
 0.00566342 0.108893 0.00301334 0.00168741 0.00194113 0.00142983 0.00165232 0.00259525 0.0519409 0.00062841 0.000467419
 0.000308604 0.000523983 0.000576126 0.0241219
 Year 1992 Obs = 0.008990178 0.010002 0.0256051 0.0881176 0.125825 0.177936 0.176835 0.0519104 0.0335067 0.0557111 0.0392078
 0.0143029 0.0168034 0.0861172 0.0.0112022 0.00270054 0.00810162 0.00990198 0.0.0317063 0.0.00410082 0.0025005 0.0.0190038
 Year 1992 Pred = 0.0174115 0.0158346 0.034795 0.0797688 0.0997101 0.175802 0.184168 0.05217 0.0269673 0.0964447 0.0642978
 0.0102957 0.00406409 0.0771151 0.00211081 0.00117135 0.00133732 0.000978828 0.0011251 0.00175918 0.0350732 0.000422953
 0.000313724 0.00020664 0.000350147 0.0163062
 Year 1993 Obs = 0.010099 0.0293971 0.0530947 0.117388 0.151985 0.193481 0.126287 0.116188 0.0251975 0.0254975 0.0344966
 0.0155984 0.0176982 0.0.0406959 0.00179982 0.0.00189981 0.0029997 0.00139986 0.0.0174983 0.0.0.0172983
 Year 1993 Pred = 0.0208432 0.0545592 0.0339217 0.0600126 0.0974447 0.105897 0.170418 0.149521 0.0411969 0.0261867 0.0768916
 0.0502478 0.00791683 0.00308399 0.0578831 0.0015701 0.000864722 0.000980995 0.000714191 0.000817211 0.00127288 0.025295
 0.00030419 0.000225098 0.000147965 0.0117834
 Year 1994 Obs = 0.0183982 0.0465953 0.0948905 0.133987 0.105189 0.121188 0.107389 0.130787 0.0724928 0.0305969 0.019798
 0.0373963 0.0105989 0.00159984 0.0.0426957 0.0.0.00089991 0.00079992 0.00149985 0.0.0175982 0.0.00559944
 Year 1994 Pred = 0.0116784 0.0857629 0.153203 0.0758517 0.0857395 0.102326 0.0961259 0.114994 0.0898047 0.0304341 0.0158831
 0.0457144 0.0293945 0.0045704 0.00176108 0.0327553 0.000881799 0.000482572 0.000544537 0.000394648 0.000449845 0.000698391
 0.0138401 0.000166043 0.000122622 0.00642088
 Year 1995 Obs = 0.00610061 0.029903 0.163116 0.527953 0.0875088 0.0570057 0.0280028 0.0221022 0.029803 0.00730073 0.00740074
 0.00260026 0.00270027 0.00860086 0.0.0.0120012 0.0.0.0.0.0.0.00280028 0.0.00510051
 Year 1995 Pred = 0.00966505 0.0323987 0.162684 0.233985 0.0822107 0.079268 0.0828561 0.0646219 0.0731908 0.0686767 0.0191085
 0.00977512 0.0276831 0.0175664 0.00270167 0.00103163 0.0190431 0.000509411 0.000277291 0.000311485 0.000224881 0.000255499
 0.000395565 0.00782043 9.36335e-05 0.0036455
 Year 1996 Obs = 0.00030003 0.00060006 0.0114011 0.326933 0.407541 0.0770077 0.069507 0.050405 0.00480048 0.0110011 0.0189019
 0.00270027 0.00280028 0.00290029 0.00380038 0.0.00520052 0.0.00030003 0.00070007 0.0.0.00150015 0.00170017
 Year 1996 Pred = 0.00544386 0.0255552 0.058572 0.236975 0.243162 0.0752561 0.0666464 0.0588728 0.0450145 0.062777 0.0483627
 0.0131901 0.00663924 0.0185552 0.0116465 0.00177505 0.000672688 0.0123388 0.000328305 0.000177902 0.000199074 0.000143256
 0.000162309 0.000250693 0.00494623 0.00233658
 Year 1997 Obs = 0.00509949 0.00149985 0.0215978 0.0724928 0.273373 0.222578 0.0641936 0.0539946 0.0575942 0.0372963 0.0275972
 0.0759924 0.00469953 0.0176982 0.0110989 0.00909909 0.0049995 0.00209979 0.0184982 0.00089991 0.0.00249975 9.999e-05 0.00239976 0
 0.0125987
 Year 1997 Pred = 0.00394318 0.0151793 0.0487249 0.090033 0.261238 0.238264 0.0679813 0.0512006 0.0445693 0.0419828 0.0480704
 0.0363001 0.00974138 0.00483888 0.0133768 0.00832048 0.00125857 0.000473938 0.0086468 0.000229032 0.000123632 0.000137895
 9.89559e-05 0.00011852 0.00017241 0.00498307
 Year 1998 Obs = 0.0022 0.0007 0.0079 0.0274 0.1177 0.3412 0.2411 0.0717 0.0602 0.0458 0.0337 0.0074 0.0215 0.0.0029 0.0069
 0.0015 0.0.0078 0.0.0004 0.0006 0.0.0.0014
 Year 1998 Pred = 0.00428699 0.0114973 0.0302639 0.0783176 0.103767 0.267849 0.225679 0.0547809 0.0407104 0.0437094 0.0338039
 0.0379396 0.0281902 0.00746562 0.00366819 0.0100491 0.00620345 0.000932405 0.00034924 0.000617366 9.00505e-05
 0.000100161 7.17067e-05 8.08873e-05 0.00368394
 Year 1999 Obs = 0.0218978 0.009999 0.00619938 0.0216978 0.0969903 0.155284 0.228177 0.187781 0.0821918 0.0520948 0.0617938
 0.0144986 0.00339966 0.0419958 0.0.00139986 0.00039996 0.00209979 0.00029997 0.0.00149985 0.0.0.00039996 0.00079992 0.00090909
 Year 1999 Pred = 0.00496756 0.0131086 0.0240402 0.0510275 0.0948964 0.112251 0.267951 0.192559 0.0462046 0.0423486 0.0373066
 0.0282995 0.031252 0.0229159 0.00600299 0.00292293 0.00794705 0.00487479 0.00072879 0.000271742 0.00491653 0.000129305 6.93791e-
 05 7.69857e-05 5.500038e-05 0.00285317
 Year 2000 Obs = 0.00290058 0.0157031 0.0375075 0.0557111 0.0773155 0.137227 0.171034 0.267654 0.111522 0.0160032 0.00970194
 0.0469094 0.00590118 0.00640128 0.030206 0.00080016 0.00080016 0.00260052 0.00090018 0.0.0.00090018 0.0.0.00230046
 Year 2000 Pred = 0.0108908 0.0156537 0.0282468 0.0417733 0.0637292 0.105885 0.115942 0.236152 0.167884 0.0497082 0.0374058
 0.032321 0.0241086 0.0262741 0.0190568 0.00494702 0.00239061 0.00645859 0.0039406 0.000586468 0.000217837 0.00392842 0.000103031
 5.51507e-05 6.10735e-05 0.0022793
 Year 2001 Obs = 0.0161 0.0084 0.014 0.0255 0.0288 0.0539 0.0905 0.0997 0.2999 0.1934 0.0119 0.0329 0.0436 0.0054 0.001 0.0528 0
 0.0022 0.0.0054 0.0.0107 0.0.0.0039
 Year 2001 Pred = 0.00366303 0.0335419 0.0329673 0.0479701 0.0509777 0.0694588 0.106821 0.0997797 0.201016 0.176341 0.0428675
 0.0316198 0.0268832 0.0197889 0.0213324 0.015333 0.00395034 0.00189688 0.00509736 0.00309603 0.000459008 0.000169938 0.00305612
 7.99634e-05 4.27164e-05 0.00179101
 Year 2002 Obs = 0.0014 0.0105 0.0736 0.0758 0.0928 0.0793 0.0974 0.1269 0.1034 0.1788 0.1101 0.0109 0.0089 0.0077 0.0019 0
 0.0167 0.0.0006 0.0.0.0.0029 0.0.0004
 Year 2002 Pred = 0.00685174 0.0110931 0.0694613 0.055056 0.0576036 0.0547268 0.0690379 0.0906376 0.0837811 0.208266 0.150002
 0.0357432 0.0259417 0.0217658 0.0158481 0.0169301 0.012077 0.00309179 0.0014767 0.00395031 0.00239015 0.000353202 0.000130403
 0.00233958 6.10912e-05 0.00138414
 Year 2003 Obs = 0.00119988 0.0039996 0.0187981 0.0942906 0.10469 0.0936906 0.0567943 0.0947905 0.108589 0.0918908 0.148985
 0.110389 0.0127987 0.00679932 0.00589941 0.00539946 0.00079992 0.0292971 0.0.00079992 0.00409959 0.0.0.00379962 0.00219978
 Year 2003 Pred = 0.00165161 0.02111 0.0233713 0.118016 0.067264 0.0629313 0.0553715 0.0596378 0.0774983 0.0884051 0.180429
 0.127381 0.0298659 0.0213912 0.0177531 0.0128098 0.0135812 0.00962675 0.00245135 0.00116553 0.00310595 0.00187315 0.000276035
 0.000101671 0.0018204 0.00111126
 Year 2004 Obs = 0.0299 0.0025 0.01 0.0632 0.1557 0.0915 0.0578 0.0662 0.0786 0.1096 0.0875 0.1012 0.0762 0.0117 0.0068 0.0094
 0.0041 0.0011 0.028 0.0.0004 0.0001 0.0.0085
 Year 2004 Pred = 0.00319716 0.00516194 0.0451168 0.040282 0.146294 0.0745823 0.0646302 0.0485617 0.0517786 0.083037 0.0777703
 0.155583 0.108078 0.025007 0.0177167 0.0145709 0.0104344 0.0109927 0.00775039 0.00196464 0.000930537 0.00247167 0.00148648
 0.000218536 8.033e-05 0.00230305
 Year 2005 Obs = 0.00739852 0.00589882 0.0141972 0.09978 0.0717856 0.220156 0.074785 0.0729854 0.0716857 0.0627874 0.0940812
 0.0606879 0.0891822 0.0166967 0.00889822 0.00389922 0.00709858 0.00339932 0.0.0133973 0.0004999 0.0.0.00029994 0.0.00039992
 Year 2005 Pred = 0.00210083 0.0101477 0.0112036 0.0789696 0.0507086 0.164728 0.0777895 0.057565 0.0428205 0.0563477 0.0741916
 0.0681109 0.134073 0.0919112 0.0210357 0.0147687 0.0120548 0.00857796 0.00898869 0.00630882 0.0015931 0.0007521 0.00199217
 0.00119527 0.000175367 0.00188984
 Year 2006 Obs = 0.00040004 0.0156016 0.0352035 0.0325033 0.157916 0.0568057 0.228323 0.0622062 0.0561056 0.0405041 0.0394039
 0.0746075 0.0340034 0.10371 0.00690069 0.0080008 0.0149015 0.00270072 0.00590059 0.00410041 0.0136014 0.0.00050005 0.0.0.00160016
 Year 2006 Pred = 0.00103005 0.0068371 0.0225836 0.0201079 0.101945 0.0585651 0.176234 0.0710785 0.0520776 0.0478091 0.0516525
 0.0666638 0.0602181 0.116978 0.0793223 0.0179907 0.0125357 0.0101673 0.00719625 0.00750678 0.00524855 0.00132104 0.000621932
 0.00164348 0.000984066 0.00168099

[illegible]

Fmult by year for each fleet

796

1958 0.132158
1959 0.132998
1960 0.0994072
1961 0.125001
1962 0.128569
1963 0.0923007
1964 0.0753124
1965 0.071137
1966 0.0739233
1967 0.0923968
1968 0.0565511
1969 0.101947
1970 0.141265
1971 0.182919
1972 0.196333
1973 0.207792
1974 0.145073
1975 0.167227
1976 0.188335
1977 0.246385
1978 0.303262
1979 0.364648
1980 0.301533
1981 0.299575
1982 0.343829
1983 0.345944
1984 0.382745
1985 0.447507
1986 0.363824
1987 0.244977
1988 0.14831
1989 0.0759009
1990 0.0596688
1991 0.810317
1992 0.113762
1993 0.106902
1994 0.818588
1995 0.0737693
1996 0.0579532
1997 0.0222713
1998 0.0244263
1999 0.00905789
2000 0.00849867
2001 0.0100002
2002 0.0055358
2003 0.00530315
2004 0.00408046
2005 0.00424967
2006 0.00344785
2007 0.00506759

Directed F by age and year for each fleet
fleet 1 directed F at age

3.30382e-07 3.25548e-07 3.61277e-07 5.81836e-07 2.6524e-06 6.0311e-06 7.1323e-06 9.53081e-06 1.13186e-05 1.13186e-05 1.13186e-05
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1.35989e-06 1.33999e-06 1.48705e-06 2.3949e-06 1.09176e-05 2.48247e-05 2.93573e-05 3.92298e-05 4.65886e-05 4.65886e-05 4.65886e-05
4.65886e-05 4.65886e-05 4.65886e-05 4.65886e-05 4.65886e-05 4.65886e-05 4.65886e-05 4.65886e-05 4.65886e-05 4.65886e-05
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1.83593e-06 1.80907e-06 2.00761e-06 3.23326e-06 1.47394e-05 3.35148e-05 3.96342e-05 5.29627e-05 6.28974e-05 6.28974e-05
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2.4266e-06 2.3911e-06 2.65352e-06 4.2735e-06 1.94815e-05 4.42975e-05 5.23857e-05 7.00024e-05 8.31334e-05 8.31335e-05 8.31335e-05
8.31335e-05 8.31335e-05 8.31335e-05 8.31335e-05 8.31335e-05 8.31335e-05 8.31335e-05 8.31335e-05 8.31335e-05 8.31335e-05
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3.7646e-06 3.70952e-06 4.11664e-06 6.62985e-06 3.02233e-05 6.87226e-05 8.12705e-05 0.000108601 0.000128972 0.000128972
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N. Acadian redfish

Appendix to the GARM III Report

N. Acadian redfish

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Average F for ages 1 to 26
Preprint unweighted in .std and MCMC files
year      unweighted      Nweighted      Bweighted
1913      8.87233e-06      8.57849e-06      1.09242e-05
1914      3.65195e-05      3.5282e-05      4.49648e-05
1915      4.93035e-05      4.75958e-05      6.07036e-05
1916      6.51659e-05      6.28614e-05      8.02288e-05
1917      0.000101098      9.74526e-05      0.000124452
1918      8.94591e-05      8.61871e-05      0.00011011
1919      3.03979e-05      2.92782e-05      3.7411e-05
1920      3.75867e-05      3.6196e-05      4.62534e-05
1921      1.53636e-05      1.47951e-05      1.89051e-05
1922      1.05321e-05      1.01435e-05      1.296e-05
1923      8.47078e-06      8.15906e-06      1.04235e-05
1924      4.86225e-05      4.68379e-05      5.98315e-05
1925      3.02914e-05      2.91821e-05      3.72747e-05
1926      3.63744e-05      3.50454e-05      4.47604e-05
1927      3.67209e-05      3.53824e-05      4.51871e-05
1928      6.96781e-05      6.71441e-05      8.57436e-05
1929      4.13055e-05      3.98066e-05      5.08296e-05
1930      6.56127e-05      6.32376e-05      8.07424e-05
1931      0.000131183      0.000126446      0.000161435
1932      7.30268e-05      7.03951e-05      8.98681e-05
1933      0.000145994      0.000140746      0.000179665
1934      0.000631912      0.000609245      0.00077766
1935      0.00924212      0.0089102      0.0113737
1936      0.02902      0.0279142      0.0357024
1937      0.0191222      0.0182567      0.0235011
1938      0.0273674      0.0260061      0.0336076

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1939 0.0349455 0.0329864 0.0428661
 1940 0.0384159 0.0359578 0.0470569
 1941 0.0780443 0.0723934 0.0954481
 1942 0.0950736 0.0864205 0.115894
 1943 0.091595 0.0811806 0.111161
 1944 0.106785 0.0924552 0.128992
 1945 0.08922 0.0751955 0.10716
 1946 0.110625 0.0915793 0.132225
 1947 0.117472 0.0948678 0.139573
 1948 0.14528 0.114217 0.171505
 1949 0.115676 0.0879968 0.135388
 1950 0.144565 0.107966 0.168084
 1951 0.143285 0.104152 0.165132
 1952 0.111925 0.079871 0.127926
 1953 0.0929843 0.0651638 0.105791
 1954 0.0739407 0.0516471 0.0839571
 1955 0.0804999 0.0560018 0.0914636
 1956 0.0850458 0.059382 0.0965576
 1957 0.113775 0.079194 0.12889
 1958 0.103594 0.0708276 0.116835
 1959 0.104253 0.0713283 0.117081
 1960 0.0779225 0.052473 0.087313
 1961 0.0979845 0.0671098 0.109856
 1962 0.100781 0.0673683 0.112946
 1963 0.0723519 0.0489497 0.0809657
 1964 0.0590352 0.0385052 0.0660223
 1965 0.0557622 0.0370885 0.0625012
 1966 0.0579463 0.0406762 0.0649767
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 1973 0.162882 0.105684 0.198863
 1974 0.113719 0.0682444 0.132917
 1975 0.131084 0.0756941 0.143132
 1976 0.14763 0.0982708 0.154107
 1977 0.193134 0.166087 0.207808
 1978 0.237718 0.219527 0.256467
 1979 0.285837 0.24586 0.332691
 1980 0.236363 0.209563 0.29284
 1981 0.234829 0.189315 0.283541
 1982 0.269518 0.17499 0.309309
 1983 0.271176 0.146269 0.293337
 1984 0.300022 0.169248 0.316951
 1985 0.350788 0.173785 0.346254
 1986 0.285191 0.111097 0.273081
 1987 0.19203 0.0674766 0.180797
 1988 0.116256 0.0398134 0.103416
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 1999 0.00710022 0.00301252 0.00596864
 2000 0.00666187 0.00247185 0.00624213
 2001 0.00783888 0.00308157 0.00760385
 2002 0.00433936 0.00154431 0.00414417
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 2004 0.00319856 0.0013763 0.00297459
 2005 0.0033312 0.00163813 0.00318082
 2006 0.00270267 0.00153714 0.00265
 2007 0.00397234 0.00231012 0.00412204

Population Numbers at the Start of the Year

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9662.07 9026.33 8473.04 7990.19 7582.96 7209.63 6855.45 6518.54 6198.11 119246
45424.5 43225.7 41073.9 40413.1 39123.3 36734 32931.9 29121.9 25020.9 20997 17784.4 15149.7 13091.1 11528.9 10273.3 9331.78
8571.95 7911.74 7391.16 6938.1 6542.72 6209.26 5903.57 5613.54 5337.67 102719
42589.2 42976 40899 38840.2 38077.6 35633.5 31656.6 27872.8 23698.9 19774.1 16594 14055.1 11972.9 10345.9 9111.35 8119.01
7374.95 6774.45 6252.68 5841.27 5483.21 5170.74 4907.21 4665.62 4436.41 85397.8
41044.3 40338 40706.9 38721.5 36666.8 34989.4 31332.4 27438.8 23415.3 19450.2 16229.1 13619.1 11535.4 9826.4 8491.15 7477.89
6663.46 6052.79 5559.95 5131.72 4794.06 4500.2 4243.75 4027.46 3829.18 73729
39736.7 38832.9 38167.7 38494.3 36485.5 33403.2 30167.8 26534.3 23246.3 18522.1 15385.6 12837.6 10773.1 9124.76 7772.93 6716.72
5915.2 5270.97 4787.91 4398.06 4059.32 3792.23 3559.77 3356.91 3185.82 61350.5
36567.6 37597.6 36745.3 36095 36274.5 33250.8 28825.3 25574.4 21639.9 17705.4 14675.4 12190.3 10171.5 8535.69 7229.72 6158.64
5321.78 4686.72 4176.28 3793.55 3484.66 3216.27 3004.65 2820.47 2659.74 51133.3
42706.9 34639.5 35617.4 34794.3 34083.6 33369.9 29312 25060.1 21571.2 17845.2 14600.9 12102.2 10052.9 8388.01 7039.03 5962.05
5078.78 4388.66 3864.95 3444.01 3128.39 2873.66 2652.33 2477.81 2325.93 44360.9
38985 40483.6 32837.9 33752.3 32896.2 31532.5 29798.2 25874.2 21571.9 18223.9 15076.1 12335.3 10224.3 8492.95 7086.43 5946.77
5036.91 4290.7 3707.66 3265.22 2909.6 2642.95 2427.75 2240.76 2093.33 39442.4
42419.1 36981.7 38404.9 31142.4 31950.8 30607.7 28524.3 26709.2 22733.1 18672.7 15774.7 13050 10677.5 8850.2 7351.53 6134.04
5147.55 4359.97 3714.04 3209.37 2826.39 2518.56 2287.75 2101.47 1939.61 35953.5
36063.3 40229.5 35074.4 336412.3 29467.6 29669.9 27564.5 25432.9 23301.9 19513.9 16028.5 13540.9 11202 9165.45 7596.94 6310.49
5265.41 4418.61 3742.56 3188.1 2754.89 2426.15 2161.91 1963.78 1803.88 32527.1
37748.1 34196 38148.2 33248.4 34443.8 27326.8 26637.5 24487.5 22080.3 19886.4 16653.7 13679.2 11556.2 9560.07 7822.04 6483.44
5385.55 4493.65 3770.97 3194 2720.81 2351.1 2070.54 1845.03 1675.95 29299
39862.9 35755.3 32392.7 36120 31391.8 31668.3 24059.4 23123.7 20613.5 18165.8 16360.9 13701.2 11254.1 9507.44 7865.22 6435.32
5334.02 4430.77 3696.99 3102.43 2627.76 2238.46 1934.29 1703.46 1517.94 25483.6
33386.2 27772.8 33882.4 30683.2 34125.8 28950.2 28075.5 21057.3 19679.5 17180.7 15140.6 13636.3 11419.6 9379.94 7924.16 6555.43
5363.64 4445.75 3692.92 3081.33 2585.78 2190.16 1865.69 1612.17 1419.79 22505
41037.2 31634.9 35793.4 32093.4 28987.9 31465.3 25654.2 24559.3 17908.2 16388.5 14307.6 12608.7 11355.9 9509.87 7811.33 6599
5459.16 4466.68 3702.29 3075.35 2566.04 2153.36 1823.9 1553.69 1342.57 19923.8
31020.4 38922.7 30006.1 33939.9 30372.6 26939.2 28386.6 22921.3 21485.6 15422.9 14114.1 12321.9 10858.8 9779.92 8190.07 6727.26
5683.18 4701.53 3846.79 3188.48 2648.55 2209.92 1854.52 1570.77 1338.06 18315
45024.2 29400 36891.6 28429 32077.8 28057.3 23974.2 24956.9 19625.1 18036.2 12946.8 11848.1 10343.7 9115.5 8209.81 6875.21
5647.24 4770.78 3946.73 3229.21 2676.59 2223.34 1855.13 1556.79 1318.6 16497.9
28797 42667.9 27863 34948.6 26864.4 29607.8 24921.8 21030.2 21303.9 16415.8 15086.7 10829.6 9910.58 8652.19 7624.82 6867.24
5750.88 4723.73 3990.6 3301.31 2701.13 2238.88 1859.75 1551.76 1302.2 14902.9
52268.9 27318.9 40479.4 26426.1 33086.8 25007.4 26812.1 22366.8 18508.7 18478.1 14238.4 13085.6 9393.16 8596.04 7504.57 6613.46
5956.37 4988.09 4097.18 3461.29 2863.42 2342.85 1941.91 1613.07 1345.93 14055.7
33641.7 49610.6 25930.3 38412.7 25040.1 30922.6 22852.1 24322.4 19968.6 16328.8 16301.8 12561.4 11544.4 8286.85 7583.61 6620.69
5834.54 5254.84 4400.6 3614.62 3053.62 2526.17 2066.91 1713.2 1423.09 13587.6
18664 31934.6 47094.6 24609.7 36406 23425.2 28320.3 20784.7 21791 17690.5 14465.8 14442 11128.3 10227.3 7341.42 6718.42 5865.35
5168.89 4655.32 3898.54 3202.23 2705.24 2237.97 1831.1 1517.74 13298.2
4693.57 17715.5 30312.6 44692.2 23320.7 34035.7 21422 25713 18577.8 19251.2 15628.6 12779.8 12758.7 9831.28 9035.32 6485.76
5935.37 5181.73 4566.44 4112.74 3444.16 2829.01 2389.94 1977.13 1617.68 13089.1
3450.28 4452.64 16806.7 28749.3 42311.1 21708.2 30820.4 19224.7 22628.2 16112.1 16696.1 13554.3 11083.6 11065.4 8526.44 7836.12
5624.95 5147.61 4494 3960.37 3566.88 2987.04 2453.53 2072.74 1714.72 12754.8
1633.2 3276.6 4228.6 15958.2 27267.8 39717.7 20036.5 28290.9 17436.7 20341.1 14483.7 15008.6 12184.4 9963.41 9946.97 7664.67
7044.12 5056.43 4627.34 4039.78 3560.09 3206.37 2685.14 2205.55 1863.25 13007.1
1991.1 1548.93 3107.67 4009.3 15100.6 25325.6 35783 17873.4 24697.4 14978.7 17473.7 12442 12892.9 10466.8 8558.91 8544.78
6584.21 6051.14 4343.65 3975.04 3470.31 3058.24 2754.38 2306.62 1894.64 12774.1
2118.14 1886.2 1467.41 2942.81 3786.17 13896.4 22343.7 31138.9 15095 20397.9 12371.1 14431.8 10276 10648.4 8644.67 7068.92
7057.25 5437.99 4997.72 3587.48 3283.04 2866.18 2525.84 2274.88 1905.07 12115.1

133832 2004.11 1784.79 1387.72 2773.09 3450.4 11991.1 18940.1 25391.9 11958.5 16159.6 9800.64 11433.1 8140.81 8435.87 6848.46
5600.12 5590.88 4308.07 3959.28 2842.06 2600.88 2270.64 2001.02 1802.2 11107.1
4977.78 126577 1895.64 1687.14 1306.78 2519.23 2956.11 10078.9 15271 19847.9 9347.52 12631.3 7660.78 8936.83 6363.36 6594
5353.18 4377.4 4370.18 3367.45 3094.82 2221.53 2033.01 1774.87 1564.12 10090.7
2321.25 4706.38 119686 1791.26 1587.81 1183.97 2145.2 2466.83 8048.4 11800.8 15337.6 7223.35 9760.92 5919.91 6905.98 4917.32
5095.55 4136.7 3382.66 3377.08 2602.22 2391.54 1716.7 1571.02 1371.54 9006.31
1437.55 2198.72 4458.2 113323 1691.24 1459.88 1042.45 1862.3 2076.69 6622.02 9709.38 12619.4 5943.19 8031.03 4870.75 5682.07
4045.85 4192.49 3403.57 2783.17 2778.57 2141.04 1967.7 1412.46 1292.59 8538.63
1400.21 1360.78 2081.45 4218.2 106874 1546.94 1270.3 892.434 1538.8 1671.21 5329.05 7813.6 10155.4 4782.76 6462.95 3919.73
4572.63 3255.89 3373.89 2739.01 2239.75 2236.05 1723 1583.5 1136.67 7911.65
879.565 1324.61 1287.42 1968.07 3973.82 97272.3 1330.99 1073.12 724.416 1212.48 1316.81 4198.97 6156.63 8001.83 3768.52 5092.41
3088.5 3602.95 2565.44 2658.42 2158.17 1764.78 1761.87 1357.61 1247.7 7129.52
1109.6 830.672 1251.11 1215.04 1848.52 3567.94 81144.2 1084.01 829.531 538.604 901.479 979.052 3121.94 4577.46 5949.36 2801.9
3786.21 2296.31 2678.8 1907.41 1976.54 1604.6 1312.12 1309.95 1009.39 6228.47
28232.9 1046.18 783.298 1178.63 1137.9 1637.74 2887.52 63760.3 798.759 582.657 378.312 633.192 687.68 2192.83 3215.18 4178.79
1968.04 2659.41 1612.91 1881.57 1339.75 1388.31 1127.06 921.622 920.101 5083.82
1064.72 26571.6 984.776 736.474 1100.33 993.755 1282.77 2182.82 44615.4 527.638 384.887 249.902 418.27 454.263 1448.52 2123.86
2760.4 1300.03 1756.73 1065.44 1242.91 885.002 917.079 744.508 608.79 3966.03
2003.7 1003.92 25057.5 927.776 689.78 975.26 804.981 1009.05 1610.77 31391.8 371.251 270.81 175.833 294.298 319.623 1019.19
1494.37 1942.24 914.713 1236.05 749.656 874.524 622.695 645.264 523.842 3218.89
9991.06 1889.38 946.761 23608.6 869.041 611.656 790.824 633.997 745.838 1135.57 22130.8 261.727 190.918 123.96 207.476 225.33
718.518 1053.51 1369.25 644.861 871.402 528.498 616.529 438.992 454.903 2638.58
13163.5 9408.89 1779.55 890.757 22063.7 762.664 484.425 605.719 451.477 503.045 765.908 14926.6 176.527 128.768 83.6074 139.936
151.978 484.618 710.559 923.52 434.939 587.734 356.455 415.83 296.086 2086.46
3722.92 12395.7 8861.4 1674.17 832.379 19353.4 603.34 370.543 430.572 303.864 338.571 515.49 10046.2 118.81 86.6666 56.2715
94.1835 102.288 326.169 478.238 621.57 292.733 395.571 239.91 279.872 1603.56
5884.9 3502.01 11662 8326.87 1561.5 723.859 15013.1 450.924 255.361 279.323 197.124 219.64 334.412 6517.25 77.0754 56.2229
36.5048 61.0993 66.357 211.595 310.245 403.228 189.904 256.617 155.636 1221.83
19169.4 5525.24 3288.61 10936 7740.64 1337.46 542.475 10771.1 8 294.264 155.271 169.841 119.86 133.551 203.337 3962.78 46.8653
34.186 22.1965 37.1511 40.348 128.659 188.643 245.181 115.47 156.035 837.561
17385.6 18041.9 5201.06 3092.11 10209.9 6761.37 1048.03 410.298 7542.64 194.543 102.652 112.285 79.2418 88.2929 134.43 2619.86
30.9835 22.601 14.6745 24.5612 26.6748 85.0587 124.715 162.093 76.3392 656.883
11065 16419.9 17041.5 4908.87 2904.5 9170.08 5644.55 854.314 317.539 5615.87 144.847 76.4297 83.6015 58.9994 65.7384 100.09
1950.62 23.0687 16.8275 10.9259 18.287 19.8607 63.3303 92.8566 120.686 545.92
12846.8 10479.9 15552.6 16133.8 4633.99 2668.47 8060.04 4890.21 717.243 260.419 4605.66 118.791 62.6812 68.5629 48.3864 53.9131
82.0851 1599.73 18.919 13.8005 8.9605 14.9975 16.288 51.9382 76.1532 546.694
11647.8 12193.2 9947.04 14758.3 15287.2 4330.28 2437.71 7308.88 4363.71 632.395 229.612 4060.82 104.738 55.2662 60.4521 42.6624
47.5353 72.3746 1410.49 16.6809 12.168 7.9005 13.2233 14.3612 45.794 549.166
13727.3 11060.4 11578.7 9443.91 13995.5 14339.7 3990.19 2233.26 6611.74 3910.45 566.709 205.762 3639.03 93.8593 49.5257 54.173
88.2311 42.5978 64.8571 1263.98 14.9483 10.9041 7.07988 11.8498 12.8695 533.162
55923.2 12752.6 10278.6 10732.8 8616.81 11010.5 8857.43 2277.83 1073.73 2796.95 1654.23 239.733 87.0432 1539.41 39.7051 20.9508
22.9167 16.1728 18.0201 27.4364 534.699 6.32355 4.61273 2.99499 5.01281 230.987
80778.6 53019.4 12091 9741.9 10149.8 7980.94 9857.47 7842.6 1968.82 911.534 2374.45 1404.35 203.52 73.8948 1306.87 33.7074
17.786 19.455 13.7298 15.298 23.2919 453.93 5.36834 3.91595 2.54258 200.35
41608.1 76599.6 50278.8 11462.2 9216 9415.92 7171.35 8765.88 6817.92 1682.92 779.168 2029.65 1200.42 173.967 63.1644 1117.1
28.8127 15.2033 16.6299 11.7361 13.0766 19.9097 388.014 4.58879 3.34731 173.43
45975.1 38644.4 71168.3 46593.2 10453.9 7236.32 5790.5 4072.55 4185.29 2860.41 706.058 326.895 851.528 503.629 72.9866 26.5002
468.672 12.0882 6.37844 6.97696 4.92379 5.48619 8.35297 162.789 1.9252 74.1659
37073 43638.8 36681.7 67538.1 44153.1 9773.6 6618.08 5257.91 3640.61 3698.05 2527.41 623.861 288.839 752.397 444.998 64.4898
23.4151 414.111 10.6809 5.63588 6.16473 4.35058 4.84751 7.38055 143.837 67.2329
36471.5 35205.3 41441.4 34828.3 64053.2 41433.2 9014.23 6069.56 4763.27 3268.07 3319.63 2268.78 560.021 259.282 675.404 399.461
57.8905 21.0191 371.735 9.58793 5.05916 5.53389 3.90538 4.35146 6.6253 189.471
51554.2 34670.2 33466.9 39392.2 33091.8 60612.1 38947.5 8455.11 5666.28 4431.16 3040.21 3088.18 2110.6 520.976 241.204 628.313
371.61 53.8543 19.5536 345.817 8.91945 4.70643 5.14806 3.6331 4.04807 182.424
74059 49004.9 32956.2 31809.8 37424 31298.2 56910.4 36482.2 7879.01 5259.87 4113.34 2822.16 2866.68 1959.22 483.609 223.904
583.248 344.957 49.9916 18.1511 321.013 8.27971 4.36886 4.77882 3.37251 173.098
195407 70428.4 46602.8 31339.8 30244.4 35523.3 29628.4 53826.8 34439.2 7427.17 4958.23 3877.45 2660.31 2702.29 1846.86 455.875
211.064 549.8 325.174 47.1247 17.1102 302.604 7.80488 4.11832 4.50476 166.35
80932 185830 66977.2 44317.9 29798.3 28712.1 33638.2 28032.9 50836.5 32482.4 7005.15 4676.5 3657.13 2509.15 2548.74 1741.92
429.972 199.071 518.56 306.698 44.4471 16.138 285.41 7.36141 3.88431 161.147
189572 76962.4 176717 63690.4 42134.8 28278.7 27166.6 31796.6 26442.1 47876 30590.7 6597.2 4404.16 3444.16 2363.03 2400.31
1640.48 404.933 187.478 488.362 288.837 41.8587 15.1982 268.789 6.93271 155.421
56254.6 180298 73197.3 168068 60566.9 40027.9 26820.3 25751.7 30105.2 25013.7 45289.7 28938.2 6240.81 4166.24 3258.1 2235.37
2270.64 1551.86 383.057 177.35 461.979 273.233 39.5974 14.3771 254.268 153.583
132153 53502.7 171478 69615.6 159828 57541.5 37968.3 25427.2 24386.7 28485.5 23667.9 42853 27381.3 5905.04 3942.09 3082.81
2115.11 2148.48 1468.37 362.448 167.808 437.124 258.533 37.467 13.6036 385.908
103773 125692 50887.4 163094 66206.5 151888 54616.3 36023.8 24104.1 23102.8 26985.9 22421.9 40597 25939.8 5594.18 3734.56
2920.51 2003.76 2035.37 1391.07 343.367 158.974 414.112 244.923 35.4946 378.48
59299.5 98699.3 119548 48399 155106 62914.9 144153 51813.7 34144.5 22831.3 21882.9 25560.9 21237.9 38453.3 24570.1 5298.78
3537.36 2766.3 1897.95 1927.9 1317.61 325.236 150.58 392.245 231.99 392.114
206252 56401.7 93876.4 113705 46030.4 147422 59736.7 136825 49143.8 32367.5 21643.1 20744 24230.6 20132.6 36452 23291.3 5023.01
3353.26 2622.33 1799.17 1827.56 1249.04 308.309 142.743 371.831 591.623

q by index
index 1 q over time
1963 0.594601
1964 0.594601
1965 0.594601
1966 0.594601
1967 0.594601
1968 0.594601
1969 0.594601
1970 0.594601
1971 0.594601
1972 0.594601
1973 0.594601
1974 0.594601
1975 0.594601
1976 0.594601
1977 0.594601
1978 0.594601
1979 0.594601
1980 0.594601
1981 0.594601
1982 0.594601

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Proportions of catch at age by fleet  
fleet 1  
Year 1 Obs = 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0  
Year 1 Pred = 0.00187876 0.00176079 0.00185873 0.00284748 0.0123476 0.0267068 0.0300425 0.0381871 0.0431379 0.0410335 0.0390317  
0.0371276 0.0353164 0.0335936 0.0319548 0.030396 0.0289132 0.0275027 0.0261611 0.0248849 0.0236709 0.0225162 0.0214178 0.020373  
0.0193792 0.377959  
Year 2 Obs = 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0  
Year 2 Pred = 0.00191034 0.00176096 0.00185871 0.00284745 0.0123474 0.0267063 0.0300419 0.0381862 0.0431368 0.0410324 0.0390367  
0.0371266 0.0353154 0.0335926 0.0319539 0.0303951 0.0289123 0.0275019 0.0261603 0.0248842 0.0236703 0.0225156 0.0214172 0.0203724  
0.0193786 0.377944  
Year 3 Obs = 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0  
Year 3 Pred = 0.00191093 0.0017906 0.00185894 0.00284749 0.0123476 0.0267064 0.0300416 0.0381857 0.0431358 0.0410312 0.0390295  
0.0371255 0.0353144 0.0335917 0.0319529 0.0303942 0.0289115 0.0275011 0.0261595 0.0248834 0.0236695 0.0225149 0.0214166 0.0203718  
0.0193778 0.377921  
Year 4 Obs = 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0  
Year 4 Pred = 0.00191155 0.00179118 0.00189025 0.00284787 0.0123479 0.0267068 0.0300418 0.0381853 0.043135 0.0410301 0.0390282  
0.0371243 0.0353132 0.0335905 0.0319518 0.0303931 0.0289105 0.0275001 0.0261586 0.0248825 0.0236687 0.0225141 0.0214158 0.0203711  
0.0193773 0.377912  
Year 5 Obs = 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0  
Year 5 Pred = 0.00191221 0.00179178 0.00189088 0.00289587 0.0123496 0.0267074 0.030042 0.0381849 0.0431337 0.0410284 0.0390263  
0.0371222 0.0353112 0.0335886 0.03195 0.0303914 0.0289088 0.0274986 0.0261571 0.0248811 0.0236673 0.0225128 0.0214146 0.0203699  
0.0193762 0.377887  
Year 6 Obs = 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0  
Year 6 Pred = 0.00191257 0.00179212 0.00189123 0.00289639 0.0125558 0.026707 0.0300378 0.0381791 0.0431262 0.0410203 0.0390182  
0.0371141 0.0353034 0.0335811 0.0319429 0.0303846 0.0289023 0.0274924 0.0261512 0.0248755 0.023662 0.0225077 0.0214097 0.0203653  
0.0193719 0.377799  
Year 7 Obs = 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
```

N. Acadian redfish

N. Acadian redfish

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Proportions of Discards at age by fleet  
fleet 1  
Year 1 Obs = 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
```

N. Acadian redfish

Appendix to the GARM III Report

N. Acadian redfish

F Reference Points Using Final Year Selectivity and Freport options

refpt	F	slope to plot on SRR			
F0.1	0.0460683	0.213765			
Fmax	0.0938409	0.389873			
F30%SPR	0.0611839	0.265907			
F40%SPR	0.04171	0.199422			
Fmsy	0.0408952	0.196777	SSBmsy	203582	MSY 10490.6
Fcurrent	0.00397234	0.0896961			

Stock-Recruitment Relationship Parameters

alpha = 58868.2
 beta = 95580.4
 unexpl = 642383
 steepness = 0.658728

Spawning Stock, Obs Recruits(year+1), Pred Recruits(year+1), standardized residual

init	xxxx	51250.4	51242	0.00164143
1913	642256	52112.5	51242.3	0.168808
1914	642246	52128	51242.2	0.171807
1915	642221	52143.7	51242	0.174886
1916	642194	52159.7	51241.7	0.178007
1917	642167	52175.7	51241.4	0.181147
1918	642156	52192	51241.3	0.184289
1919	642209	52208.8	51241.8	0.187407
1920	642334	52226.1	51243.1	0.190488
1921	642510	52243.6	51244.9	0.193477
1922	642743	52260.8	51247.3	0.196319
1923	643017	52277.5	51250.2	0.198969
1924	643313	52293.2	51253.2	0.201379
1925	643621	52307.4	51256.4	0.203475
1926	643957	52320	51259.9	0.205221
1927	644307	52330.4	51263.5	0.206508
1928	644657	52339.4	51267.1	0.207525
1929	645008	52346.3	51270.7	0.208148
1930	645371	52351.7	51274.4	0.208457
1931	645703	52357.2	51277.8	0.208846
1932	646024	52360.2	51281.1	0.208769
1933	646348	52361.4	51284.4	0.208354
1934	646477	52360.5	51285.7	0.207921
1935	643595	52326.9	51256.1	0.207277
1936	630416	52182.4	51118	0.20661
1937	611730	51969.8	50913.2	0.205925
1938	595845	51774.2	50730.4	0.20417
1939	575019	51499.7	50477.7	0.200936
1940	551349	51158.3	50170.7	0.195408
1941	517571	50626	49691.6	0.186764
1942	468693	49751.4	48896.7	0.173711
1943	421056	48724.2	47977.3	0.154867
1944	377730	47528	46980.3	0.116183
1945	339493	45777.9	45935.6	-0.034456
1946	307277	45641.2	44901.4	0.163833
1947	274346	45424.5	43658	0.397639
1948	241919	42589.2	42196.6	0.0928445
1949	213686	41044.3	40674.7	0.0906922
1950	191539	39736.7	39271.3	0.118117
1951	169645	36567.6	37653.6	-0.293407
1952	153992	42706.9	36323	1.62312
1953	145259	38985	35505.5	0.937216
1954	140868	42419.1	35071.7	1.90677
1955	138484	36063.3	34829.3	0.349023
1956	135554	37748.1	34524.6	0.894849
1957	130763	39862.9	34009.3	1.59209
1958	124627	33386.2	33316.6	0.020913
1959	119992	41037.2	32767.2	2.25613
1960	117277	31020.4	32434.3	-0.446818
1961	115820	45024.2	32252.2	3.34446
1962	112806	28797	31867.1	-1.01554
1963	111311	52268.9	31672.1	5.02216
1964	112799	33641.7	31866.2	0.229116
1965	115510	18664	32213.1	-1.48607
1966	118339	4693.57	32565.5	-3.95952
1967	120076	3450.28	32777.4	-3.74391
1968	121974	1633.2	33005.1	-4.27403
1969	123597	1991.1	33196.5	-4.00053
1970	119361	2118.14	32690.6	-3.89075
1971	109776	133832	31468.8	2.05814
1972	96844.1	4977.78	29627.4	-2.53604
1973	83568.6	2321.25	27460.6	-3.5127
1974	73439.2	1437.55	25578.3	-4.09301
1975	67286.8	1400.21	24320.7	-4.05875
1976	61981	879.565	23157.4	-4.65012
1977	56638.7	1109.6	21904.1	-4.24069
1978	49717	28232.9	20143.2	0.480025
1979	41128.7	1064.72	17710.4	-3.99724
1980	32701.4	2003.7	15006.6	-2.86273
1981	26352.5	9991.06	12722.7	-0.343644
1982	20941.9	13163.5	10580	0.310626
1983	16583.5	3722.92	8703.68	-1.20742
1984	13386.5	5884.9	7231.92	-0.293049
1985	10736.9	19169.4	5945.06	1.66455
1986	8954.26	17385.6	5042.55	1.75978
1987	8350.72	11065	4729.98	1.20832
1988	8728.63	12846.8	4926.12	1.36284
1989	9957.03	11647.8	5553.97	1.05297
1990	11874.6	13727.3	6505.4	1.06172

that's all

Appendix O. Ocean pout

Appendix Tables and Figures by S.E. Wigley, L. Col, and C.M. Legault

Appendix Table O1. Number of commercial lengths (individual fish measured) and number of samples for Ocean pout collected during 1969 to 2007, by calendar quarter.

Year	Q1	Q2	Q3	Q4	Total	# of Samples
1969					0	
1970					0	
1971					0	
1972					0	
1973					0	
1974					0	
1975					0	
1976					0	
1977					0	
1978					0	
1979					0	
1980					0	
1981					0	
1982					0	
1983					0	
1984		592			592	5
1985	670	335			1005	9
1986	780	458			1238	11
1987	1477	717			2194	19
1988	1093	805		106	2004	17
1989	1283	864			2147	17
1990	1006	112			1118	12
1991	1044	259		93	1396	14
1992	402	181			583	6
1993	93				93	1
1994					0	1
1995		76			76	1
1996				17	17	1
1997					0	0
1998					0	0
1999					0	0
2000					0	0
2001					0	0
2002	109				109	1
2003	136	76			212	4
2004	37				37	1
2005					0	0
2006	133	54			187	4
2007	167	11			178	3

Five commercial age samples have been obtained: 28 fish in 1985; 29 fish in 1989; 53 fish in 1991(from 2 samples); and 21 fish in 1992.

Appendix Table O2. Number of observed trips and combined discard ratio of Ocean pout discards to kept of all species for selected fleets, 1989 – 2007 using NEFOP data.

YEAR	Large-mesh Otter Trawl		Small-mesh Otter Trawl		Gillnet		Scallop Dredge	
	OB trips	d/k ratio	OB trips	d/k ratio	OB trips	d/k ratio	OB trips	d/k ratio
1989	34	0.07836	91	0.06529	67	0.00001		
1990	43	0.11079	55	0.01436	84	0.00014		
1991	56	0.04205	127	0.04462	448	0.00028		
1992	58	0.01583	74	0.00543	599	0.00023	13	0.00177
1993	27	0.01606	23	0.00374	420	0.00024	20	0.00457
1994	28	0.00792	17	0.01852	195	0.00030	18	0.00200
1995	74	0.00890	77	0.00456	182	0.00004	22	0.00026
1996	44	0.00840	59	0.00356	136	0.00005	35	0.00087
1997	26	0.00922	60	0.00074	152	0.00016	26	0.00075
1998	17	0.01144	34	0.00075	209	0.00001	23	0.00138
1999	33	0.01458	53	0.00123	122	0.00023	28	0.00056
2000	93	0.00572	43	0.00058	137	0.00059	250	0.00012
2001	150	0.00827	59	0.00101	92	0.00009	64	0.00009
2002	197	0.00945	101	0.00111	125	0.00020	84	0.00004
2003	352	0.00656	106	0.00150	418	0.00017	91	0.00008
2004	563	0.00375	312	0.00163	971	0.00014	213	0.00001
2005	1363	0.00299	358	0.00293	787	0.00008	268	0.00002
2006	639	0.00269	185	0.00175	221	0.00003	199	0.00002
2007	724	0.00358	218	0.00126	259	0.00005	288	0.00003
mean 2004-2006		0.00314		0.00210		0.00009		0.00002

Appendix Table O3. Ocean pout discards (mt) and coefficient of variation from the large-mesh otter trawl, small-mesh otter trawl, gillnet, and scallop dredge fleets, 1989 – 2007. Discards were derived using a combined ratio estimator of Ocean pout discard to kept of all species.

YEAR	Large-mesh Otter Trawl		Small-mesh Otter Trawl		Gillnet		Scallop Dredge		Total	
	mt	CV	mt	CV	mt	CV	mt	CV	mt	CV
1989	4912.2	0.33	2488.3	0.50	0.1	1.50			7400.6	0.28
1990	8887.3	0.30	525.4	0.42	1.8	1.26			9414.5	0.29
1991	3189.1	0.41	1713.2	0.37	3.5	0.58			4905.9	0.30
1992	1147.6	0.36	192.3	0.42	3.1	0.27	177.1	0.570	1520.0	0.29
1993	941.5	0.28	146.6	0.62	3.9	0.39	254.0	0.340	1345.9	0.21
1994	445.0	0.40	784.8	4.51	4.9	0.85	46.1	0.525	1280.9	2.77
1995	417.9	0.34	146.2	0.48	0.8	0.65	8.6	0.451	573.5	0.28
1996	448.7	0.39	137.6	1.21	1.1	0.84	41.2	0.722	628.6	0.39
1997	456.3	0.53	29.3	0.49	3.2	0.59	32.6	0.290	521.5	0.46
1998	595.7	0.63	30.2	0.57	0.3	0.80	46.7	0.748	672.9	0.56
1999	701.5	0.30	45.6	0.69	4.4	0.57	34.6	0.679	786.1	0.27
2000	310.3	0.64	19.5	0.51	8.4	0.75	9.6	0.265	347.8	0.57
2001	490.0	0.36	30.4	0.43	1.3	0.56	9.8	0.413	531.6	0.34
2002	539.4	0.33	28.0	0.34	3.4	0.54	5.0	0.561	575.7	0.31
2003	379.7	0.17	34.6	0.40	3.1	0.34	9.3	0.276	426.8	0.15
2004	248.1	0.12	38.8	0.29	2.7	0.34	1.2	0.544	290.7	0.11
2005	140.5	0.09	56.2	0.21	1.0	0.62	3.1	0.196	200.8	0.09
2006	113.3	0.12	65.0	0.54	0.5	0.77	3.8	0.210	182.5	0.21
2007	143.4	0.11	26.3	0.44	0.8	0.78	4.3	0.276	175.0	0.11

Note: 1989 – 1991 total discard do not include scallop discards.

Appendix Table O4. Ocean pout discards (mt) from the large-mesh otter trawl, small-mesh otter trawl, gillnet from 1968 - 1988 and scallop dredge fleets from 1968 – 1991 based on the survey scale method.

YEAR	Large-mesh Otter Trawl	Small-mesh Otter Trawl	Gillnet	Scallop Dredge	Total
1968		3470.4	1.0	5.5	3476.9
1969		3125.1	0.9	3.5	3129.5
1970		2761.6	0.9	3.2	2765.8
1971		2018.4	0.6	2.5	2021.5
1972		1495.9	0.8	1.4	1498.2
1973		1292.2	0.6	1.4	1294.2
1974		1131.6	0.7	1.6	1133.9
1975		714.8	0.3	1.5	716.6
1976		520.0	0.2	2.0	522.2
1977		922.9	0.4	4.7	928.1
1978		1369.5	1.3	6.9	1377.6
1979		1499.2	1.9	8.1	1509.3
1980		2002.6	5.1	8.3	2015.9
1981		2724.3	5.5	13.5	2743.2
1982	2110.5	2308.1	6.3	14.6	4439.5
1983	3308.0	1161.2	6.0	13.4	4488.7
1984	2988.9	687.0	7.0	9.3	3692.2
1985	2506.7	636.8	7.4	10.1	3161.0
1986	2420.9	851.0	10.4	14.1	3296.4
1987	2002.6	597.1	7.5	16.5	2623.6
1988	1681.5	541.4	6.7	14.0	2243.6
1989				14.3	
1990				19.5	
1991				19.7	

*Note: Regulatory otter trawl mesh size prior to 1982 was less than 5.5 inches;
1989 – 1991 scallop dredge discards were estimated using this method due to no observer coverage of this fleet.*

Appendix Table O5. Stratified mean catch per tow in weight and numbers, mean length and individual average fish weight of Ocean pout in **NEFSC winter surveys** (strata 1-3, 5-7, 9-11, 13-14, 73-75), 1992-2007. *No vessel conversion factors applied.*

Year	Mean weight per tow (kg)	Mean number per tow	Individual average weight (kg)	Mean length (cm)
1992	34.64	47.29	0.733	51.9
1993	27.86	48.57	0.574	47.1
1994	9.18	15.28	0.601	47.1
1995	7.32	16.92	0.433	43.3
1996	9.68	17.13	0.565	47.2
1997	11.70	21.36	0.548	47.5
1998	4.77	12.63	0.378	40.4
1999	15.44	24.85	0.621	48.3
2000	8.46	18.14	0.466	44.6
2001	13.45	28.01	0.480	46.1
2002	7.94	12.05	0.659	51.1
2003	18.54	20.25	0.916	56.0
2004	9.58	12.89	0.744	49.6
2005	2.84	5.61	0.506	41.3
2006	3.09	7.44	0.415	40.3
2007	1.72	2.43	0.709	48.9

Appendix Table O6. Stratified mean catch per tow in weight and numbers, individual average fish weight and mean length of Ocean pout in **Mass. inshore spring surveys** (strata 25-36), 1978-2007.

Year	Mean	Individual		Mean length (cm)
	weight per tow (kg)	Mean number per tow	average weight (kg)	
1978	42.00	107.39	0.391	38.8
1979	47.11	94.79	0.497	39.6
1980	34.42	60.13	0.572	42.9
1981	74.98	125.46	0.598	43.5
1982	61.39	90.50	0.678	47.2
1983	98.69	123.35	0.800	50.2
1984	85.25	147.25	0.579	45.0
1985	96.36	130.93	0.736	47.2
1986	28.46	62.62	0.454	39.4
1987	31.61	66.44	0.476	41.3
1988	26.18	56.71	0.462	39.7
1989	36.40	54.19	0.672	46.8
1990	25.04	38.19	0.656	47.0
1991	21.20	29.08	0.729	49.6
1992	42.43	59.02	0.719	48.5
1993	32.87	46.82	0.702	51.0
1994	22.34	36.73	0.608	46.9
1995	25.75	44.22	0.582	46.5
1996	14.03	26.06	0.538	45.6
1997	13.05	28.04	0.465	41.9
1998	5.56	8.45	0.658	49.7
1999	5.42	8.61	0.630	46.5
2000	16.35	22.22	0.736	49.8
2001	13.27	19.55	0.679	49.9
2002	6.27	10.47	0.599	48.1
2003	4.95	8.42	0.588	47.8
2004	7.66	9.27	0.827	53.0
2005	7.48	9.51	0.787	53.4
2006	6.22	9.03	0.689	49.6
2007	5.58	8.44	0.661	48.6

Appendix Table O7. Stratified mean catch per tow in weight and numbers, individual average fish weight and mean length of Ocean pout in **NEFSC spring surveys with conversion factors applied**, in the Gulf of Maine - Mid-Atlantic region (strata 1-26, 73-76), 1968-2007; 2008 preliminary.

<i>with vessel conversion factors</i>				
Year	Mean weight per tow (kg)	Mean number per tow	Individual average weight (kg)	Mean length (cm)
1968	5.446	6.768	0.805	51.1
1969	6.154	8.629	0.713	49.3
1970	5.143	6.133	0.839	51.9
1971	2.195	3.135	0.700	50.2
1972	4.463	5.104	0.874	51.6
1973	2.753	3.618	0.761	49.3
1974	1.479	2.310	0.640	47.0
1975	1.293	1.358	0.952	53.4
1976	1.170	1.912	0.612	46.9
1977	3.461	6.201	0.558	44.7
1978	3.371	11.831	0.285	31.6
1979	1.096	3.695	0.297	34.9
1980	4.333	8.955	0.484	42.7
1981	5.247	9.891	0.530	42.7
1982	3.273	6.083	0.538	44.0
1983	4.236	5.076	0.835	50.5
1984	5.540	7.275	0.762	50.0
1985	6.494	9.011	0.721	48.7
1986	6.345	6.995	0.907	53.0
1987	2.686	3.065	0.876	51.7
1988	3.244	5.405	0.600	45.0
1989	1.926	3.726	0.517	44.0
1990	3.501	4.459	0.785	50.3
1991	2.610	3.917	0.666	49.7
1992	2.257	2.639	0.855	52.9
1993	3.084	3.546	0.870	53.4
1994	1.593	1.848	0.862	54.3
1995	1.916	2.525	0.759	50.5
1996	2.058	3.127	0.658	47.6
1997	1.632	2.069	0.789	52.4
1998	1.733	2.957	0.586	46.1
1999	2.561	3.340	0.767	50.2
2000	2.016	3.113	0.648	48.2
2001	2.798	3.748	0.746	51.6
2002	2.025	2.809	0.721	51.3
2003	1.903	2.043	0.931	55.4
2004	0.546	0.673	0.812	50.8
2005	0.526	0.854	0.616	45.9
2006	0.526	0.789	0.667	47.4
2007	0.477	1.076	0.443	42.9
2008	0.424	0.839	0.505	43.9
mean 1968-2007	2.878			
median 1968-2007	2.586			
median 1980 -1991	3.869			

Appendix Table O8. Relative F and randomization test results of eight formulations of AIM for Ocean pout: with and without vessel conversion factor applied to the survey biomass index and landings, catch, catch calculated using half of the estimated discard, and catch calculated using twice the estimated discard.

<i>without vessel conversion factor</i>				
	Landings	Catch	Catch (0.5xDiscards)	Catch (2xDiscards)
Relative F	564460.60	0.02	0.01	0.03
5%percentile	0.00	0.00	0.00	0.00
95% percentile	745206700000.00	4085.19	43718.27	61560.40
Randomization Test				
Critical Value	0.042	-0.081	-0.086	-0.066
Significant Level	0.732	0.570	0.552	0.608
<i>with vessel conversion factor</i>				
	Landings	Catch	Catch (0.5xDiscards)	Catch (2xDiscards)
Relative F	0.00	0.11	0.05	0.18
5%percentile	0.00	0.00	0.00	0.00
95% percentile	1043285000000.00	1316.51	2201.72	36624.88
Randomization Test				
Critical Value	-0.011	-0.153	-0.154	-0.139
Significant Level	0.626	0.391	0.372	0.438

Appendix Table O9a. Ocean pout input vectors used in LOSS model exploration.

Input vectors

Age	M	Mean weight at age	Maturity at age	Fishing Selectivity	Index Selectivity
1	0.2	0.001	0.1	0.01	0.5
2	0.2	0.008	0.5	0.1	1
3	0.2	0.022	1	0.5	1
4	0.2	0.045	1	1	1
5	0.2	0.075	1	1	1
6	0.2	0.112	1	1	1
7	0.2	0.153	1	1	1
8	0.2	0.199	1	1	1
9	0.2	0.247	1	1	1
10	0.2	0.297	1	1	1
11	0.2	0.347	1	1	1
12	0.2	0.397	1	1	1
13	0.2	0.446	1	1	1
14	0.2	0.494	1	1	1
15	0.2	0.54	1	1	1
16	0.2	0.584	1	1	1
17	0.2	0.626	1	1	1
18	0.2	0.665	1	1	1
19	0.2	0.702	1	1	1
20	0.2	0.737	1	1	1
21	0.2	0.769	1	1	1
22	0.2	0.799	1	1	1
23	0.2	0.827	1	1	1
24	0.2	0.852	1	1	1
25	0.2	0.876	1	1	1
26	0.2	0.898	1	1	1
27	0.2	0.918	1	1	1
28	0.2	0.936	1	1	1
29	0.2	0.953	1	1	1
30	0.2	0.969	1	1	1

Appendix Table O9b. Summary of LOSS model exploration run results for Ocean pout, with varying steepness, depletion (S1/S0) values and two initial stock sizes (200,000 and 500,000).

obj_fun	18.9304	18.9808	19.0364	19.0956	19.1582	19.1166	19.1019	19.103	18.9265	18.9272	18.9279	18.9292	18.9304	18.9316
likely_ind	18.9304	18.9808	19.0364	19.0956	19.1582	19.1166	19.1019	19.103	18.9265	18.9272	18.9279	18.9292	18.9304	18.9316
likely_catchwt	0.00	2.98E-10	0.00	6.45E-10	7.43E-10	2.68E-07	3.07E-07	2.45E-07	1.83E-10	1.72E-10	1.61E-10	1.43E-10	0.00	1.12E-10
Fpen	0	0	0	0	0	0	0	0	0	0	0	0	0	0
rmse	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
sigma	0.566	0.595012	0.629	0.667358	0.710524	0.68153	0.67157	0.672339	0.563567	0.563968	0.564354	0.565088	0.566	0.566417
S1/S0	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.20	0.30	0.40	0.60	0.80	1.00
S0	215237	164421	141935	128870	120142	296994	474431	437114	685103	475182	370631	266613	215237	185100
R0	302182	230839	199269	180927	168673	416965	666078	613687	961851	667133	520348	374311	302182	259871
steepness	0.25	0.35	0.45	0.55	0.65	0.75	0.85	0.95	0.25	0.25	0.25	0.25	0.25	0.25
Fmsy	0.016	0.042	0.066	0.088	0.109	0.131	0.155	0.181	0.016	0.016	0.016	0.016	0.016	0.016
SSBmsy	102380	71907	57774	49144	43060	100107	150123	129231	325877	226026	176295	126817	102380	88045
Fratio	0.33	0.15	0.10	0.07	0.05	0.01	0.00	0.00	0.39	0.38	0.37	0.35	0.33	0.31
SSBratio	0.51	0.60	0.71	0.86	1.05	2.75	3.04	3.25	0.13	0.20	0.26	0.38	0.51	0.62

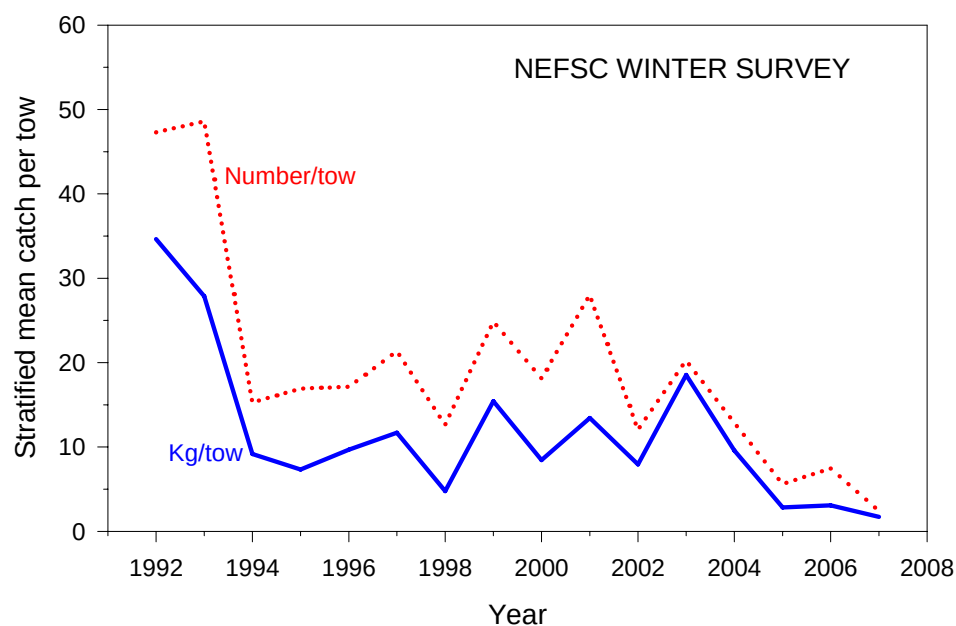
obj_fun	18.9586	19.041	19.1067	19.1291	3525.1	19.1402	19.1412	3490.36	3.01E+08	1.71E+08	85724800	8413490	18.9586	18.9393
likely_ind	18.9586	19.041	19.1067	19.1291	19.1375	19.1402	19.1412	19.1415	20.2771	20.2588	20.2339	20.0103	18.9586	18.9393
likely_catchwt	7.72E-10	1.05E-10	5.643E-11	4.57E-11	3505.96	3.79E-11	3.56E-11	3471.22	3.01E+08	1.71E+08	85723100	8413470	7.72E-10	8.55E-11
Fpen	0	0	0	0	0	0	0	0	44745.3	22893.7	1595.37	1.3386	0	0
rmse	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
sigma	0.581939	0.631918	0.67486	0.69008	0.695939	0.697847	0.698529	0.698706	2.17506	2.13567	2.08313	1.66583	0.581939	0.570796
S1/S0	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.20	0.30	0.40	0.60	0.80	1.00
S0	200,000	200,000	200,000	200,000	200,000	200,000	200,000	200,000	200,000	200,000	200,000	200,000	200,000	200,000
R0	280790	280790	280790	280790	280790	280790	280790	280790	280790	280790	280790	280790	280790	280790
steepness	0.25	0.35	0.45	0.55	0.65	0.75	0.85	0.95	0.25	0.25	0.25	0.25	0.25	0.25
Fmsy	0.016	0.042	0.066	0.088	0.109	0.131	0.155	0.181	0.016	0.016	0.016	0.016	0.016	0.016
SSBmsy	95132	87467	81409	76269	71681	67414	63286	59129	95132	95132	95132	95132	95132	95132
Fratio	0.53	0.06	0.03	0.02	0.01	0.01	0.01	0.01	319.93	320.05	320.09	320.53	0.53	0.23
SSBratio	0.34	1.19	1.75	2.11	2.38	2.61	2.83	3.08	0.00	0.00	0.00	0.00	0.34	0.78

obj_fun	19.0478	19.0928	19.1015	19.1029	55473700	19.1016	24470	59.5129	18789000	18.9398	19.0255	19.0556	19.0478	2278070
likely_ind	19.0478	19.0928	19.1015	19.1029	19.0952	19.1016	19.1008	19.1	20.1336	18.9398	19.0255	19.0556	19.0478	19.0346
likely_catchwt	7.87E-12	4.79E-12	4.119E-12	3.8E-12	55473700	3.46E-12	24450.9	40.4129	18789000	1.81E-10	6.44E-11	1.59E-11	7.87E-12	2278050
Fpen	0	0	0	0	0	0	0	0	2.0263	0	0	0	0	0
rmse	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
sigma	0.636255	0.665497	0.67135	0.672252	0.667089	0.67141	0.670826	0.670305	1.88439	0.571097	0.622227	0.641219	0.636255	0.627871
S1/S0	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.20	0.30	0.40	0.60	0.80	1.00
S0	500,000	500,000	500,000	500,000	500,000	500,000	500,000	500,000	500,000	500,000	500,000	500,000	500,000	500,000
R0	701976	701976	701976	701976	701976	701976	701976	701976	701976	701976	701976	701976	701976	701976
steepness	0.25	0.35	0.45	0.55	0.65	0.75	0.85	0.95	0.25	0.25	0.25	0.25	0.25	0.25
Fmsy	0.016	0.042	0.066	0.088	0.109	0.131	0.155	0.181	0.016	0.016	0.016	0.016	0.016	0.016
SSBmsy	237831	218667	203521	190673	179203	168535	158214	147823	237831	237831	237831	237831	237831	237831
Fratio	0.05	0.01	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.27	0.12	0.06	0.05	0.04
SSBratio	1.43	1.95	2.24	2.46	2.63	2.84	3.04	3.27	0.00	0.26	0.61	1.10	1.43	1.68

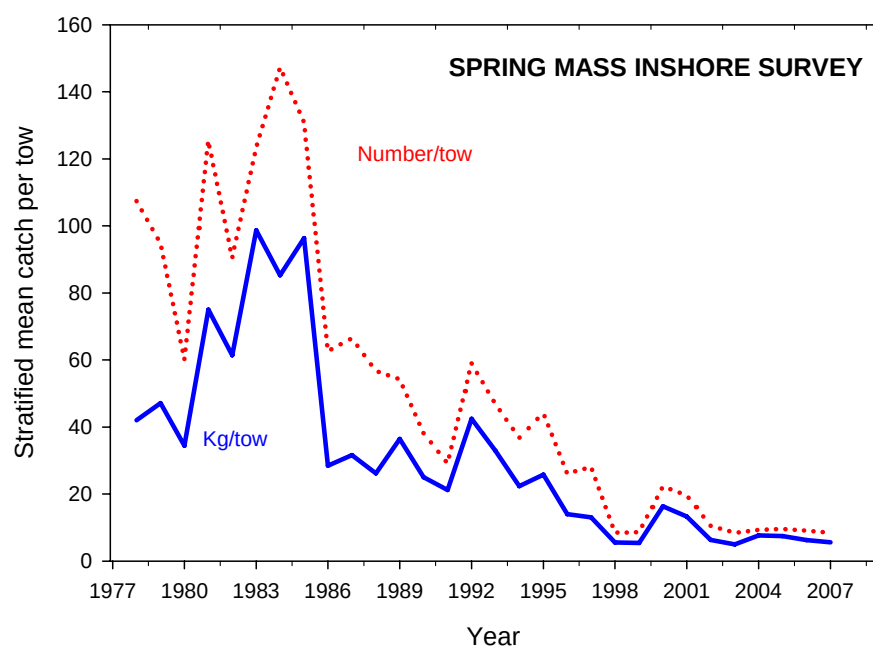
Appendix Table O10. NEFSC spring survey index(kg/tow), total catch ('000 mt), 3yr moving average of spring survey biomass index, relative exploitation rate (catch/ 3yr average of spring survey biomass index) for Ocean pout, 1968 – 2007; preliminary 2008.

With vessel conversion factors applied.

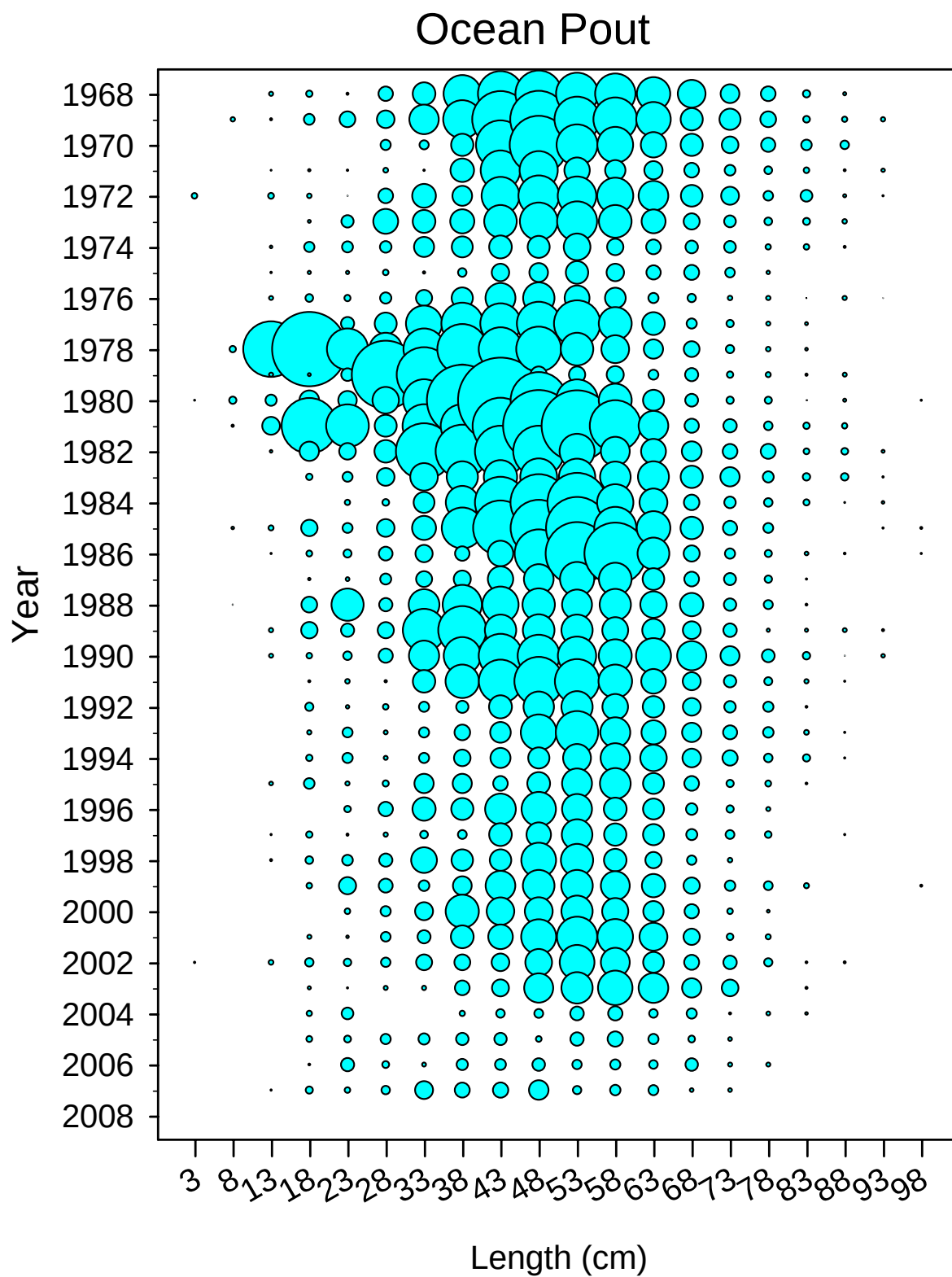
Year	NEFSC Spring Index kg/tow	Total Catch (‘000, mt)	3 year moving average (kg/tow)	Exploitation ratio (catch/ 3yr avg index)
1968	5.446	16.5379	5.800	2.851
1969	6.154	30.1015	5.581	5.394
1970	5.143	9.9378	4.497	2.210
1971	2.195	7.9315	3.934	2.016
1972	4.463	4.8492	3.137	1.546
1973	2.753	6.6642	2.898	2.299
1974	1.479	4.8659	1.842	2.642
1975	1.293	0.9936	1.314	0.756
1976	1.170	1.2002	1.975	0.608
1977	3.461	1.9871	2.667	0.745
1978	3.371	2.4126	2.643	0.913
1979	1.096	2.1813	2.933	0.744
1980	4.333	2.3659	3.559	0.665
1981	5.247	2.9942	4.284	0.699
1982	3.273	4.7605	4.252	1.120
1983	4.236	4.8967	4.350	1.126
1984	5.540	5.0162	5.423	0.925
1985	6.494	4.6650	6.126	0.761
1986	6.345	4.0984	5.175	0.792
1987	2.686	4.8086	4.092	1.175
1988	3.244	4.0546	2.619	1.548
1989	1.926	8.7289	2.890	3.020
1990	3.501	10.7460	2.679	4.011
1991	2.610	6.3496	2.789	2.277
1992	2.257	1.9940	2.650	0.752
1993	3.084	1.5779	2.311	0.683
1994	1.593	1.4769	2.198	0.672
1995	1.916	0.6385	1.856	0.344
1996	2.058	0.6796	1.869	0.364
1997	1.632	0.5545	1.808	0.307
1998	1.733	0.6899	1.975	0.349
1999	2.561	0.8041	2.103	0.382
2000	2.016	0.3668	2.458	0.149
2001	2.798	0.5492	2.280	0.241
2002	2.025	0.5879	2.242	0.262
2003	1.903	0.4524	1.491	0.303
2004	0.546	0.2960	0.992	0.298
2005	0.526	0.2048	0.533	0.384
2006	0.526	0.1875	0.510	0.368
2007	0.477	0.1785	0.475	0.375
2008	0.424			
mean 1968-2007	2.88		2.88	1.18
median 1968-2007	2.59		2.65	0.75
1980-91 median			4.17	1.12
1977-1985 median			4.25	0.76



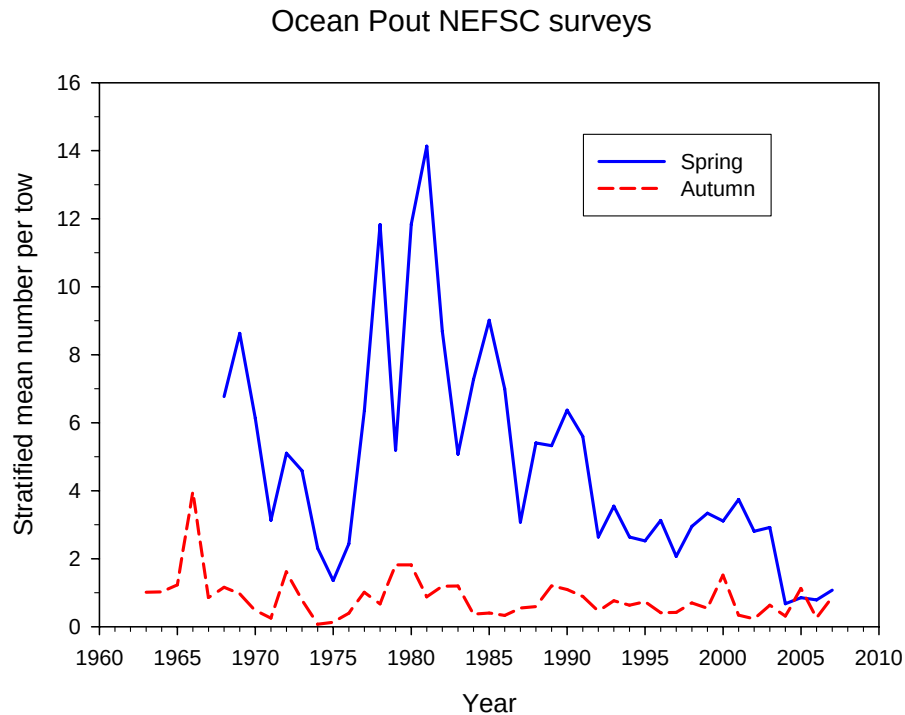
Appendix Figure O1. Trends in mean catch per tow, in numbers and weight (kg) for Ocean pout in the NEFSC winter survey, 1992 – 2007.



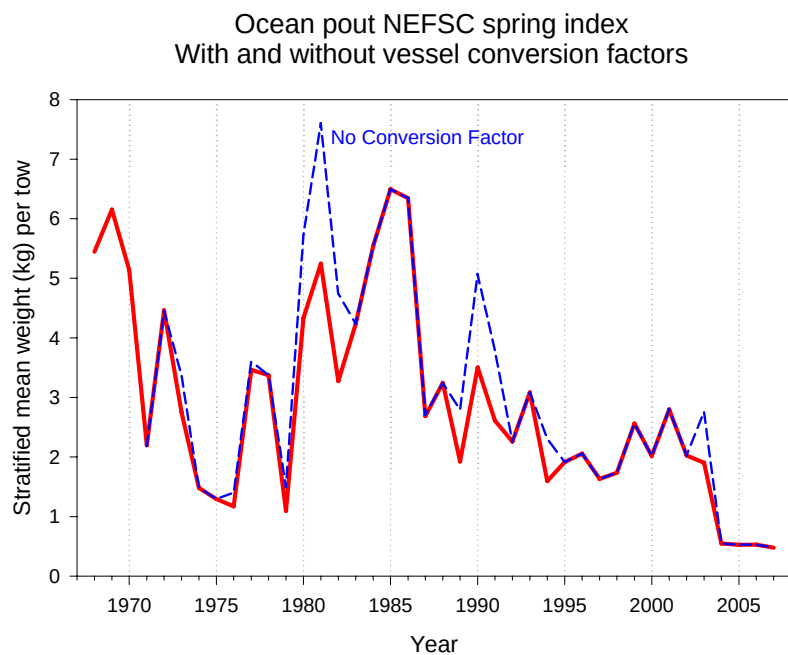
Appendix Figure O2. Trends in mean catch per tow, in numbers and weight (kg) for Ocean pout in the Massachusetts inshore survey, 1978 – 2007.



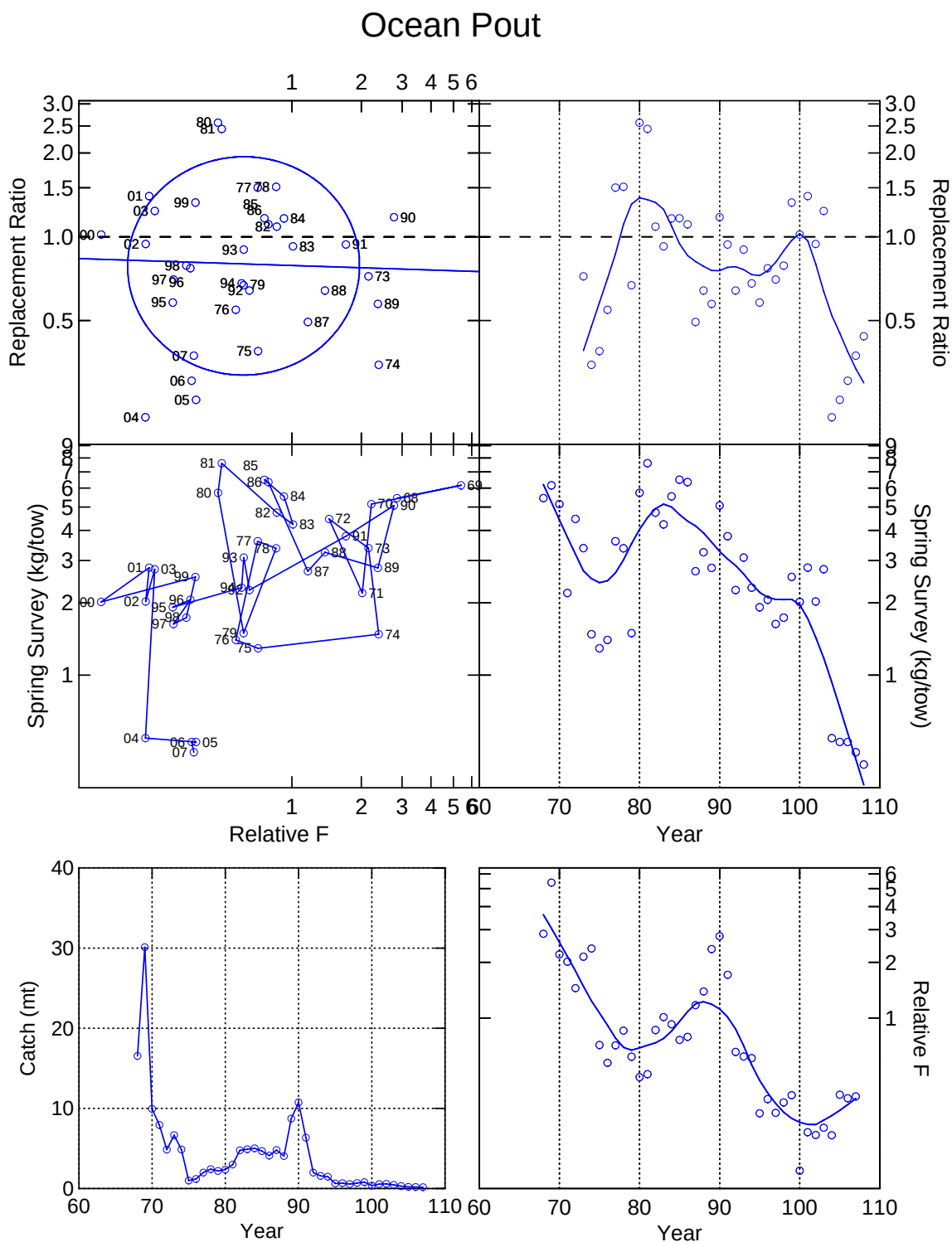
Appendix Figure O3. Stratified mean number per tow at length of Ocean pout from the NEFSC research vessel spring survey, 1968 to 2007, binned into 5 cm intervals.



Appendix Figure O4. Stratified mean number per tow of Ocean pout from NEFSC spring and autumn bottom trawl surveys, 1963 – 2007.



Appendix Figure O5. Stratified mean weight (kg) per tow of Ocean pout from NEFSC spring survey, 1968 – 2007, with and without vessel conversion factors applied.
[Note: R/V Delaware II underwent a refit in 1997].



Appendix Figure O6. Trends in relative biomass, total catch, fishing mortality rate indices (catch / survey index) and replacement ratios for Ocean pout. Relative F is computed as catch in year t divided by a 3 yr average of indices in year t-1, t, and t+1.

Appendix P. Gulf of Maine/Georges Bank windowpane flounder

by Lisa Hendrickson

This section does not have an appendix. The complete assessment is available in the Report of the 3rd Groundfish Assessment Review Meeting (GARM III), Center Reference Document 08-15.

Appendix Q. SNE/MA Bight windowpane flounder

by Lisa Hendrickson,

This section does not have an appendix. The complete assessment is available in the Report of the 3rd Groundfish Assessment Review Meeting (GARM III), Center Reference Document 08-15.

Appendix R. Gulf of Maine haddock

By Michael Palmer

This section does not have an appendix. The complete assessment is available in the Report of the 3rd Groundfish Assessment Review Meeting (GARM III), Center Reference Document 08-15.

Appendix S. Atlantic halibut

by L Col and C Legault

This section does not have an appendix. The complete assessment is available in the Report of the 3rd Groundfish Assessment Review Meeting (GARM III), Center Reference Document 08-15.

**Report of the
Groundfish Assessment Review Meeting
(GARM III)**

Part 1. Data Methods

By

Chairman: Robert O'Boyle

**Review Panel: Victor Crecco, Lou Van-Eeckhaute, Desmond
Kahn, Coby Needle, Brian Rothschild, Stephen Smith, Jon Helge
Vølstad**

**Including Presentation Highlights for each Working Paper
written by the lead Assessment Scientists**

Report Date: December 27, 2007

**Meeting Dates and Location:
October 29 - November 2, 2007
Northeast Fisheries Science Center
Stephen H. Clark Conference Room
Woods Hole, Massachusetts**

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SUMMARY

During 29 October – 2 November 2007, a review of the seven types of data inputs (landings, discards, tagging, fishery independent and dependent surveys, ecosystem and recreational) was undertaken for the Groundfish Assessment Review Meetings (GARM). This was the first of a four part process, with the remainder focusing on models (25 – 29 February 2008), biological reference points (28 April – 2 May 2008) and the assessments themselves (4 – 8 August 2008). The overall GARM process has been designed so that each review can inform the subsequent ones.

A considerable amount of information on the GARM data inputs was considered in the meeting time available. Consequently, the review could only focus on the most important issues and highlight work that could be undertaken by the Northeast Fisheries Science Center to address these. This report provides a synopsis of each presentation along with the associated discussion, during which a number of specific suggestions and recommendations were made to address identified issues. Following this, a panel of seven reviewers provides its perspective on the activities required to meet the objectives outlined in the meeting's terms of reference. Many of the recommendations made can be implemented in time to be included in the next GARM in February 2008. However, a number will require longer-term actions which the Northeast Fisheries Science Center is encouraged to pursue.

Overall, the meeting successfully fulfilled its terms of reference and represents an important contribution to the remainder of the GARM III process.

INTRODUCTION

The chair (R. O'Boyle) opened the meeting by welcoming the participants (appendix 1) to the first of four GARM (Groundfish Assessment Review Meeting) reviews scheduled until August 2008. After introductions, he provided background on the GARM review, which is a peer review process developed in 2002 to provide assessments for the groundfish stocks managed under the Northeast Multispecies Fishery Management Plan. The first and second GARM reviews were held 8 – 11 October 2002 and 15 – 19 August 2005 respectively. The GARM process was initially intended to be distinct from the Northeast Stock Assessment Review Committee (SARC) process, which produces "benchmark" stock assessments. The initial purpose of the GARM was to provide assessment updates, using extant model formulations and data sources as well as to provide comments and recommendations regarding specific stock assessments and generic data collection and analysis procedures.

With this GARM III, the intent of the process has evolved. GARM III is to be the most comprehensive to date with the intent being the production of benchmark assessments and peer reviews of 19 groundfish stock assessments managed by the New England Fisheries Management Council (NEFMC). This process will take place over four meetings, with each having a different purpose:

- Data Methods (29 Oct – 2 Nov 2007) – this meeting
 - Review of the data inputs (commercial and survey) to be used in the stock assessments and the methodologies for analyzing
- Modeling (25 – 29 Feb 2008)

- Determination of the most appropriate stock assessment methods and models for each of the 19 stocks
- Biological Reference Points (BRPs) (28 April – 2 May 2008)
 - Establishment of the BRPs for the 19 stocks
- Assessment (4 – 8 August 2008)
 - Application of the methods from the previous three meetings, along with survey and catch information through calendar year 2007, to estimate fishing mortality rates and biomass for each stock

The chair noted that the schedule has been established to allow time between meetings for scientists of the Northeast Fisheries Science Center (NEFSC) to address issues raised in each review. He noted that the GARM is a technical review of the science pertinent to assessments and would not be entertaining discussion on management issues, which is the purpose of the NEFMC. He also emphasized that the results of the meeting are confidential until its report has been released publicly.

The terms of reference (appendix 2) was then discussed. The meeting was to review the commercial and survey data that would be used in the stock assessments and identify appropriate statistical methods for analyzing those data (including bycatch and discard issues, changes in growth rates and other life history traits, issues related to merging databases, etc.). Other sources of data to be considered would be from tagging programs for cod and yellowtail flounder and from Industry-Based Surveys. Candidate sources of data relevant to ecological and ecosystem considerations would also be described. The draft agenda (appendix 3) had been structured to sequentially review the seven data types under consideration. It was noted that the agenda was exceptionally busy, with 34 working papers (appendix 4) to be considered and would be modified as needed. As it transpired, the working paper reviews were not completed until Thursday morning with the meeting adjourning noon on Friday.

The chair then introduced the GARM reviewers: Victor Crecco, Lou Van-Eeckhaute, Desmond Kahn, Coby Needle, Brian Rothschild, Stephen Smith, and Jon Helge Volstad who would be formulating the main recommendations of the meeting.

Regarding the conduct of the meeting, the chair noted that the presentation highlights and associated discussions would be recorded, the latter by the following rapporteurs:

- A. Landings--Kathy Sosebee
- B. Discards--Paul Nitschke
- C. Tagging--Gary Shepherd
- D. Surveys--Anne Richards
- E. Industry Based Surveys--Lisa Hendrickson
- F. Ecosystem indices--Laurel Col
- G. Recreational Landings and Discards--Laurel Col

Following these comments, the meeting commenced.

The first section of this report provides the above mentioned ‘Presentations and Associated Discussion’. The presentation highlights are brief summaries provided by the authors of the working papers and do not provide many of the technical details. It is expected that the NEFSC will consider the recommendations of this report and produce working papers that are most appropriate as Center Reference documents. The discussion provides a synopsis of the main

topics touched upon, as well as suggestions and recommendations, to inform the final session of the meeting in which the main conclusions and recommendations of the meeting were summarized.

The next section of the report, entitled ‘Progress towards Objectives’, provides the review panel’s recommendations and observations, structured by the meetings’ objectives as per the terms of reference. These are based upon the discussions held during the final session of the meeting and post – meeting reflections.

PRESENTATIONS AND ASSOCIATED DISCUSSION

COMMERCIAL LANDINGS

Working Paper A1: Wigley S E, Hersey P, Palmer J E. 2007. A Description of the Allocation Procedure applied to the 1994 to present Commercial Landings Data.

Presentation Highlights

The multi-tier trip-based allocation is designed to combine each mandatory reporting dealer (Dealer) trip with a vessel trip report (VTR) trip or a group of VTR trips of similar characteristics to obtain area fished and effort associated with the Dealer trip. Although the trip-based allocation and the single species proration yield similar results with regard to stock landings (Wigley et al. 2007), the trip-based allocation is an improvement over the single-species proration because it provides area fished at a fine level of resolution (statistical area rather than stock level) for all species. It also estimates effort associated with these landings. The trip-based allocation represents a comprehensive approach to determining area fished and effort in Northeast region’s commercial landings in order to meet scientific and fishery management needs as well as commercial data reporting requirements to Northwest Atlantic Fisheries Organization and supports economic and ecosystems research.

The multi-tier trip-based allocation has been developed to augment commercial landings data with area fished and effort; however, trip characteristics, species landings and price information will not change. All species on a given trip/subtrip will be assigned the same area and effort. The multi-tier trip-based allocation utilizes Vessel Trip Report data that have been aggregated into four levels: Level A, Level B, Level C and Level D. At Level A, Dealer and VTR trips are matched one to one. At Levels B, C and D, VTR trips are grouped together to form a pool of trips with similar characteristics which define the stratification cell within the level of aggregation.

A Dealer trip seeks an area match at Level A, and progresses through the increasing levels of aggregated VTR data until a match occurs. Area is obtained first then effort is obtained.

For each area level and stratification cell, a discrete probability distribution function is formed representing the proportion of trips which fished in a unique statistical area. A discrete cumulative distribution is formed using the statistical area probabilities. Each unique statistical area within the VTR group will have a cumulative probability associated with it. Before the allocation begins, every Dealer trip is assigned a random number between 0 and 1. The random number is compared with the cumulative probability associated with each area. The cumulative probabilities are in ascending order; when the random number is greater than or equal to the

cumulative probability value, the statistical area associated with the cumulative probability is assigned to the Dealer trip. Thus, a single area fished is assigned to a Dealer trip on a probabilistic basis by sampling (with replacement) the distribution of VTR areas within the group.

Total effort is not known in the Dealer data; each Dealer trip will be supplemented with effort (days fished and days absent) taken directly from a VTR trip or estimated from the pool of VTR trips with similar characteristics. When a match occurs at Level A, days fished and days absent are transferred to the Dealer trip only when both effort metrics have values (both must be not null). If available, the number of hauls, haul duration, crew size, gear quantity, and gear size are also transferred. If a match occurs at Level B, C or D, then an estimate of days fished (DF) per trip and an estimate of days absent (DA) per trip are assigned to the Dealer trip. Both days fished and days absent are estimated by the median of their distributions, respectively, within the cell. The median was selected as the simplest statistic of central tendency for distributions of various shapes.

The allocation assumes the follow: 1) Dealer landings are a census of total landings; 2) vessels land only once per trip; 3) each Dealer trip that enters the allocation represents one trip; and 4) VTR data set is a representative subset of the Dealer set.

The proportion of Dealer landings entering the allocation range between 19% and 32%. Between 51% and 73% of the landings that enter the allocation to find area fished match at Level A (a one to one match of Dealer and VTR trips). Total commercial landings changed very slightly (< 1 mt) due to rounding of whole species pounds on split trips. An evaluation of input data for allocation revealed the VTR subset generally reflected Dealer data. An evaluation of the random component of the allocation indicated that the random component did not contribute to a wide spread in stock landings, indicating that the random component is not a large source of stock landings variability. Although some statistical areas on the biological samples associated with allocated trips changed, the majority of samples remained unchanged.

Strengths of the trip-based allocation include: 1) provides landings at a finer temporal and spatial resolution than the single species proration; 2) is a comprehensive approach to create a master dataset to support all analyses; 3) uses the same data sources as the single-species proration; 4) the multi-tier feature of the trip-based allocation is similar to the pre-1994 data where port agents conducted interviews or used their local knowledge to determine area fished and effort; and 5) the trip-based features maintains the link to biological samples. Weaknesses of the trip-based allocation include: 1) use of VTR data (self-reported data), however, this is the only data set containing the needed information; 2) VTR compliance and data auditing could be improved; and 3) examination of effort over the entire series is needed.

Discussion on Working Paper A1

There was discussion on the differences in the proportion of trips between the VTR and the dealer data particularly for invertebrate species and the large-mesh groundfish fishery. Part of the reason for this is that not all of the lobster vessels are required to submit a VTR, and part is due to aggregation of trips in the dealer data for state landings information, resulting in a large number of single records which are actually multiple trips and/or vessels. In other words, trips may not mean the same thing in both databases.

The two algorithms used to prorate VTR data to statistical and stock area (old single-species vs new trip-based) were clarified and discussed. In the single species algorithm, proration for

each species is undertaken separately (using port group, gear group, and market category, matched at permit month day, matched set by stock area, proportions applied to dealer landings). The trip-based allocation uses a similar approach but occurs at a finer scale and apportions the landings of the entire trip amongst statistical areas fished based upon a four level (A through D) allocation process. The first level (A) is considered the most detailed information which is used to apportion the landings in the other levels. This allows for multi-species analyses and recreation of patterns on a consistent basis. It was noted that where latitude and longitude positional information is available, it is included in the database. The approach is meant to be similar to that of a port agent interview prior to 1994. It was noted that new and old systems produced landings allocations amongst stocks that were consistent. One of the advantages of the new system is the availability of intra-trip data on statistical area fished.

A small portion of the data is from smaller vessels that are grouped together and end up not allocated. It was clarified that the large amount of non-allocated data in Table 4 of working paper A1 are landings that did not enter the allocation process from fisheries that do not need to submit this type of logbook (i.e. surf clam, quahog, tunas) as opposed to data that required allocation.

It was noted that only one realization from the randomization simulation (different random number seed) was carried forward into the database. There is a potential for the selection of different areas assigned to Levels B, C, and D depending on the random number seed. This was tested and the distributions of the landings by stock area were generally fairly tight. The new database provides the potential to estimate the variance in the landings in the assessments due to stock area assignment.

Working Paper A2: Wigley S E, Legault C, Brooks E, Cadrin S, Col L, Hendrickson L, Mayo R, Nitschke P, Palmer M, Sosebee K, Terceiro M. 2007. Annual Comparisons of the trip-based allocated and the single-species prorated commercial landings, biological samples and numbers of landed fish at age

Presentation Highlights

Annual comparisons between the data used in the GARM 2005 stock assessments and the trip-based allocated commercial data were conducted for most GARM species for 1994 to 2003. These comparisons included: annual total species landings, annual stock landings, biological samples (lengths and ages), and the resultant numbers of fish at age.

There were negligible changes in annual total species landings between current landings (CFDETS) and trip-based allocated landings (CFDETS_AA) due to rounding in the trip-based allocation. There were minor changes in annual total species landings between data used in the GARM2005/TRC2007 and CFDETS_AA due to revisions and updates of the commercial landings. For multi-stock species, some shifts in stock landings occurred, the majority of biological samples retained statistical area (and stock area), and there were generally minor changes in landings at age. Statistical area changes of biological samples for single stock species are inconsequential.

Strengths of this analysis include: 1) comprehensive examination of GARM species with multiple stocks and most GARM species with unit stocks; 2) followed the estimation process all the way through to landings at age; 3) utilized the biological samples as much as possible; 3) includes estimates of uncertainty for landings at age and 4) landings at age do not change using the trip-based allocation. Weaknesses of this analysis include: 1) focused on GARM species, but invertebrates and other species should be examined as well; 2) unfair comparisons, in some

cases, due to inclusion of lengths or ages from observer or survey sources in the GARM 2 but not AA calculations, making LAA comparisons difficult and 3) did not consider alternative to trip-based allocation schemes.

Discussion on Working Paper A2

The NEFSC's port sampling process was discussed and many clarifications made. Differences in the landings at age (LAA) for some species using the allocated data and samples were noted. Some of these differences may be due to low sample sizes in some years, resulting in even fewer samples after the allocation. It could also be due to the augmentation of port samples with samples from the observer program in the prior assessment. There is a need to examine the impact of these differences on the relevant assessments at the next meeting.

Working Paper A3: Nies T, Applegate A J. 2007. Accuracy of Self-Reported Fishing Locations in the New England Multispecies Trawl Fishery and

Working Paper A5: Applegate, A.J. 2007. Using VMS data to characterize fishing activity in the US yellowtail flounder [*Limanda ferruginea* (Storer 1839)] fishery

Presentation Highlights

Working paper A.3 investigated the accuracy of VTR location information that is used for several purposes in fishery analyses. With respect to the GARM TOR, this information is used to allocate landings to statistical area and ultimately stock area. The key points of the presentation were:

- VTRs did not accurately report area fished for 20% - 30% of a subset of observed trawl tows
- Impact of errors depends on spatial scale used (statistical area vs. stock area)
- Errors can affect allocation of landings to stock area; this may be important for some stocks
- Errors could affect other analyses: discard estimates, effort distribution, ageing, protected species interactions. Care should be exercised when assuming that the VTR locations are accurate at spatial scales smaller than stock areas.

Working paper A5 established that VMS speed profiles can be used to reliably predict trawl fishing locations. VMS positions from a random sample of trips landing large amounts of yellowtail flounder were classified as either fishing or non-fishing positions based on speed profiles. These positions were matched to observed tow locations for those same trips. A reasonable and statistically valid association between VMS positions tagged as fishing activity and observed tows was demonstrated.

Working paper A3 matched VMS or observer data to VTR records for subsets of trawl trips for calendar years 2003, 2005, and 2005. The assignment of fishing locations as determined by VMS speed profiles or observed haul locations was compared to the assignment of fishing locations from VTRs. The differences were reported by statistical area and stock area. This evaluates the errors in the distribution of fishing effort introduced through erroneous VTR reports. For the three years examined, between 20-30 percent of observed tows examined were assigned to the incorrect statistical area by the VTR. Most of the errors are caused by vessels fishing in more than one statistical area, but reporting only one area. The presentation highlighted

that there are some statistical areas where erroneous VTR reporting is more problematic (e.g. SA 526).

In an additional analysis, the catch (landings and discards) of cod, yellowtail flounder, and winter flounder on the observed trips (matched to VTRs) was allocated to statistical area and stock area by the observed area and the VTR area. This illustrated how the VTR reporting errors can affect the distribution of catch for the data set used. The results showed that for some stock/year combinations the errors were minor, but for other stock/year combinations they were substantial. In particular, SNE/MA yellowtail flounder was identified as of particular concern. In a second analysis, yellowtail flounder catch on a different subset of trips was allocated to statistical area where VMS reports most fishing activity occurred. This is compared to the allocation reported by the VTR. This analysis also suggested that the VTR may over-allocate SNE/MA yellowtail flounder. Finally, the impacts of using VTR to allocate fishing effort were shown using observed haul duration as a measure of effort. The total effort assigned to statistical areas by VTR was shown to often be in error.

Strengths of these analyses are:

- The paper used methods to verify the accuracy of VTR location information
- The methods used allow an illustration of the magnitude of the errors and possible impacts.

Weaknesses of the analyses are:

- Observer coverage was directed to special programs in 2004 and 2005. Since some of these programs limited where vessels could fish on a given trip, this may bias the results to underestimate errors introduced by VTRs. At the same time, it makes it difficult to extend the results to the fishery as a whole.
- Because of a lack of observer and VMS coverage, the analyses cannot be extended to the full catch time series.
- While the paper suggests it may be possible to develop a way to use VMS to allocate catch in the future, there is no obvious correction factor that can be applied to existing data.

Working Paper A4: Palmer M C, Wigley S E. 2007. Validating the stock apportionment of commercial fisheries landings using positional data from Vessel Monitoring Systems (VMS)

Presentation Highlights

Vessel Monitoring System (VMS) positional data from northeast United States fisheries were used to validate the statistical area fished and stock allocation of commercial landings derived from mandatory Vessel Trip Reports (VTRs). A gear-specific speed algorithm was applied to 2004 – 2006 VMS data from the otter trawl, scallop dredge, sink gillnet and benthic longline fisheries to estimate the location of fishing activity. Estimated fishing locations were used to allocate the landings of eight federally managed species to stock areas: Atlantic cod (*Gadus morhua*), haddock (*Melanogrammus aeglefinus*), yellowtail flounder (*Limanda ferruginea*), winter flounder (*Pseudopleuronectes americanus*), windowpane flounder (*Scophthalmus aquosus*), goosefish (*Lophius americanus*), silver hake (*Merluccius bilinearis*) and red hake (*Urophycis chuss*). Haul location and catch data from the

Northeast Fisheries Observer Program (NEFOP) were used to assess the relative accuracy of both VMS and VTR allocation methods.

Overall, the mean VMS – NEFOP agreement rate was 86.4 ± 7.6 % compared to a mean VTR – NEFOP agreement rate of 58.5 ± 4.9 %. VTR's accurately record the identity of at least one of the statistical areas on a given trip, but exhibit a tendency to under-report the number of statistical areas fished when fishing occurs in multiple statistical areas. The VMS algorithm had a tendency (approx. 10 % of all trips) to overestimate the number of statistical areas fished such that when all fishing activity from a given trip occurs in a single statistical area, VTRs more accurately reflected the true fishing location. However, on trips where fishing activity occurred in multiple statistical area, the VMS algorithm showed pronounced gains (77.2 ± 11.2 % NEFOP agreement) relative to VTR reports (12.0 ± 5.9 % NEFOP agreement). The VMS method achieved distributions of stock landings closer to NEFOP estimates in 18 out of 24 instances (8 species over 3 years). The stock allocations from both the VMS and VTR-based methods were within ± 5 % for all stocks, suggesting that the impacts on total stock allocations are relatively minor. However, these small differences represent major relative differences for less abundant stocks such as southern New England/mid-Atlantic yellowtail where in 2005 the VTR-based method allocated 61.9 % more landings relative to the VMS-based method. The VMS-based method is not a replacement for the VTR-based method; however, it can, and should, be used as a tool to identify those vessels where targeted outreach activities would improve the accuracy of VTR statistical area reporting.

Discussion on Working Papers A3, A4 and A5

The impact of mis-reported statistical area(s) or the reporting of a single statistical area when fishing actually occurred in multiple areas on the allocation process was discussed. The impact on smaller stocks (SNEMA yellowtail flounder) may be greater than that on larger stocks and there may be a masking of trends in the relative fishing mortality (F) for index-based stocks. This could be examined in the assessment.

The statistical area reporting practices of fishermen on a trip were discussed. There may be predictable patterns in the reporting of statistical area by fishermen that could be used in the proration algorithm.

The value of using Vessel Monitoring System (VMS) data in verifying the statistical area fished was discussed, recognizing that these data also have issues. For instance, in Europe, some boats have been observed to slow down to develop fishing time in an area. There may also be issues with misreporting due to regulations (one area having a lower quota, etc). The need to communicate with and educate fishermen who have misreported the statistical area of fishing was highlighted as a means to improve the quality of the data on statistical area fished.

There was discussion on the difference between the conclusions of the main papers. Some of these were due to the number of vessels examined in each. One paper examined a subset of vessels (offshore vessels with a large catch of groundfish) whereas the other considered a wider range of vessels. Overall though, the papers were complementary, highlighted the need for caution in interpreting the statistical area fished data, and the future potential of the VMS data to supplement and verify the statistical area fished information in the VTR database.

Working Paper A6: Legault C, Brooks E, Seaver A. 2007. BioStat Bootstrapping for Estimating Uncertainty in Commercial Landings at Age

Presentation Highlights

Estimation of uncertainty for commercial landings at age is an important component for stock assessment, especially for use in forward projecting models which allow uncertainty in the catch at age. The bootstrapping process described in this working paper occurs at three levels: port samples, lengths within samples, and ages within lengths for that sample. This three tier bootstrap incorporates all levels of uncertainty in the data collection and then is treated in the same manner as the original sample to generate a bootstrap estimate of landings at age. Repeating this process many times produces distributions of landings at age which can be summarized by coefficients of variation as well as a variance-covariance matrix for landings among ages. The software is already developed and easy to use, typically taking only minutes to conduct 1000 bootstraps. An extension of the software to allow incorporation of an ageing precision matrix is in beta testing.

Results from specific application of the bootstrap method in BioStat show that uncertainty in landings at age are highest at the youngest and oldest ages and that there are often positive correlations among ages. These results showed high agreement with those of the model based estimates provided in WPA7, both in terms of the pattern of CV and the presence of positive correlations among ages, even though there are some slight differences in how the samples are expanded to the total catch. These positive correlations are not found in the typical assumption of a multinomial process for modeling error in the catch at age in forward projecting models. Preliminary exploration of using the variance-covariance matrix directly in the likelihood function of a catch at age analysis found different estimates of F than when the multinomial assumption was made.

Some additional uses of the bootstrap approach are to use the bootstrapped landings at age separately in virtual population analysis runs to produce distributions of stock and F matrices. Results can also be used to guide sampling requests and assist in determination of the plus group age. It is recommended that bootstrapping be performed regularly as part of the estimation of landings at age.

Working Paper A7. Miller T. 2007. Model-based estimation of numbers-at-length and(or) - age for commercial landings in the Northeastern United States

Presentation Highlights

Model-based estimates of numbers-at-age per unit weight are multiplied by the true total weight. An implicit assumption is made that the numbers-at-age per unit weight in the larger landings are the same as that in the unsampled smaller landings. The estimates are derived with respect to model-based inference, but are also appropriate for design-based inference using a specific type of stratified multi-phase design. Model-based inferences depend on the how closely model assumptions match the reality of the data-generating mechanism (Valliant et al. 2000).

The overall model reflects measurements with multiple sources of error. For example, the estimate of total number at length l for a given market category in a trip can be viewed as a measurement of the true total number at length l (in the market category) with error. Furthermore, this measurement error can be estimated with the data components used to make the measurement (the number of fish sampled in the trip with length l in the market category).

Similarly, the estimate of total number at length l at a port may be viewed as a measurement with error where the data used to make the measurement (the trip-specific total numbers at length l) are also measured with error and the precision of the measurements for each trip can be assumed to be different. As such, different measurement error components (trip- and port-levels) for an overall estimate (measurement) of the total numbers caught at length are produced.

Discussion on Working Papers A6 and A7

There was considerable discussion on the design of the NEFSC port sampling program. Questions arose on the definition of the sampling unit used. Sampling appeared clustered while the current analysis of the data assumes independence. It appeared that the current sampling procedure does not fit well into standard sampling theory. A request was made to develop a schematic of the bootstrapping sampling procedure. This was provided later in the meeting and led to the conclusion that bootstrapping below the port level was not required (see below)

It was considered that the model and design-based sampling approaches should produce similar results if both are based upon the same assumptions. The advantage of the modeling approach is that auxiliary information can be included. However, there was no discussion on what kind of auxiliary data would be appropriate.

COMMERCIAL DISCARDS

Working Paper B1: Blaylock J, Wigley S E. 2007. Summary of trips from the Northeast Fisheries Observer Program and Vessel Trip Report data

Presentation Highlights

The Northeast Fisheries Observer Program (NEFOP), which was implemented in 1989, has observed trips for a wide variety of gear types. During 1989 to 2007, the majority of NEFOP trips represent five main gear types: longline, otter trawl, shrimp trawl, sink gillnet, and scallop dredge. The number of NEFOP and Vessel Trip Report trips were summarized for 1994 to 2006 for those five gear types, stratified by area fished, mesh group, trip category and calendar quarter. Given that stock assessments need a time series of discard data, this inventory summary indicates that there are some stratification cells where there are little or no coverage. Issues of stratification, imputation and hindcasting will arise when estimating discards for stock assessments.

Working Paper B2: Wigley SE, Palmer MC, Blaylock J, Rago P J. 2007. A Brief Description of the Discard Estimation for the National Bycatch Report and Working Paper B6: Wigley S E, Rago P J, Sosebee K A, Palka D L. 2007. The Analytic Component to the Standardized Bycatch Reporting Methodology Omnibus Amendment: Sampling Design and Estimation of Precision and Accuracy

Presentation Highlights

Three methods and two ratio estimators (discard weight to kept weight of all species and discard weight to days absent) were examined in the Standardized Bycatch Reporting Methodology (SBRM) analysis. This analysis used 2004 Northeast Fisheries Observer Program (NEFOP) data to estimate sample sizes needed to achieve a desired precision and to evaluate

accuracy in the NEFOP data. A broad stratification of calendar quarter, region (port of departure), gear type, mesh size, access area (open, closed) and trip category (general or limited) was used. The three methods and two estimators yielded similar results; the combined ratio of discard weight to kept weight of all species was determined to be the preferred approach.

For the National Bycatch Report, the combined ratio of the discard weight to kept weight of all species was used to estimate discards in 2005 for the 33 Magnuson-Stevens Act species from 25 fleets in the Northeast Region. Similar to the SBRM analysis, this analysis used a broad stratification; however, instead of port of departure, area fished was used. In addition to estimating discards and associated precision, this analysis also validated the estimation method and underlying data by estimating landings using the Northeast Observer Program data. For many of the species and species groups, the estimated landings based on NEFOP data compared favorably to the VTR landings, with the 95% confidence interval of the estimated landings encompassing the VTR landings, confirming that the method and underlying data provide sound estimates of discards. It is important to emphasize that discard estimates and the stratification used in this analysis may not necessarily correspond to the discard estimates derived for individual stock assessments.

The strengths of this analysis include: 1) a wide variety of species were examined; and 2) validation of method and underlying data was undertaken. The weaknesses of the analysis include: 1) only examined a single year; 2) estimated discards and landings at species level, not stock level; 3) used a broad stratification with many cells containing large sample sizes.

Discussion on Working Papers B1, B2 and B6

The discussion raised a number of suggestions for NEFSC to pursue. The statistical methods for filling in missing data should be examined. Using nearest neighbor estimates for filling in missing years may also be appropriate. The impact of filling in missing cells or hindcasting for the results of the assessment should be investigated.

The National Bycatch report used a consistent method of estimating discards for many different species and fisheries. It was noted that a finer tuned stratification of the observer data will likely be developed in each species specific stock assessment which may result in more precise discard estimates. In addition, the use of allocated dealer data will allow for finer stratification in the discard estimates. However, the discard estimates used in the stock assessment should be on the same order of magnitude as the National Bycatch report estimates. The combined ratio method was validated by comparing estimated landings using expanded kept portion of the catch in the observer data to the actual report landing. The estimated landings appear to be in line with the reported total landings. Using kept weight of all species in the denominator of the combined ratio ensures that all the catch data were used in estimating discards.

Working Paper B5: Legault C. 2007. Discard Estimation using Observer Data

Presentation Highlights

Discards were estimated by six methods in four sample populations created using observer data. In each population, the total discards were known. Random samples of 10% of the population were selected and each of the six methods used to estimate the total discards. Bias for each method was estimated as the mean of difference between the 1000 estimates and the true value. There were two clear winners out of the six, the ratio of sums and the mean discard per

trip. Both had zero bias, although individual realizations could still be relatively far away from the true value, plus/minus 50%. In contrast, the four clear losers were highly biased and almost always far away from the true value. These four poor performers were mean ratios of different types. Although only four sample populations were created, it was the use of actual observer data, with all of its inherent variability, which made this a reasonable test for the estimators and led to the poor performance of the mean ratio estimators. Use of all species kept as the denominator in the sum of ratios method appeared to produce less biased results than use of only the species of interest in the denominator.

Discussion on Working Paper B5

The discard simulation analysis using actual observer data showed a clear difference in the performance of the discard estimators. Discard estimators which use a mean of ratios were highly biased. Increased sampling did not make these estimates less biased. The ratio of sums (sum of discard weight over sum of kept weight) over all trips and the effort based estimator were unbiased and is the preferred ratio as there are difficulties in obtaining the total number of trips in the fishery for the effort based expansion. Although the combined ratio estimator preformed well, there was some discussion on whether landings of all species is a good surrogate for effort. The poor relationship between the discards of a species to the total landings was questioned. The simulation suggests that the estimator is invariant to the correlation between the numerator and the denominator. However, the effort based discard estimator may perform better at low sample sizes.

Working Paper B4: Terceiro M. 2007. Comparison of commercial fishery discard estimates for SNE/MA winter flounder

Presentation Highlights

The National Bycatch Report's combined ratio bycatch estimation approach (NBRD2) has been applied for comparison with observer (OB) and VTR discard rate estimation methods for 1994 and later years. Discard rates by half-year were calculated for trawls and scallop dredges, and applied to the corresponding landings (winter flounder landings for the OB and VTR rates; landings of all species for the NBRD2 rates). The OB discard rate estimates were higher and more variable (with some infeasible estimates), than discard estimates from the VTR and NBRD2 methods, which were generally of about the same order of magnitude. Coefficients of Variation (CVs) for the VTR estimates have not been calculated; CVs for the NBRD2 estimates for combined trawl and scallop fisheries ranged from 118% (1994) to 11% (2005), with a median value of 28% for 1994-2006. If the VTR and NBRD2 discard estimates are examined by gear, it is apparent that the scallop dredge estimates generally make up a larger part of the NBRD2 estimate total when compared to the VTR estimates. The scallop dredge fishery lands a small amount of SNE/MA winter flounder (less than 35 mt annually) compared to the trawl fishery (1,200-4,600 mt annually), and so even though the VTR scallop dredge discard rates can be high, the VTR discard estimates (based on expansion by winter flounder landings) are relatively low. In previous assessments, neither the OB nor VTR discard rate data were considered adequate for the estimation of discards specific to the scallop dredge fishery, due to sample size and inter-annual variability of the rates.

In contrast to the VTR estimates for scallop dredge gear, the NBRD2 scallop dredge discard estimates are quite variable and can be much larger than the trawl discard estimates, in spite of a

low discard rate (discard of winter flounder to total landings of all species), because of the large magnitude of total landings in the fishery (used as the expansion factor) and the sensitivity of the discard estimate calculation to small inter-annual changes in the absolute discard rate. CVs for the NBRD2 estimates for the scallop dredge fishery ranged from 75% (1997) to 15% (2005), with a median value of 42% for 1994-2006. It remains unclear if the NBRD2 scallop dredge discard estimates for SNE/MA WFL are appropriate for use in the assessment.

Wigley et al. (B2) indicated that the NBRD2 estimate of landings for winter flounder (3,186 mt) was comparable to the Dealer reported landings (3,667) for 2005, with the 95% confidence interval (2,606-3,767 mt) encompassing both the Dealer landings and the VTR reported landings (3,477).

Discussion on Working Paper B4

The working paper described a real life example of estimating discards for a fishery that does not retain any catches of the discarded species. The working paper questioned how to estimate winter flounder discards in the scallop fishery. In this fishery, the combined ratio method produces very low ratios of discards to total landings but the expansion using total landing of all species was very large. The resulting discard estimates for the scallop fishery were relatively high compared to the trawl fishery discards and in years with low observer coverage, the estimates can be high and variable. The review panel suggested looking at other sources of information such as regulatory changes that could support a possible large discard event. It was noted that the trends appear to be similar among the different discard estimates from 1994 to 2003 but that there is some divergence between the trends after 2003.

Working Paper B3: Hendrickson L, Nies T. 2007. Discard and gear escapement survival rates of some Northeast groundfish species

Presentation Highlights

There are few studies that address discard and gear escape survival rates of the Northeast groundfish species that will be assessed during GARM III. No studies were identified for white hake, redfish, Ocean pout, and windowpane flounder. The working paper summarized important study design elements, factors affecting survival rates and survival rate estimates from existing studies. Most of the studies pertained to trawl gear but there were also a few longline studies for which the discard survival rates were estimated for haddock, Atlantic cod, and Atlantic halibut. Survival rates can be quite variable for the same species, gear type, and survival monitoring period because many factors affect the survivorship of discards and gear escapees. In addition, there are many important study design considerations that can affect survival rate estimates.

Survival rates are species-specific and may also be size-dependent. Some of the survival rate studies included in the review had design shortcomings such as: small sample size, lack of a control group, unrepresentative commercial fishing and handling conditions, and short holding times of caged individuals. Most of the studies did not include post-release mortality estimates attributable to avian predation, which can be a substantial source of discard mortality for some species. Therefore, it was recommended that a thorough evaluation of the adequacy of a particular study design be conducted before deciding to use the survival rate estimates in a stock assessment. Well-designed survival rate studies of Atlantic cod (longline and trawl), American plaice (trawl), and yellowtail flounder (trawl) were identified in the working paper. In general, discard survival rates were higher for flatfish (and highest for yellowtail flounder and winter

flounder) than gadids and higher discard survival rates were reported for large fish compared to small fish. For example, trawl discard survival rates from one study were 0-25%, 17-37%, and 66-89% for Atlantic cod, American plaice, and yellowtail flounder, respectively. The same study estimated trawl escape survival rates for cod, American plaice and yellowtail flounder as 94-96%, 39-41%, and 68-90%, respectively. For haddock, gear escape survival rates are size-dependent with the lowest survival rates for fish < 15 cm. No precision estimates associated with survival rate estimates from any of the studies were presented. The Gulf of Maine and southern New England-Middle Atlantic winter flounder stocks are the only GARM III stocks for which a discard survival rate > 0 is used in the assessment (a value of 50% is used and is based on an average from two studies).

Discussion on Working Paper B3

There is limited information available on discard survival rates for GARM species in the commercial fishery. There is even less known about escapement survival. Escapement mortality is assumed to exist but is difficult to quantify. Escapement mortality estimates do not exist for GARM stocks. Gulf of Maine and Southern New England winter flounder are the only GARM stocks that assume greater than zero percent survival for commercial discards. The stress of capture or escapement can lead to higher predation mortality. However, the cod tagging study does indicate that survival in commercial gear is greater than zero. The question to the GARM was whether there is a basis to assume survival of discards greater than zero percent for a stock? It was recommended to use survival rates greater than zero percent if there are studies to support the higher survival rate estimates.

TAGGING DATA

Cod

Working Paper C1: Tallack S. 2007. A description of tagging data from the Northeast Regional Cod Tagging Program (WP3A) and preliminary applications of weighting and mixing analysis (WP3C)

Presentation Highlights

During 2005, it was recognized that the Northeast Regional Cod Tagging Program's (NRCTP) large, quality-controlled database had the potential for real management application, particularly with regard to stock identification through estimates of mixing and growth. Between April 2003 and July 2005, over 114,000 cod were T-bar tagged on over 100 commercial and recreational vessels, during dedicated tagging trips in both US and Canadian waters. The size range of fish tagged was 29-134cm, with 41% (n=46,613) being sublegal (<53cm) at the time of release. Different tag combinations were used to enable estimates of tag shedding (n=18,305 double-tagged) and reporting rates (n=2,240 high reward releases). Tag release data is detailed, quality controlled and downloadable as an MS Access relational database (the master database is built in SQL). By October 2007, recapture information has been received by GMRI (Gulf of Maine Research Institute) for over 5% of the tagged cod releases (n>6,500). By December 2007, release and recapture information for an additional 67,554 cod tag releases during 2000-2003 will be available. These fish represent recent cod tagging efforts undertaken by the University of New Hampshire, University of Massachusetts' School of Marine Science

and Technology and Fisheries and Oceans Canada. The GMRI is currently auditing, error-checking and collating these three datasets into the same format as the larger, NRCTP dataset, ready for inclusion into the NEFSC multi-species tagging database (currently still in development). In total, 182,029 cod tag releases and >10,157 tag recaptures will be available for future movement analyses for the time period of 2000 onwards.

There are two core assumptions when defining a stock, namely that the stock is self-sustaining and that neighboring stocks exist in isolation. As the bank of recapture data has increased, a descriptive depiction of “passages of travel” for Atlantic cod in the Gulf of Maine region has become possible. These migration patterns may violate both core stock definition assumptions, as indicated through the quantification of movements using a model. Of the movements observed, some were anticipated; e.g. exchanges of fully recruited cod between the Bay of Fundy (Canada) and Georges Bank (US). However, a more surprising split in migration patterns has been observed where smaller cod appear to recruit from the Cape Cod nearshore waters and migrate either: 1) northwards into the inshore Gulf of Maine waters, or 2) eastwards out onto Georges Bank. This divergence in migration patterns is not currently accounted for in the current stock assessment models and it is recommended that cod movements and exchange rates feature in future stock assessment methods.

Working Paper C2: Loehrke J, Cadrin S. 2007. A Review of Tagging Information for Stock Identification of Cod off New England

Presentation Highlights

Recent observations of cod movement across stock boundaries are generally consistent with historical tagging data as well as information from other stock identification approaches. This working paper provided an historical context in which to consider recent tagging data for spatial delineation of cod stock assessments. A review of cod stock identification approaches, focusing on tagging investigations, was presented and organized chronologically. Four conclusions were made with special consideration to transboundary movement:

1. Movement across boundaries is documented in all relevant investigations.
2. The primary direction and magnitude of movement varies between studies.
3. The current stock management boundaries are defined for operational purposes.
4. Evidence suggests that it may be appropriate to reevaluate stock boundaries, particularly in the vicinity of the Great South Channel where there is considerable mixing and growth rates are intermediate between those observed in the Gulf of Maine and Eastern Georges Bank.

Working Paper C3: Miller A. 2007. Estimating instantaneous rates of regional migration and mortality from conventional tagging data and

Working Paper C4: Miller A. 2007. A finite-state continuous-time approach for inferring regional migration and mortality rates from conventional and archival tagging experiments

Presentation Highlights

A finite-state continuous-time approach for inferring instantaneous migration and mortality rates from different types of tagging studies including tag-recovery are the subject of recent work by Miller and Andersen (in review). Here we apply the statistical method to data from tag-

recovery experiments by the Gulf of Maine Research Institute (GMRI) on Atlantic cod, but expand the set of states to allow estimation of tag reporting probabilities, tag shedding rates and account for incomplete mixing of newly released individuals.

The main concern with the results so far is the unexpectedly high estimates of natural mortality. Potential causes for positive bias in natural mortality include 1) movement of fish to areas inaccessible to fishing or outside of the study area, 2) heterogeneity of size of released fish when there are differences in fishing mortality with size and 3) less than 100% reporting of high reward tags. The first potential cause is not readily dealt with using any tagging study, but the second cause could perhaps be treated by allowing fishing mortality to change with length and assuming a model for growth of tagged fish. Finally, the third cause is probably contributing substantially to the results here because tagged fish may just not be seen in large trawl catches. Non-reporting of high-reward tags does not appear to be a treatable problem, but if we can assume that this occurs equally across regions, the estimates of migration rates would be unbiased even though the natural mortality rates would be positively biased.

Discussion on Working Papers C1, C2, C3 and C4

It was noted that catch and effort scaling by statistical area in the cod movement paper was from NEFSC dealer data pro-rated and then combined for stock area. The selection of the cod model by Miller (C3 & C4) was not unduly influenced by the number of model parameters as it was based on a likelihood ratio test criteria and would be same choice even if AIC were used.

The suggestion was made to evaluate alternative tagging models such as the Brownie or MARK models. However, it was noted that in this situation these models may have to make some undesirable assumptions and the confounding of migration and mortality may create misleading fishing mortality estimates. A simple model of the number of recaptures divided by number of releases was also suggested.

The assumption of 100% reporting of high reward tags may not be reasonable. Lower possible rates should be considered. The majority of cod tagged were small (less than 53 cm). The model was parameterized with a constant natural mortality but it may be higher on smaller fish due to predation.

A sensitivity analysis of the Miller model was suggested. It was suggested that some rates be fixed such as exchange rates, natural mortality, reporting rate, etc. The possibility that tag return rates differ by gear type should also be investigated. In particular, differences in gear composition for the different areas may result in area - specific differences in estimates of fishing mortality. Also, if possible, the fully recruited fishing mortality using only legal size fish should be estimated. It was noted that size distribution affects probability of capture (for sensitivity issues).

The question was raised as to whether the tag return data supported the current stock definitions. The large exchange of cod between Georges and Browns Banks was noted. It is possible that permanently closed areas may have reduced tag release and recaptures (~20,000 tagged cod were released in closed areas (Cashes, CAI, CA II, WGOMCA)), because recaptures in those areas are limited to tagging trips and recreational recoveries. This may affect parameter estimates because of refuge effects. It was assumed that all fish are available and have equal probability of capture, whether tagged or untagged.

It was suggested that an analysis be conducted to examine the impact of net movements among areas. Also, it was suggested that the differences within Georges Bank be examined. If movement rates were taken at face value, would net loss be similar to having a higher natural

mortality? It was noted that the results have to be conditioned on biomass by region and would be a function of the size or age of fish tagged. Incorporating additional parameters into the model to address this would be difficult but is possible.

It was concluded that the tag analysis represented a first look at sensitivity for bias. Additional work could go beyond the tag results to consider the implications of the higher natural mortality in the assessment models (e.g. VPA).

There was discussion on how much movement was needed before the current view of stock definitions was invalidated. This could be examined through the modeling presented at the meeting including expected equilibrium distributions of abundance and biomass across stocks under different migration rate scenarios and the impact of different stock boundaries on these distributions. It was unclear how much of these explorations could be done during this GARM.

Yellowtail

Working Paper C5: Cadrin S, Westwood A, Alade L, Moser J, Martins D. 2007. Yellowtail Flounder Tagging Data

Presentation Highlights

New England fishermen and staff at the Northeast Fisheries Science Center tagged over 45,000 yellowtail flounder in all three New England stock areas. The study was designed to charter commercial fishing vessels to tag yellowtail flounder with conventional disc tags and data-storage tags with the objectives of estimating movement among stock areas and mortality within stock areas as well as providing growth observations. Preliminary results indicate frequent movements within the Cape Cod and Georges Bank stock areas with a less frequent movement among stock areas. Results are expected to provide information for yellowtail flounder stock assessments and management decisions. This report provides supporting technical information for preliminary estimates of movement and mortality to be reviewed for yellowtail flounder stock assessments (TOR C).

Working Paper C6: Cadrin S. 2007. Movement-Mortality Analyses of Yellowtail Flounder Tagging Data

Presentation Highlights

The objective of this working paper was to provide updated analytical results from the cooperative yellowtail tagging study and demonstrate potential utility of the data for future stock assessments (TOR C). However, the tagging study is still in progress and these data are preliminary. More importantly, these analyses are presented to illustrate developmental methods and are not intended for stock assessment purposes. Background and introductory information about the yellowtail flounder tagging study are described in GARM Working Paper E3.

Working Paper C7: Alade L, Cadrin S. 2007. Evaluating the Precision and Accuracy of the Yellowtail flounder Movement-Mortality Model via simulation

Presentation Highlights

In this study we begin to address the uncertainty of the yellowtail flounder movement-mortality model by simulating a population that emulates the yellowtail flounder population and tagging study. The results in this paper only provide a snapshot of the several possibilities for simulation and analyses. Based on the presented simulations, recapture data with coefficients of variation of 10% - 25% tend to provide the most accurate estimates of fishing mortality and movement rates. While exploratory simulations will continue to be used to determine the general properties of the model, the results in this paper should be viewed as demonstrations. Future directions involve evaluating the effect of sample size on variance estimates, simulating a design that assumes proportional releases, time varying mortality rates and stock-specific reporting rate.

Working Paper C8: Wood A, Cadrin S. 2007. Can survival be estimated from the yellowtail tag-recapture database? A preliminary analysis.

Presentation Highlights

The analysis of the yellowtail data was based on the suite of Brownie models using the Mark program. Multi-period tagging models were applied. The model require a host of assumptions such as the representativeness of the tag releases, proper accounting of returns, catchability of tagged vs untagged fish, etc. Final model selection was based on an adjusted AIC value. Estimates of over-dispersion were higher than acceptable for these kinds of models. Four basic models were explored. Recaptures were fit to yearly, monthly and seasonal models. The general seasonal model likely best but still overparameterized. The model is considered preliminary and, once the models and the data are refined, the overall fit and the resulting parameter estimates will be greatly improved.

Discussion on Working Papers C5, C6, C7 and C8

Suggestions were made to improve the MARK model. It may be possible to limit releases to one release area and do separate MARK analyses for each stock. Other suggestions were made regarding the Cadrin model, including use of a sex disaggregated model and a model based on historical changes in regulations. Since fishing effort generally is generally related to aggregations of species, use landings instead of effort for specific auxiliary information could be considered. It was also suggested to explore alternative simple models such as the 'catch equation' method to examine natural mortality in SNE yellowtail.

The model estimated survival to be very low but with a great deal of inter-monthly variation. The mortality estimates were very high except in SNE yellowtail. The lack of tag recaptures for this stock created estimation problems in the Cadrin model. In both the MARK and Cadrin models, estimates of fishing mortality (F) were around 1.0 with natural mortality (M) around 0.2. The VPA also estimates high F which may be from high levels of discarding. There was then discussion on the level of discarding. Is SNE really a discard fishery? Discarding is high in two of the three stocks. It was suggested that with F being as high as estimated, the population couldn't persist. Recoveries in 2003 from Georges Bank, for instance, relative to the number released (an R/M or Peterson model) implied that exploitation was quite low. It was noted that R/M is commonly used for continuous fisheries, despite the intended 2-sample design of the

Peterson model and the implicit assumption of a closed population in the period between the two samples. It was mentioned that application of a Peterson model to a continuous fishery makes a logical inconsistency of recapturing tags over a period that is assumed to be closed to any losses. There could be other issues for the low exploitation in the early years (tag loss, etc.). The Miller model implies low dispersal of cod which is likely the case with yellowtail. Low dispersal rates may produce unreasonable values of the other parameters.

The low fitted reporting rate in the Cadrin model (13%) was noted. It was pointed out that even though it seems extremely low, in this fishery, there is an incentive to ignore tags (scallop fishery) and not report. It was suggested that tag returns be examined by vessel to determine the expected returns due to magnitude of vessel landings. This could also be done by fishery.

It was recommended that the Cadrin model was compared to the Miller model to examine the impact of the assumptions made in each. A suggestion was made to apply the Miller model to yellowtail but it was felt that the Miller model needed further evaluation using sensitivity analysis, although it was noted that some sensitivity analysis (sample size, etc.) was presented in the working paper. A caution was raised to avoid integrating results of tag model into VPA. The preference was to keep them independent as a means of checking conclusions. The tag models should move to integrate other information such as catch at length or catch at age. However, it was cautioned that results can be driven by the auxiliary data.

It was asked if the tag data and analyses support the current stock definitions. The reviewers concluded that nothing new resulted from this tag data, particularly boundary issues. What was known about the SNE-GB border was confirmed with tagging. Some Georges Bank fish move to Nantucket shoals seasonally. Diagonal results in the model for Cape Cod and Georges Bank are similar to tagging results from the 1940s (during WWII when F was presumably lower). This implies that the Cadrin model estimates of movement between these areas may be legitimate.

A question was asked on whether migration among stock areas can be quantified. It could but only if conditioned on a model derived F . Perhaps other methods for total mortality (survey data, etc.) would be more appropriate for use in the tag model. Further discussion considered if it could be concluded that there was limited movement between Cape Cod, Gulf of Maine and Georges Bank. If F were high, then fish wouldn't survive long enough to migrate far. A suggestion was made to consider what process would be needed to make off-diagonals (stock movement) higher. It may be possible to use the Cadrin model to do sensitivity of this hypothesis.

The short time series of returns was thought likely to hamper analysis of mortality rates. The results may be most useful for migration and stock structure information. It was concluded that the mortality models are works in progress but not yet ready for use in assessment. It was noted that the tagging results could possibly be used as confirmatory estimates of survival in time for the final GARM meeting.

FISHERY – INDEPENDENT SURVEYS

Presentation: Rago P. 2007. NEFSC Bottom Trawl Surveys - Overview

Presentation Highlights

A brief overview of the NMFS trawl survey series was presented noting that it provided a synoptic view of the fish populations from Cape Hatteras to Scotian Shelf using a consistent

stratified random design over the whole series. Of the three series, the oldest was initiated in 1963 while the newer series (winter series) was discontinued after the 2007 survey. In addition to numbers, weights and size composition for many species, ancillary data on food habits, growth and maturity are collected in addition to some basic oceanographic data (e.g., temperature, salinity).

Discussion on Presentation

It was noted that it was not possible to address the meeting terms of reference on fishery independent surveys (FIS) due to the lack of working papers on each issue. There are many issues to consider and it is important to prioritize work at the NEFSC to address those which are most relevant to the assessments. It was suggested that the Center hold a one to two day internal session as soon as possible to discuss FIS issues. It was suggested that the review panel provide its suggestions on the issues most pertinent to be discussed.

The choice of estimators for survey indices was discussed. With respect to delta distribution vs. zero-inflated distributions, auxiliary variables are needed to distinguish real and sampling zeroes, e.g. side scan or multi-beam sonar, bottom type or depth. Previous work suggests maximum likelihood estimates are not stable and Bayesian approaches may be best (and can incorporate the sampling scheme). Investigating estimators is a long-term research project beyond the scope of the current GARM. A quick approach to examining the usefulness of auxiliary variables would be to evaluate the gain in precision with a perfectly-known auxiliary variable. The auxiliary variable must be known everywhere to be used in this kind of analysis.

Issues with survey catchability (q) were discussed. Suggested methods for dealing with possible density-dependence in conversion coefficient estimates included (1) ignoring possible density effects when there are no estimates over a range of densities, (2) re-estimating the coefficients when density changes, (3) evaluating the empirical estimates by letting conversion coefficients be estimated as parameters in models, (4) comparing index trends over time with other ongoing surveys in same area (e.g. DFO survey on Georges Bank vs. Albatross and Bigelow) to validate trends produced with conversion coefficients, and (5) eventually considering data before and after the change in gear as separate time series.

The importance of tow duration effects was noted. For some species (strong swimmers, e.g. cod), larger individuals may be able to out-swim the net for relatively short tows. The effect may depend also on fish density or behavior pattern (schooling vs. individual swimmers); it is thought that schools are less likely to escape. NEFSC surveys for this GARM used 3.8 kt tow speed, so fish are likely to tire within the 30-minute tow time. Most studies show no difference in short vs. long tows; extensive Norwegian experiments on 15 vs 30 minute tows have shown no indication of an effect on q .

Working Paper D1: Jacobson L, Correia S, Blaylock J. 2007. Potential environmental and spatial effects on survey data and assessments for GARM stocks

Presentation Highlights

The purpose of this paper was to examine environmental and spatial factors that may affect NEFSC bottom trawl survey catchability parameters and interpretation of survey trend data used in GARM stock assessments. Mechanisms that might change survey catchabilities and assessments for multiple species were of particular interest.

Results show that GARM species respond to temperature and depth in complex ways that depend on species, stock, season and fish length. Spatial distributions (latitude, longitude and depth) have changed relative to survey strata sets used in stock assessments, potentially changing survey catchability. In many cases, trends appear to be occurring still. Some stocks (e.g. GBK yellowtail flounder) have spatial distributions that shifted towards closed areas after closed area management was implemented in 1994.

Effective area swept by NEFSC bottom trawls probably changes with depth but there is little effect on trends in survey abundance, length composition or abundance at age data.

Survey catchability coefficients for young haddock, Pollock, and white hake may be affected by the presence of large numbers of recruits in strata outside of the strata sets used for assessments during some years, although more investigation is required.

Changes in mean size at age of GBK haddock appear to have changed fall survey catchability at age, but results are preliminary and more work is required.

The conclusions and recommendations in this report are intended to be robust to the underlying mechanism and would hopefully help improve GARM stock assessments under a wide range of conditions. Assessment scientists and experts should evaluate recommendations on a stock by stock basis, but alternate approaches to handling or modeling survey data may benefit GARM stock assessments. In particular, use of relatively large survey strata sets (including additional offshore and particularly inshore strata where possible) would probably make survey data trends more robust to changes in environmental and spatial factors. Consider expanding survey strata sets for age structured assessments to include additional inshore and offshore strata sampled consistently since (but not before) the first year with survey age data. Survey “holes” (years of missing data for some survey strata) should be filled using some sort of statistical model so that additional strata can be used in assessment strata sets and to facilitate interpretation. Database management software should include procedures for post-stratifying survey data by splitting large strata that overlap stock boundaries or other regions of particular interest (e.g. closed areas). Given potential changes in survey catchability at age associated with changes in size at age, it would be useful to consider stock assessment modeling approaches that use survey length composition.

Discussion on Working Paper D1

During the discussion, several clarifications relating to the working paper were made, including the following: (1) catchability (q) was from $N=qS$ where S is the survey index (as opposed to tow efficiency discussed in the overview for this session); (2) catch-weighting used number (not kg), as is done in assessments; (3) door/gear/vessel conversion coefficients were not used because the analysis was done on an annual basis; (3) changes in time of sampling among years was not accounted for; however, this is more of a problem in the early part of the time series and this analysis only used 1979-2006; (4) the analysis did not include sampling in Canadian waters.

Discussion was then pursued on each hypothesis:

Hypothesis 1: Shifts in distribution vs. depth and bottom temperature

Shifts in bottom temperature may be systematic, but if size-groups react differentially due to different preferences, the pattern of shift will be complicated. Suggestions for improving the analyses included: (1) include tests for interactions (e.g. depth * temperature), (2) use a plus

group for plots (e.g. age vs. depth) because sample sizes are small for older ages, (3) follow the methods of Perry and Smith (1994) to refine the analysis and construct hypothesis tests, (4) evaluate how annual random station selection may affect estimated distribution with respect to temperature and depth (e.g. if all stations fall in deep water within a stratum in a given year, this may produce a spurious year effect).

Hypotheses 2 and 4: Distribution of GARM stocks has shifted relative to standard strata sets, possibly affecting survey catchability

The importance of addressing these issues depends on (1) the proportion of the stock that falls within the standard strata sets. The higher the proportion within the sets, the more resilient are the estimates to a shift in distribution, (2) the stability of the proportion within the strata set over time – if the proportion is relatively constant over time, then impacts would be minor, and (3) the tradeoffs of being more or less inclusive.

Suggestions for the analysis of changes in the proportion of a stock in a standard strata set included (1) plot stock abundance vs. abundance from the whole area (proportion of stock in each stock area) to look for indications of change in q , (2) consider using different sets for different seasons because distribution of stocks may be different between seasons, (3) do not include areas in the analysis that have been excluded for biological reasons. The goal is to set up analyses that minimize the risk of measuring a different population between years. It isn't possible to have a quantitative summary of how much distribution changes over time if fish are distributed in areas that aren't sampled. Apparent (spurious) changes may be observed if the fishery is changing and causing shifts in distribution (this is not the same as a change in q).

The importance of inconsistently-sampled (and therefore ignored) strata (e.g. inshore strata) was discussed. A simple exercise to evaluate the importance of incomplete coverage would be to start with a time series from the consistent strata set (strata sampled in all years), then sequentially add strata that are sampled less frequently, ignoring holes, and look at effects on the estimates. If data are imputed for missed strata, the uncertainty in the imputations needs to be taken into account or overall uncertainty may be underestimated. Standard imputation methods exist, e.g. small area methods, model-based Bayesian approaches.

Basic biology must be considered when distribution is evaluated. The habitat where fish occur may not be where they survive well (e.g. haddock may be swept off Georges Bank rather than retained in an area favorable for survival). This is different than an environmental shift causing fish to move into a new habitat where they can now survive.

It was pointed out that other weaknesses of survey sampling may be as important as size of the strata set, e.g. rough bottom types are more poorly sampled, yet some species are primarily associated with these habitats. The list of hypotheses in the working paper did not cover all possibilities – human effects may be important, e.g. small cumulative changes in survey practice over time may have an influence that can't be quantified.

Hypothesis 3: Changes in depth distributions causes changes in q due to area-swept-depth relations

In addition to changes in q with wing and/or door spread, changes may come about through effects on overall net geometry, e.g. the relation between wing/door spread and headrope height.

Hypothesis 5: Changes in mean size at length has altered age-specific q 's

Although it was asserted several times that this is the most important issue for the assessments of GARM III, it received relatively little discussion. However, it was noted that each analyst should consider the possible importance of this issue in their respective assessments. For instance, if there is a change in size at age in the population, survey results could be biased due to selectivity with size. This is an issue of particular concern for Georges Bank haddock which has recently shown large declines in size at age, where haddock at age are now the size of the previous age observed before the year 2000. It was noted that the impact on TAC advice should be examined, especially as this decline in size at age appears to be carrying through to subsequent year classes. Density-dependent effects on estimates of relative catchability at age are possible and should also be considered.

It was commented that it may not be appropriate to use average growth curves to convert selectivity-at-age to selectivity-at-length if size-at-age is shrinking over time. To help with model selection in the assessment, it would be useful to have an estimated prior for age-specific q .

INDUSTRY-BASED SURVEYS

Working Paper E1: Legault C, Keith C, Johnston R. 2007. Comparison of the Southern New England Yellowtail Flounder Industry Based Survey with the Northeast Fisheries Science Center Bottom Trawl Survey: Annual Trends and Distributions

Presentation Highlights

The comparison between the fine scale resolution of the Southern New England Yellowtail Flounder Industry-Based Survey (SNEYT IBS) and the Northeast Fisheries Science Center Bottom Trawl Survey (NEFSC BTS) clearly demonstrates the need for dense station locations to resolve fine-scale abundance issues. Once domain estimation was used to allow direct comparison between catch rates from the two surveys, the absence of yellowtail flounder in some NEFSC strata in the NEFSC BTS despite relatively high abundance found in the SNEYT IBS was a clear indication of the inability of the NEFSC BTS to measure fine-scale distributions. However, the long time series and comprehensive spatial scope of the NEFSC BTS makes it the preferred index of stock abundance over time. Trade-offs in density of stations, area coverage, and biological sampling must always be made in surveys, making some surveys better for specific topics than others. Some of the difficulties encountered in this analysis highlight the problem of cooperative research projects that are funded to collect data but are not funded to analyze the data.

Working Paper E2: Chouinard C, Beutel D, Legault C. 2005. Consensus Report of the Technical Review of the Maine Department of Marine Resources

Presentation Highlights

Since the fall of 2000, an inshore trawl survey has been conducted in the spring and fall of each year in coastal waters of Maine and New Hampshire. The “Maine-New Hampshire Inshore Groundfish Trawl Survey” project has been funded by the Northeast Consortium and NOAA Fisheries, Northeast Regional Office and is led by scientists at the Maine Department of Marine

Resources. The main objective of the survey is to provide abundance indices of marine species in coastal waters that could be useful in stock assessments conducted by NOAA Northeast Fisheries Science Center. The data are also of use to the New England Fishery Management Council and the Atlantic States Marine Fisheries Commission. The presentation summarized the findings of a 2005 review panel on this survey.

As one of the major sources of information available concerning the coastal waters of the Gulf of Maine, it was imperative that all aspects of the surveys be formally assessed. The goals of the review panel required an extensive examination of survey design, data processing, and survey results to inform and improve future work and to assess the viability of using the data in the management of the resource. Overall, the survey was considered by the panel to be a valuable project with high scientific standards. It felt though the objectives of the survey needed to be clarified. As well, there was a need to adjust the design of the survey (random and fixed stations issue) to ensure achievement of the survey's objectives. Minor modifications and suggestions for improvement in survey operations, biological sampling and data collection were also suggested. The panel considered the survey to be an excellent example of a cooperative project with extensive outreach work and good data accessibility and that the data collected had a high potential for use in stock assessments, ecosystem analysis and increased understanding of coastal waters of Maine and New Hampshire. The panel made a number of recommendations for next steps and use of the data including 1) securing long-term funding, 2) implementing adjustments to sampling design, survey operations, biological sampling and data collection as soon as possible, 3) conducting small scale experiments to help resolve issues with the survey operations (e.g. towing in tide, depth-warp ratio) and a comparative fishing experiment if a second vessel becomes available, 4) detailed analysis of the data collected to date to help identify issues relating to the survey and illustrate its value and 5) developing closer contact with the NMFS stock assessment analysts who are likely to be important users of the data.

Working Paper E3: Chouinard G, Weinberg K, McGovern J. 2006. Peer Review of Industry-Based Survey for Gulf of Maine Cod

Presentation Highlights

The presentation summarized the findings of an August 2006 review panel on a cod industry-based survey initially designed to examine the distribution and demographics of the Gulf of Maine cod stock. The survey design utilized a standardized grid as well as randomly selected locations provided by fishermen. An additional objective of the survey was to provide information on the age and length structure of cod within rolling closure areas. The panel undertook a comprehensive review of the technical aspects of this survey and considered that it represented an enormous amount of work for the investigators, cooperating fishermen, and the NCRPP. The care taken in the development of the survey design and gear was noted as well as the outreach program designed to keep the fishing community and general public aware of survey activity. The panel considered that the survey provides valuable information on cod in the Gulf of Maine when no other sources of data are available, particularly high resolution information on the spatial and temporal distribution, size composition, maturity and potentially age of cod which augments information from existing surveys. There is concern that the lack of sampling of cod in water deeper than 75 fathoms may not provide a complete picture of cod distribution particularly during the winter although the survey data are useful in determining the location and timing of cod in spawning condition as well as the coincidence of spawning cod with rolling closures. The panel assumed that the efficiency of the four commercial vessels

providing data is the same, noting however that inter-vessel comparisons would be desirable. It considered that the data provide a qualitative spatio-temporal view for a number of parameters but further statistical analyses are required. It concluded that while it may be possible to use the data collected to derive indices of stock abundance for specific species, a significant number of issues would first need to be examined and resolved.

Working Paper E4: Chouinard, Martin M, Sowles J. 2007. Peer Review of the Southern New England Yellowtail Industry-Based Survey

Presentation Highlights

The presentation summarized the findings of a February 2007 review panel on the technical aspects of the Southern New England industry-based survey for yellowtail flounder. The main objective of the survey was to assess the temporal and spatial abundance, distribution and size composition of yellowtail flounder (and associated species) within the Nantucket Lightship closed area, other proposed closed areas and adjacent areas. The survey also had a number of secondary objectives. The survey utilized a stratified random design based on strata defined by 30 minute latitude by 30 minute longitude rectangles and an equal number of fixed stations selected by the fishing industry. The panel noted the survey's high sampling intensity and the significant amount of effort by the team conducting the survey. It concluded that the survey had collected sufficient information to suggest that the Nantucket Lightship closed area does not meet the objective of protecting juvenile yellowtail. It recommended that analysis of the efficacy of the closed area be formally conducted and documented, noting that the survey dataset would be useful to identifying alternate closed areas. The panel was satisfied with the vessel selection process to minimize inter-vessel differences as well as the selection of the most appropriate trawl gear. It noted that the age samples have been very useful in complementing the age-length tables for the assessment of yellowtail flounder. However, the panel considered that the utility of the survey in tracking changes in abundance was low due to the shortness of the time series. Further, the mixed design of the survey (stratified random and fixed station) posed particular analysis difficulties, such that the survey estimates using all stations may be biased. Given the high sampling intensity, the panel felt that it should be possible to obtain unbiased indicators of the trends in yellowtail abundance by analyzing stratified random and fixed stations separately and that, if it were continued in the future, consideration should be given to using a unique sampling design, guided by the knowledge gained during the 2003-2005 surveys. As well, procedures and protocols (e.g. towing speed, guidelines for declaring null sets, swept area, fishing station standardization and analyses) need to be further documented to ensure that data are correctly interpreted and repeatable methods are used if the survey were to be resumed. It recommended that funding be made available to complete the documentation and development of metadata for this dataset to preserve its integrity and usefulness, noting the wealth of information available for analysis which would provide new knowledge on the biology of yellowtail flounder in the area. To the extent possible, it encouraged project team members, NEFSC scientists, and others to analyze these data. However, due to the single-species nature of the survey, the panel considered that the integration of this survey as it now exists with the NMFS survey, would be difficult and not cost effective. While the Southern New England industry-based survey was considered a good example of a cooperative project that provides valuable information on yellowtail flounder in the area, it, as well as other like surveys, are considered more appropriate to address short-term issues than to conduct long-term monitoring.

Discussion on Working Papers E1, E2, E3 and E4

Summaries of the peer-review panel reports (E.2, E.3 and E.4) were presented for each of the surveys. The surveys included a Maine/New Hampshire inshore groundfish trawl survey (spring and fall, 2000-2006), southern New England yellowtail flounder trawl survey (spring and fall, 2003-2005), and a Gulf of Maine cod trawl survey (November-June, 2003-2006). The designs of the yellowtail flounder and ME/NH surveys included stratified random sampling as well as sampling of fixed stations. The Gulf of Maine cod survey employed a fixed-station grid design. Due to the specificity of survey objectives, sampling during each survey occurred within a limited area and sometimes involved multiple vessels and gears for which conversion factors do not exist. Data from all three surveys have been audited and the yellowtail and cod survey data are available in the NEFSC research survey database. The ME/NH survey data are also available at the NEFSC but in a different format.

It was recommended that the NEFSC scientists consider using data from the three IBS surveys on a case-by-case basis. It was suggested that biological data might be the most useful data to examine for the cod and yellowtail surveys. As a result of the short time series and design issues pertaining to the yellowtail and cod surveys, these surveys were not considered useful for providing relative abundance indices. It was also noted that there is no conversion factor available for standardizing catch rates of the four vessels used to conduct the cod survey. However, the review panel suggested that the cod maturation data and size frequency data, in comparison to similar data collected during NEFSC surveys, might be useful ancillary information for the Gulf of Maine cod assessment. It was suggested that data from the yellowtail survey might be useful as a weighting factor with respect to analysis of the yellowtail flounder tagging study (C6). An attempt to use data from the yellowtail flounder survey was conducted whereby stratified mean catch per tow indices were computed and compared with those from the NEFSC research trawl surveys for a similar strata set, season, and year (E1). The review panel provided recommendations for the refining the analysis. It was concluded that such IBS surveys would be more useful in addressing management issues that require fine-scale sampling (i.e., closed area evaluations).

ECOSYSTEM DATA

Working Paper F1: O'Brien L, Jacobson L, Rago P J, Traver M, Col L. 2007. Trends in Mean Length and Weight at Age for Selected Groundfish Stocks.

Presentation Highlights

If trends in growth are significant and persistent there would be potential ramifications for stock assessments that involve stock projections or calculation of biological reference points. Randomization tests and linear regression were used to test for significant trends in mean length at age and mean weight at age for seven GARM stocks: Georges Bank (GB) cod, GB haddock, GB yellowtail flounder, Gulf of Maine (GM) cod, GM winter flounder, American plaice, and witch flounder and three other stocks: fluke (summer flounder), mackerel, and northern GB silver hake. Mean values were converted to Z-scores and presented, along with mean number per tow, as quintiles using Visual Report (NEFSC Toolbox) to display year and year class effects and possible density dependence.

No significant trends in mean length or weight at age were detected for GM cod. No significant trends in mean length at age were detected for GM winter flounder and only significantly increasing trends in mean weight at age 2 and age 3. GB yellowtail flounder showed significantly increasing trends in mean length at age for most ages and significantly increasing trend in mean weight at age 2 and age 3 only. Significantly declining trends were observed for mackerel mean weight at age but not mean length at age, whereas GB haddock showed significant trends in mean length but not mean weight at age. Silver hake showed significantly increasing trends younger ages and significantly decreasing trends in older ages for both mean length and weight at age. The remaining stocks (GB cod, American plaice, witch flounder, and fluke) generally showed significant declines in mean length and mean weight at age. These results indicate that fish condition is declining in mackerel, which may be related to competition or otherwise limiting resources. For all other stocks, mean length and weight at age generally trended together indicating that a different mechanism is influencing somatic growth. Further analyses will be conducted to explore what biological or environmental variables may be correlated with these trends.

Discussion on Working Paper F1

It was noted that the validity of the model assumption that somatic growth is constant over time needs to be examined since changes in growth could significantly affect spawning stock biomass and stock status determination. Persistence or transience in growth trends over time need to be determined so that an appropriate temporal interval for average growth can be made. Slower growth in young fish could also lead to higher predation, and these changes in natural mortality rates would violate the assumption of equilibrium. Changes in growth also have implications for reference points, and the causes for these changes are important to determine. If the changes are determined to be due to environmental factors, there may not be a need to change the reference points. However, if the growth changes are due to genetic shifts, then reference points should be altered accordingly. It was noted that there have been similar noticeable changes in condition factor of Canadian haddock stocks. Mackerel is the only stock that directly shows a decrease in condition for this analysis of U.S. stocks, with weight decreasing without corresponding decreases in mean length. However, decreases in length at age over time seen in many stocks could be an indirect effect of sustained poor condition.

It was discussed that non-linear relationships such as a quadratic equation should be explored to determine whether there are additional trends and to characterize these relationships. Splitting the time series further was also discussed to account for management changes such as closed areas etc. Auto-correlation of length and weight variables was raised as a concern, and it was suggested that a Durbin-Watson analysis be conducted to account for these correlations. It was also discussed that variance needs to be determined since the actual trends over time may not be significant given the confidence intervals. This could be done by bootstrapping the survey lengths and weights; however this is unrealistic given the time constraints of the GARM III. Another recommendation was to include the scale of trends in addition to the quintile divisions (e.g. range divided by the mean) since the divisions may be irrelevant if the magnitude of the change is small.

Working Paper F2: Sutherland S J, McBride R, O'Brien L, Mayo R K, Pregracke S E. 2007. Recent Trends in Weight-at-Age of New England Flatfishes

Presentation Highlights

This analysis sought to determine whether recent changes have occurred in weight-at-age among nine flatfish stocks from the Northwestern Atlantic. Data from NEFSC survey cruises (1992–recent) were used to generate estimates of weight-at-age (WAA), length-at-age (WAA), and length-weight (L/W) parameters for these stocks. Trends within these measures were tested with correlation analysis by age, sex, and stock. Of the 51 tests conducted, only 2 (age-6 females for American plaice and witch flounder) showed significant ($P < 0.001$) decreases in WAA during the study period. These decreases were supported by changes in LAA and the L/W regressions as well. Sex ratios were also examined for each stock, as changes here could create an artificial change in WAA, but only summer flounder exhibited a significant correlation between the percentage of males and time ($P = 0.0001$).

Discussion on Working Paper F2

It was discussed that the Bonferroni correction used in this analysis is conservative, and that if a 0.1 significance level is used as in the previous study, declines in weight at age are consistent in both methods. The results of sex ratio shifts in summer flounder were discussed, which could be related to mesh size or minimum size limit changes targeting the faster growing, larger female fish. It was suggested that Murphy's change (Murphy 1952) in sex ratio method be used to determine whether there are non-linear relationships.

Working Paper F3: Miller T, Jacobson L, O'Brien L, Legault C, Rago P J. 2007. A state-space approach for modeling maturity as a function of time and age

Presentation Highlights

In age-structured stock assessment models, an estimate of the vector of probabilities of maturity at age (for females in particular) is a necessary component of an estimate of spawning stock biomass. When maturity at age changes over time, it is also necessary to account for these changes. The state-space model is appealing because it directly accounts for changes in population attributes through time that are imperfectly observed from various ongoing data collection activities. More generally, the state-space model is useful for framing questions about any time series of data where the attribute of interest changes through time (Durbin and Koopman 2001). Other aspects of state-space models that are appealing from a more practical perspective include that predicted attributes at times where observations have large uncertainty due to either lower sampling or poorer information in the collected data can be improved by observations that neighbor the point in time with less uncertainty. Also, predictions can be made within the time series where observations may be missing or backward or forward in time beyond the available observations (i.e., hind- and fore-casting). As such properties are useful for projection of fish populations into the future, we propose the use of a state-space model for estimating maturity at age over time.

Given yearly estimates of any other population attributes such as mean weight at age or length at age and corresponding estimates of observation errors, the structural time series approach applied here for maturity could also be used to detect whether trends exist in these other population attributes. The structural time series approach can easily incorporate measured

environmental covariates to improve predictions of the state through time and similar to GLMs the usefulness of various environmental covariates in prediction of the state can be assessed.

Discussion on Working Paper F3

The assumption that samples of individual fish are random was raised as a concern since the samples are clustered into tow groups. The review panel suggested using a quasi-binomial and/or generalized linear mixed effects models and coding the tows as groups to identify tow affect, however it was noted that this violation of independence applies to all methods. It was discussed that unlike previous analyses, there was no evidence for changes in maturity rates over time for Georges Bank haddock since the large confidence intervals indicate that apparent stanzas of maturity rates could simply be a random walk. Without taking into consideration the magnitude of the variability, mean maturity rates indicate stanzas of maturity patterns over time; however the model was stationary in the mean without a clear directional trend. It was questioned how large of a change would need to occur in order to acknowledge changes in maturity since it also cannot be definitively determined that there are no changes in maturity over time. Maturity rates are related to size, and previous size at age analyses could similarly have high uncertainty which would reduce evidence of trends. A further recommendation is to test the annual proportion mature instead of using the logistic relationship, and allow the model to fit the curve instead of fitting the model to an S-curve. Also, since length and weight variables are correlated, it was recommended that the age at 50% maturity be modeled over time rather than modeling the length-weight parameters.

The constant maturity rate used for forecasting projections was a concern, however since no trend was detected in the state-space model, this constant trend could be reasonable. It was noted that maturity can change with population size, and that the variability of maturity estimates have not been incorporated into spawning stock biomass. It was discussed that using a moving average of maturity rate would reduce variability, although there is no clear method for determining the appropriate bin for the moving average, and dampening the effect of the changes may overestimate or underestimate spawning stock biomass. Another approach to reducing uncertainty would be to use a length or age plus group that represents the mature fish in the stock, as used in Canadian stocks. This would incorporate the evidence that first time spawners are generally less fecund than older fish, and would eliminate the variability of the age at 50% maturity. Since this state-space model showed little trend over time, the average maturity rate over the time series could be used. However, this is not advisable since there are realized environmental and population changes over the time series which likely influence maturity. Covariates of biological and environmental variables should be incorporated to determine if trends in maturity exist.

The biological feasibility of inter-annual variation in maturity rates needs to be examined further. Knowledge of whether maturity is influenced greatest by genetics or conditions of individual fish which could exhibit considerable annual variability is important in determining realistic shifts in maturity rates. In assessments, pooling of maturity data over years is common since sample sizes are often too small to calculate annual 50% maturity rates, and the lack of pooling in the state-space model could be contributing to the high variability in the results. It was concluded that a moving window of average maturity rates should be used, and implications for using a smoothing method versus calculating maturity stanzas should be examined. Finally, it was commented that this model only examined one stock which is not necessarily

representative of the other 18 GARM stocks, and that these stocks need to be examined individually.

Working Paper F4: Legault C, Blaylock J. 2007. Analysis of Recorded Sample Weight vs Length-Weight Equation Derived Sample Weight using Commercial Port Sampling and NEFSC Survey Data

Presentation Highlights

Comparison of recorded sample weight with the weight predicted by a length-weight equation applied to the length frequency of the sample demonstrated changes in the population length-weight relationship over time, but not in the commercial catch generally. This apparent discrepancy could be due to a number of reasons. The survey comparisons are believed to be a representation of the population and these results agree with other working papers that fish appear to be getting slightly lighter at length in recent years. In contrast, the commercial data, which is a measure of the fishery landings, did not in general show trends in the length-weight relationship over time. There are two possible reasons for this. The commercial data could be too noisy to detect the population trends due to accumulating catch over the entire year from many gears and the use of estimated weight for the sample. Alternatively, the commercial fishery could be targeting a specific size or condition of fish. An additional analysis, not presented in the working paper, confirmed the decreasing weight at length in the survey data using individual fish weights, although the magnitude of the decline was not large relative to the variability in the observed weights at length.

Discussion on Working Paper F4

It was noted that the lack of trends in commercial landings despite decreasing trends in survey weights at length could be due to the uncertainty in the estimation of commercial catch weight as well as the targeting of larger fish in commercial fisheries. Analysis of individual fish weights at length from the survey data show that variability is greater than any clear trends; however this analysis is limited to data since 1992. It was suggested that linear regressions or non-parametric analyses be preformed in order to determine objective trends in weight at length over time.

Working Paper F5: Hare J, Friedland K. 2007. Review of Environmental and Ecosystem variables relevant to assessments: *In-situ* Oceanographic Data and Remote Sensing Sea Surface Temperature and Chlorophyll Concentration

Presentation Highlights

The northeast U.S. continental shelf is changing (Friedland and Hare, 2007) and accounting for these changes may improve our understanding of the dynamics of fishery resources in the ecosystem. The NEFSC is currently working with a number of oceanographic data sets that describe the past and current state of the ecosystem. These data sets are separated into remotely-sensed and *in-situ* data. The remotely sensed data are derived from satellites and the NEFSC primarily is working with Level III processed-data. The *in situ* data sets are actual measurements of ocean properties and predominantly, but not exclusively, come from dedicated NEFSC monitoring activities.

The NEFSC is using these datasets to link environmental variability to ecosystem dynamics. For example, Friedland et al. (2003) estimated the distribution of winter Atlantic salmon habitat in the Labrador Sea and Denmark Strait using the OISST dataset and found that this habitat distribution was correlated with Atlantic salmon production indices. As another example, Kane (2007) linked the change in zooplankton community structure on Georges Bank to a recent shelf-wide freshening (Mountain 2004).

For the purposes of the GARM III, these environmental datasets would be included in an exploratory analysis with various stock parameters including weight-at-age. Maturity-at-age may also be included. This exploratory analysis would be an initial step in including environmental data in stock assessments. There is full recognition that mechanistic hypothesis regarding the effect of the environment on fishery population dynamics are needed, and it is hoped that the exploratory activities undertaken as part of the GARM can contribute to this broader need.

Discussion on Working Paper F5

Environmental data was discussed as potentially being important for assessments since changes such as melting arctic ice decreasing water temperature and salinity could cause changes in lower trophic level compositions and food availability. Traditionally, environmental variables are not incorporated into stock assessments and would instead be addressed as independent research questions. However, there are direct applications to assessments such as recruitment success and productivity, and there may be strong explanatory variables for recruitment other than stock size which could be incorporated as stanzas into stock assessments. Data for environmental variables need to be made more accessible to assessment biologists and synthesized into a model in order to incorporate productivity into stock assessments. It was concluded that changes in environmental variables indicate that the assumption of equilibrium is being violated, and that a comprehensive science plan should be made to determine which variables are important to assessments in order to prioritize facilitating the accessibility of these variables. It was suggested that the potentially important environmental variables be incorporated into a traffic light approach be reviewed during the biological reference point meeting.

Working Paper F6: Link J, Overholtz W J. 2007. Background Data Available for GARM3 Analyses of growth and Maturity

Presentation Highlights

The Northeast Fisheries Science Center of the National Marine Fisheries Service has had the Food Web Dynamics Program (FWDP) in one form or another since 1953. The FWDP is responsible for designing the collection of, sampling, processing samples, quality control and data auditing, database management, and analyzing food habits data for the major fish species in the northwest Atlantic. The food habits database contains more than 500,000 stomachs from over 130 predators and has more than 1,300 different prey items. For most fish species, diet can be adequately characterized with the examination of 500 – 1000 stomachs, which is the case for the 40-50 main species. The data have been collected quantitatively since 1973 to present (at the time of this report, 2007). These data serve as the basis for a plethora of multi-species, single-species add-ons, and ecosystem models. For the purposes of the GARM III, we will provide a set of food habits time series for the GARM species in appropriate strata sets, seasons, and size groupings.

Working Paper F7: Link J S, Overholtz W J, Fogarty M, Col L, Legault C. 2007. GARM3 System Capacity Analyses

Presentation Highlights

There has been some concern expressed (by numerous stakeholders) whether all 19 groundfish (and more broadly, the entire fish community and even all targeted species) can have biomass simultaneously at optimal levels (e.g., B_{MSY}). We propose four approaches to address this question. The four proposed approaches are: 1) Converted energy budget values will be calculated to provide context, compare to other ecosystems, and be rebalanced to see if simultaneous optimal biomass is even feasible; 2) a transfer efficiency calculation will apply the overall productive capacity of the system as a limit/constraint for fish stock production at their various trophic levels; 3) an aggregate production model will be fit using ASPIC or a similar production model for all 19 groundfish and commercially targeted species as one “mega” stock and associated fishery; 4) a multi-species production simulation model will be used to bound the sensitivities of the issue.

Discussion on Working Papers F6 and F7

The system capacity analyses will be important during the reference point meeting in providing an ecosystem level reference to addressing the question of whether there are limitations on production for rebuilding all groundfish species simultaneously. The concern was raised that if the ecosystem results show large discrepancies from the individual stock assessments, this could cause problems with advising management and needs to be considered prior to the meeting. It was noted that the ecosystem analyses will not be made on a species-specific level, avoiding potential problems of assessing negative impacts of one species being rebuilt in relation to another species. It was noted that environmental variables such as temperature and trophic effects could cause MSY to vary, especially for stocks such as cod which are at the southern edge of their habitat range. Since this is the first time that these environmental variables have been analyzed together with single species assessments, there will be problems with modeling these combined data sets, especially where high levels of data uncertainty exist such as foreign fleet landings and commercial discards. It was noted that the time series of the analysis could be restricted to time periods with reduced uncertainty, and that scenario analyses should be done to determine the effects of varying these areas of uncertainty.

The review panel noted the magnitude of the environmental information being analyzed and the progress towards incorporating ecosystem work into assessments. However, based on these system-wide analyses, it will be difficult to address which species will not be able to reach MSY based on ecosystem interactions. It was noted that trophic interactions can be significant, as seen for inshore Southern New England stocks, and that ideally changes in M over time, as indicated by ecosystem analyses, should be incorporated into assessment models for the modeling workshop. There are several instances of stocks either being highly responsive to management measures, initially responding and then declining likely due to predation, or showing negligible response, indicating a possible regime shift due to biomass collapse or reduction of genetic variation. Even if responses to management measures occur, the predicted rebuilding time could be significantly prolonged due to ecosystem interactions. Therefore, examining these variables is important to assessing the stocks and it is recommended that ecosystem effects be analyzed on a species by species basis.

In regard to the models used for these ecosystem analyses, it was noted that models such as EcoPath and EcoNetwrk often rely on changes in transfer efficiencies to balance the models, and these metrics need to be documented and discussed. It was also noted that these types of ecosystem modeling packages often do not incorporate appropriate links between the benthos and fish populations. In these ecosystem analyses, benthos has been incorporated and there could be interactions such as the recent increase in scallops reducing available prey for larval fish. It was recommended that the system be examined at differing levels of energy allocation to the benthos.

The concern was raised that although statistical areas or survey strata sampled twice a year on groundfish surveys may be acceptable for addressing trends in adult populations, this may be too coarse of a resolution for recruitment interactions with plankton since larval fish are often only in this life stage for a short temporal period and small geographic area. It was noted that plankton samples are available six times a year with finer resolutions from GLOBEC, although there may be limited analyses of direct fish larvae prey. The review panel concluded that although these resolutions are not optimal for detailed ecosystem analyses, these concerns should not inhibit the incorporation of ecosystem changes into assessments, and forecasts could be conditioned on environmental variables. However, it was cautioned that when a model becomes overly complex, it is difficult to have confidence in the results.

The concern was raised that the GARM framework is not intended to be an ecosystem control rule amendment, however it was noted that putting constraints on harvest rates based on ecosystem interactions is not a violation of the Magnuson-Stevens Act if these constraints would reduce effort. In conclusion, the review panel suggested that sensitivity analyses be preformed, and that important trophic interactions and environmental variables be included in the assessments since they can substantially affect recruitment and MSY reference points.

RECREATIONAL LANDINGS AND DISCARDS

Working Paper G1: Terceiro M. 2007. Magnitude and precision of Marine Recreational Fishery Statistics Survey (MRFSS) estimates of the recreational catch of winter flounder and Atlantic cod

Presentation Highlights

For the stocks considered in the GARM, only winter flounder and Atlantic cod have significant recreational catch. The magnitude of the landings (catch types A+B1) and live discards (catch type B2) of the recreational fisheries are estimated by the National Marine Fisheries Service's Marine Recreational Fishery Statistics Survey (MRFSS). These estimates have been revised since GARM II in 2005.

The PSE (proportional standard error) of landings in numbers of winter flounder has ranged from 8.2% (1990, 1992) to 28.3% (1993) while the PSE of landings in weight has ranged from 8.2% (1992) to 27.5% (2005). The PSE of the live discards in numbers of winter flounder has ranged from 9.0% (1990) to 45.3% (1989).

The PSE of landings in numbers of Atlantic cod has ranged from 9.0% (1984, 2001, 2006) to 37.3% (1985) while the PSE of landings in weight has ranged from 10.1% (1989) to 56.2% (1985). The PSE of the live discards in numbers has ranged from 7.5% (2006) to 57.7% (1981).

Discussion on Working Paper G1

It was noted that length-frequencies of recreational landings are generally sparse, and that the only GARM stocks that include recreational landings in the assessment models are Gulf of Maine winter flounder, Southern New England winter flounder, and Gulf of Maine cod. These stocks all use survey based age-length keys and have to occasionally borrow length data from neighboring years. Recent declines in recreational landings for winter flounder are considered to be realistic since they correspond to reductions in commercial landings; however survey indices are also declining, indicating that reduced landings are not resulting in population increases. Similar findings were noted in the Mid-Atlantic region for several inshore species which do not have useful trawl indices but have reasonable biomass trend estimates based on recreational landings. The recent appearance of haddock in the Gulf of Maine recreational landings was discussed, and was considered to be plausible since it has been previously documented with the 1973 year class that large year classes can produce substantial recreational haddock landings.

Recreational discards were discussed, and a survival rate of 85% is used for winter flounder. Discards are not included in the Gulf of Maine cod assessment, assuming 100% survival of discards. This is probably unrealistic since it has been documented that gadoids have lower survival rates than flatfish due to their swim bladders. Cod survival rates have been estimated at 35% for longline gear and about 50% survival for commercial jigs; however these may not be comparable to recreational catch survival. Since live cod discards can reach two to three times the recreational landings, the assumption of 100% survival should be reexamined especially since discarded fish have increased as minimum sizes have increased. Allocating discards to ages is particularly difficult since there are generally no length-frequencies for recreational discards. It was noted that state divisions of marine fisheries provide estimates on discard lengths for recreational fisheries; however these estimates may not be consistent across the time series. It was suggested that commercial discard length frequencies could be used to provide a scale of discard size ranges.

The concern was raised whether MRFSS data should be used since there have been critical reviews of the data (NRC, 2006), but it was concluded that there is nothing that can be done to correct historical issues in the recreational data, and the uncertainties do not warrant exclusion of the data. It was noted that the low proportion of recreational landings compared to commercial landings in most GARM species reduces the concern of using this data set. For stocks that include recreational landings in catch at age calculations, models other than ADAPT should be considered that do not violate assumptions such as aging being measured without error. It was suggested that a meeting be conducted to focus on discards and data issues by species.

The allocation of recreational landings was discussed. Massachusetts landings were determined to be somewhat problematic for allocation since the state is a dividing region for many stocks. Since recreational landings do not include information on the capture location, assessments for the last 25 years have allocated recreational landings based on the port of landing where the samples were taken. Recreational landings are not allocated based on effort since effort estimates are not considered to be reliable and provide inconsistent landing estimates compared to total recreational landings by port. It would be beneficial to implement a standardized recreational allocation, however landings prior to 1985 would be impossible to include since site registers have changed. Site registers are lists of landing ports.

The use of party charter logbooks was discussed and it was noted that the distribution of catch could be used to validate the allocation of MRFSS data. However, the quality of the data

was noted to be unreliable in that recreational logbooks are often completed on a seasonal or annual basis with only very rough estimations of area fished.

PROGRESS TOWARDS OBJECTIVES

This section provides the review panel's response to the objectives of the GARM terms of reference. The volume of material presented and discussed at the meeting did not allow for an in-depth exploration of detailed technical aspects of the issues. The focus of the review was identification of the major issues and options for addressing these, which are reflected in this section.

COMMERCIAL LANDINGS

1. Proration Methods for allocating dealer landings and port samples to Statistical and Stock Areas

- a. Evaluate algorithms used to estimate assignment of statistical and stock areas for dealer records, based on Vessel Trip Reports (VTR) for 1994-2006*

The current Vessel Trip Report (VTR) system has been in place since 1994, when reporting changed from a voluntary interview system to mandatory submission of trip related information (area fished, effort, gear characteristics, etc). However, before 2004, matching of VTRs with Dealer Reports, which provide landings of a trip, has not been straightforward due to the absence of a linking identifier. The latter, VTR serial number, which is available since 2004, is not yet ready to be employed in this matching but is planned for future implementation. In lieu of this, matching has been done on a single stock and species basis (the 'single species allocation system').

Wigley et. al. (A1) described a four level, trip-based hierarchical algorithm which offers a number of advantages over the single species allocation system, including comprehensive and consistent approach across all species, continuity with previous interview system, common data source for all species and finer scale of spatial resolution than currently available. Also, the new system is well documented with all allocation decisions transparent. While suffering from some of the problems present in the single species system (e.g. based on VTR self reports, compliance issues), it meets reporting needs and allows a broader range of analyses (e.g. ecosystem and economic) than currently available.

The new algorithm matched the majority of trip records at level A with decreasing degrees of matching from level B through D (where area is assigned on a probabilistic basis). Multistock species (e.g. cod, haddock, yellowtail, winter flounder and windowpane flounder) are potentially most at risk of having landings reallocated amongst stocks, this particularly due to reallocations in Statistical Areas (SA) adjoining several stocks. Overall though, the highest percent of total landings that required matching at level B, C and D was 13% and thus inter-stock reallocations were not considered significant. While there is little impact on landings allocations amongst stocks overall, there could be issues in the case of small stocks adjacent to larger ones.

The new allocation system brought attention to the accuracy of the SA information in the VTRs. Nies et. al. (A3) compared the areas fished from observer and VMS information to areas fished by large offshore groundfish trawlers, which indicated that 20 to 30 percent of observed

fishing activity was assigned to the wrong statistical area. Palmer et. al. (A4) determined that when all fishing activity from a given trip occurred in a single SA, the VTRs reflected the true fishing location. However, on trips where fishing activity occurred in multiple SAs, there was significant reduction in the accuracy of the SA in the VTRs. This raised questions as to how fishermen report SAs on multi-SA trips. For instance, is there a predictable sequence to the SA reported in the VTR e.g. the first SA fished? Further research on SA reporting practices by fishermen was encouraged. It was noted that the growing use of Vessel Monitoring Systems (VMS) provides an important source of the positional information of fishing, as illustrated by Applegate and Nies' (A4) examination of fishing trip records from the yellowtail flounder fishery. While interpretation of the VMS data is still required to identify the area of fishing, these can be used to verify and supplement the VTR statistical area of fishing information. It is recognized that there remain uncertainties with the SA assignments but the current assignments are an improvement over what currently exists. It was recommended that issues with uncertain area of fishing information in the VTR can best be addressed through outreach and communication with fishermen who have low levels of reporting.

Overall, the new trip – based allocation system has a number of advantages over the single stock allocation system and is recommended for adoption. Managers will likely be interested in the impact of the new allocation system on assessments. The GARM III assessments should provide a comparison of the results using the old and new allocation system. Further, the new system affords an opportunity to investigate the impact of uncertainty in reported stock area on assessments, particularly for those small stocks in which a potential problem may exist (SNE yellowtail, Southern windowpane, Northern silver hake). The implications of the new allocation system for these resources should be investigated through a sensitivity analysis which would be included in the relevant assessments. More generally, the new system affords an opportunity to generate many different realizations of landings allocation, thus providing a consistent means of reporting stochasticity in the assessment-management cycle in the longer-term. Indeed, an appropriate ultimate goal of the allocation system may be a holistic and robust scheme that utilizes sales notes (dealer records), observer sampling, log books (VTR) and VMS records to generate probabilistic catch estimates.

b. Consider implications of algorithm for use of biological samples to estimate Catch At Age (CAA) by stock area

The algorithm was designed to ensure maintenance of the link between the trip area of capture and the biological sampling information. Wigley et. al. (A2) determined that the majority of biological samples matched at level A and thus there was no change in SA designation. For the five multi-stock species (cod, haddock, yellowtail, winter flounder and windowpane, there were slight shifts in biological sample allocation to stock area but overall, significant changes to the stock landings at age were not expected.

It was noted however, that the allocation of non – GARM species, which was not investigated at the meeting, would require further investigation.

c. Compare results of revised algorithm with landings from GARM II

The algorithm resulted in small changes in the overall landings reported by stock due to rounding errors. These, reported by Wigley et. al (A1), are considered minimal. Thus, the landings are unchanged relative to those used in GARM II.

Evaluate uncertainty in CAA using information from the realized sampling design for port samples, the Age-Length Key (ALK), and overall sampling intensity

Legault et. al. (A6) and Miller (A7) explored a design (bootstrapping) and model – based approach respectively to the estimation of uncertainty in the landings at age. The bootstrapping was undertaken at three sequential levels - from port through length frequency to age within length. The model – based approach employed a correlation structure similar to that of the bootstrapping but allowed adjustment of the weighting given to each trip's sample. Both techniques produced similar results with high coefficients of variation (CVs) observed at the youngest and oldest ages. The ease of use of the bootstrapping approach was noted as an advantage. One advantage of the modeling over bootstrapping is that it allows the incorporation of auxiliary information and exploration of different assumptions to improve the estimates of uncertainty. Otherwise the approaches should provide similar results and either could be used.

A cautionary note on the bootstrap estimation procedures as currently implemented is warranted. Miller (A7) states: "Another complication is that there is a higher likelihood of sampling trips with larger landings. When this is ignored, biased prediction of numbers-at-age for the un-sampled trips will occur." As sampling generally has been a low percentage of the landings, the bias could be severe for estimates of total numbers at age and length. The bootstrap procedure assumes simple random sampling of trips within a region. A more appropriate approach would be to resample with probabilities that are modified to reflect a higher likelihood of sampling trips with larger landings. Also, it should be noted that since the sampling fractions are generally two percent or less, it is reasonable to assume sampling with replacement, thus eliminating the need for bootstrapping at the second (length samples within selected trips/market categories) and third sampling stage (subsampling of otoliths from selected lengths). Only bootstrapping at the first level only is required. The NEFSC was encouraged to undertake a comparison of bootstrapping at the first, port, level only with the results reported at this meeting to confirm this.

The above discussion highlights the importance of sampling rates at the port level and the importance of distributing sampling amongst more trips to ensure representative coverage of fishing activities. It was noted that the updated SA information in the VTR database affords an opportunity to check the sampling coverage of the spatial distribution of the catch. It was recommended that for each stock and fishery, the sampling rates be tabulated by market category and SA to guide sampling reallocation as needed and thus lead to improved estimates of the uncertainty in the landings at age. Further, it is recommended that the NEFSC explore the use of probability-based methods that are more in line with general survey practice (i.e., move away from opportunistic sampling) to safeguard against, possibly severe, biases in key estimates.

COMMERCIAL DISCARDS

1. Evaluate methods for estimation of discards by stock area and measures of uncertainty

a. Consider adequacy of sampling coverage by year and gear type and implications for measures of uncertainty

Blaylock and Wigley (B1) summarized the information available from the Northeast Fisheries Observer Program (NEFOP) in relation to the VTR database for 1989 – 2007 across a

range of gears and seasons. It was pointed out that the NEFOP coverage was initially oriented towards marine mammals (mandated coverage) but since 2003, has not only increased but also been more representative of the activities of five primary gear types, although there are still stock and time specific gaps (e.g. less overall coverage in the Mid-Atlantic). Wigley et. al. (B2) provided an in-depth analysis of observer coverage for 2005 which showed where coverage was good and where imputation (assumptions from sampling of adjacent cells) was required and Wigley et. al. (B6) provided background on methodologies for estimation and imputation. Overall, while it was acknowledged that the adequacy of sampling coverage has improved over time, the analysis was undertaken at a coarse level. In order to adequately judge the adequacy of sampling, an estimate of precision beyond what was presented is required.

b. Test and apply model-based methods for estimating discards in strata without observer coverage

It was noted by NEFSC scientists at the review that the current practice of estimating discard rates in unsampled strata is to use data either from neighboring sample cells or from cells in which fishing activities were considered comparable to the cells in question. Decisions are made on a case by case basis. It was recommended that an analysis of the sensitivity of the derived discard rates to different sample selection assumptions be undertaken. Further, statistical techniques (e.g. Generalized Linear Models) should be applied to the data and the results compared to those of current practice, which should lead to improvements in the imputation of discard rates.

c. Compare and contrast alternative models for estimation of discards

The Standardized Bycatch Reporting Methodology (Wigley et. al, 2007) documents a number of estimators of discarding and validation of the combined ratio method was provided using the 2005 observer data set by Wigley et. al. (B2). VTR data were used as a surrogate for Dealer data to expand the NEFOP discard ratios to total discards. In most cases (95%), there was good correspondence between VTR and Dealer landings, adding confidence to the use of these data, although there were patterns in the data (e.g. surf clam / quahaug, hakes) that require exploration. Overall, the technique was synoptic, reasonably well validated and exhibited little evidence of bias.

Legault (B5) provided a comprehensive simulation study to test the overall performance of a number of discard estimation techniques with respect to bias and precision. Two were clearly superior to the other four techniques: combined ratio estimator (ratio of sums) and the direct estimator, based on mean discard per trip scaled up to all trips in the simulation datasets. The latter had been advocated by McAllister (2007) for the estimation of discards, and would be the preferred approach if there is no correlation between the numerator and denominator of the estimate (i.e. no correlation between discard weight and kept weight). However, the method only provides unbiased estimates of total discard if the total number of trips is known, which in the New England groundfisheries, is often not the case. Total landings estimates are considered more reliable than those of the total number of trips. The combined ratio estimator of mean discard based on observed trips has the advantage that it can be combined with known landings data to estimate total discards. This is a pragmatic solution to data deficiencies, and appears to provide

estimates with similar precision as the direct estimator. The bias in the combined ratio estimator depends on the sample size (number of observed trips) and was negligible for the data being assessed in the simulation study. It is emphasized that the unweighted mean of discard ratios should not be used to estimate total discard based on landings. As was demonstrated in simulations by Legault (B5), the total discard estimates based on applying the simple mean of discard ratios from observed trips to the landings was biased even when 99% of the trips were sampled. The reason for this is that the individual fish observed on a trip are not a random sample of fish from the total catch.

The issue then is which landings to use in the estimation of discards. Two approaches were discussed. The first was estimation of discards produced during harvest of the target species, i.e. winter flounder discards produced from landings of winter flounder. The second was estimation of discards from trips that did not land the target species, either “all” trips, or possibly a subset of trips that land species associated with discards of the target species. For example, scallop dredges can produce high discards of various flounders, including winter flounder. Ignoring these discards would produce seriously biased low estimates of discard mortality. On the other hand, weighting by total landings appears to produce unreasonably high estimates of discards in some cases when the catch of all species landed is high, as illustrated by an analysis of SNE/MA winter flounder (Terceiro, B4).

Unbiased estimates of the discard rates for the total landings are crucial to obtain unbiased total discard estimates. Thus, it is necessary to estimate discard rates for the most appropriate components of the fishery before scaling up to total landings. A biased estimator from observer trips that misses a targeted fishery, for example, can yield very biased estimates of total discard if it is applied to total landings that include the targeted fishery. The observer database should be analyzed to develop a suite of harvested species that are associated with discards of the species of interest. Discards should then be estimated based on expansion of the observed discards as a function of the landings of this suite of associated species.

- d. Consider methods to hindcast estimates of discards for years prior to start of Observer Bycatch program and*
- e. Comment on appropriateness of hindcast estimates and their implications for stock assessments*

While no formal analysis to address these objectives was presented at the meeting, NEFSC scientists reported that hindcast or historical estimates of discarding have been based upon survey data to infer discard rates and assumed percent discard of the landings. Modeling of discard rates might be possible but would require building and testing hypotheses of how fishing behavior is influenced by regulations and markets to produce discards. The NEFSC was encouraged to undertake these explorations. Another approach to estimate discards is to use growth and gear selectivity models to determine the likely discard proportion in a given year, assuming that faster-growing fish reach marketable size more rapidly and are therefore less likely to be discarded. This can be valuable, either for stocks for which discards take place but there are no discard data, or for stocks for which all fish caught of a given species and size range are discarded (in which case the discard proportion cannot be estimated). Further, while not discard estimation per se, the examination of processor records to determine the total weight and number of fish entering the plants, to the degree that this is possible for the GARM species, could be used to estimate the extent of misreporting or under-reporting and thus provide

verification of the total catch on which the discards are based. Both of these approaches are considered explorations that the NEFSC is encouraged to consider in the longer term.

f. Consider use of length samples from observer samples and “borrowing” of appropriate age-length keys from appropriate sources (eg. Research Trawl Surveys)

There was no formal presentation to address this objective. During the discussion, it was noted that, in principle, the same methods used to estimate the landings at age could be employed to estimate the discards at age. As well, as the intent is to use estimates of the variance of the landings in the assessment models, comparable estimates of the variance of the discard at age are required. The low overall sampling rates of the discards present significant challenges which again highlight the need to use sampling and analytical approaches that address the potential biases, as noted in the landings section above.

g. Consider measures of accuracy (bias) for discard estimates

There are two sources of unrecorded mortality related to the fishing process: 1) discard mortality (mortality of fish caught but discarded from the catch) and 2) escapement mortality (mortality of fish caught but which escape from the gear and subsequently die. Hendrickson and Nies (B3) reviewed estimates of both types of mortality available in the literature. Some general patterns in discard mortality were evident (e.g. highest survival for bladderless fish such as flatfish, lowest for juveniles). It was noted that the current assumption for most GARM stocks is that discard mortality is 100% except for the two stocks of winter flounder where, based upon a few studies, a discard mortality of 50% is used. No specific guidance can be provided other than to state that if well designed studies of discard mortality exist, these should be used on a case by case basis. Otherwise, a discard mortality of 100% should be assumed. It is recommended that the NEFSC conduct or arrange for gear-specific discard mortality studies.

In relation to escapement mortality, it was recognized that estimates of this are very difficult to obtain and would require a sustained monitoring and research program over a number of years. Although the estimates provided in the review are illuminating, it was considered that only qualitative statements on escapement mortality could be made at this time.

TAGGING DATA

1. Do results of tagging experiments support existing stock definitions for cod and yellowtail flounder?

Loehrke and Cadrin (C2) summarized the three major cod studies that have been conducted in the Gulf of Maine Area (GOMA: 4X-5Z-5Y) with the most recent in 2003 - 2005 being the most comprehensive. The analysis by Tallack (C1) of the latter tagging study in general corroborated the population movements as they are currently understood. As has been reported by earlier studies, there is a strong interaction between cod in 4X and 5Z and a less strong interaction between cod in 4X and 5Y. However, a split in migration patterns has been observed where cod less than 53 cm appear to recruit from the Cape Cod nearshore waters and migrate either: 1) northwards into the inshore Gulf of Maine waters, or 2) eastwards out onto Georges

Bank. It will be important to keep this interaction in perspective during the remainder of the GARM III process.

Cadrin et. al. (C5) reported the results of a large tagging study undertaken to describe the exchange amongst the Georges Bank and SNE yellowtail stocks. While they consider the results preliminary, they indicate high movement on Georges Bank but low movement between the Southern New England / Cape Cod and Georges Bank stocks. Overall, however, the study corroborated the location of the stock boundary between these components and the current stock structure of yellowtail in the GOMA.

It was noted that while tagging data is an important source of information to inform stock boundaries, other data such as that on growth also need to be considered.

2. Can migrations among stock areas be quantified?

For cod, a finite – state continuous – time (FisCot) model of migration and mortality processes in the GOMA was used to quantify cod migration rates (Miller, C3, C4). While the model could benefit from a number of improvements, it illustrated that cod migration rates could be quantified.

As noted above, the tagging data assembled by Tallack (C1) confirm apparently significant exchanges of cod among the management units in the GOMA, which are not included in current stock assessments, with a major locus of exchange occurring on the western boundary of the dividing line between 5Z and 5Y. The FisCot model computed exchange coefficients based on the current management unit definitions. It was suggested that the sensitivity of the current management unit definitions to these exchange rates be tested by simulating a movement of the western boundary. Overall, the FisCot model was seen as a valuable tool to examine the implications of management unit boundaries for the determination of key population parameters.

Cadrin (C6) also undertook modeling yellowtail tag recapture data using a formulation in which movement and mortality were considered separately. While the model showed promise, it did not adequately fit the tagging data, with significant trends in residuals in evidence. Simulations suggest that the model may not perform well when true movement rates are low, due to parameter correlations between mortality and movement. It was suggested that auxiliary information, such as external estimates of fishing mortality or of movement inferred from biomass estimates from the NMFS surveys, be used to constrain model fitting.

It was concluded that while the model is a possible future application for yellowtail, the current model cannot currently provide quantified estimates of migration rates.

3. Develop appropriate analytical models for estimation of migration and fishing mortality

Three models were considered to estimate migration and fishing mortality rates for cod and yellowtail stocks in the GOMA, which have extensive tagging databases available. The first, used for cod, used a finite – state continuous – time process (FisCot) which allowed migration and mortality to occur simultaneously. It also incorporated double tagging information to allow estimation of tag shedding rates. The model allowed incorporation of a number of other processes (e.g. conventional and archival tags, exact time of tagging) which provides considerable flexibility in the analysis of tagging data. However, the current formulation does not include fish size or age, which would greatly enhance its utility. The model estimated high natural mortality (0.6) for all cod stocks and low fishing mortality rates, compared to the results of the relevant VPAs.

The second model, the movement – mortality model used for yellowtail, was an update of an existing formulation which modeled movement and mortality separately. It made a number of the same assumptions as the FisCot model but could not resolve model fit issues in relation to migration of yellowtail between Georges Bank and Southern New England. Thus, it was considered a preliminary formulation that required further development. An exploration of the sensitivities of this model to various assumptions on measurement and process error (Alade, C7) was instructive in identifying the model's strengths and weaknesses and guiding future work.

The third model, MARK, was also used to explore yellowtail migration and mortality processes. As with the second model, it too had difficulty fitting the yellowtail tagging data. Auxiliary data could also be useful in improving model performance. While promising, it too was considered preliminary and not yet ready for use in the assessments.

Given the difficulties that these models have encountered to date, it may be instructive to model the tag-recovery data from each stock area separately to compare to the multi-stock analyses. This is the approach used in analysis of tag data from striped bass, which also uses the MARK reparameterization of the Brownie models. Also, models built on a monthly time scale may be attempting to analyze a finer timescale than these approaches were designed for, as they have been applied most commonly on an annual scale.

The tag data can also provide Petersen estimates of exploitation rate (Ricker, 1975), which can be accompanied by sensitivity analysis of violations of the assumption that all recaptured high-reward tags are reported (e.g. test effect of a 90% reporting rate of high reward tags, etc.). A number of studies can be consulted which illustrate the approach, including Crecco (2003), which is currently the primary analysis applied by the ASMFC Striped Bass Tagging Subcommittee, Kahn and Helser (2005) and Hewitt et al. (2007) for applications to blue crab, and Pollock et al. (1991) who outline the approach and provide formulae for variances. It was noted that the models presented at the meeting can be reformulated to provide Petersen estimates. Insight on the implications of assumptions can be gained by comparing the results of different model formulations, which the NEFSC is encouraged to undertake as part of its analysis of the tagging data for this GARM.

Overall, of the models presented, the FisCot model showed the most promise in modeling migration and fishing mortality rates in cod and yellowtail stocks during this GARM. The sensitivity analysis of its performance presented at the meeting was instructive in developing a more comprehensive understanding of its behavior under different assumptions and uncertainties.

4. Consider sources of uncertainty, particularly tag reporting rates, and commercial fishing effort

The sensitivity analysis of the FisCot model highlighted a number of sources of uncertainty that need to be kept in mind. The model indicated that fishing mortality was highly correlated with reporting rate, which was in turn linked to the assumption of a 100% return rate for high valued tags. Another model input is the assumed initial capture rate. This is a measure of the rate of return, based upon the initial aggregation of tagged fish, within one month after release. These assumptions should be verified as they may explain some of the discrepancy between the FisCot estimates of exploitation rate (5%) and those from assessment models (50%).

The model also assumes that fish of all sizes behave the same. As fishing mortality is generally relevant to mature fish, it would be useful to reformulate the model for cod of greater than 53 cm.

An unresolved issue is the seemingly high natural mortality rate (0.6) estimated by the model compared to what is used in stock assessments (0.2). It was noted that natural mortality rates in cod stocks north of 4X have been estimated to be higher than 0.2. This will require further exploration.

5. Consider use of tagging data to “inform” stock assessment

The FisCot model was considered as having the most potential for informing the upcoming GARM assessments. As stated above, updates for the other two models would not be available in time for the February GARM meeting but might be for that in April. If these models become available then, they could be used to corroborate the findings of the GARM rather than being inputs to the process.

It was noted at the meeting that there is a trend in fisheries population modeling to fully incorporate tagging processes within stock models. However, there is benefit to maintaining the tagging models separate from the assessment models. They provide a means to potentially estimate mortality rates independent of assumptions about the level of natural mortality required in catch-at-age models. The two modeling approaches are independent views of the same underlying processes and differences can yield insight on the veracity of the assumptions used in each. Also, the tagging data series is short and inclusion of the tagging data directly into the population model would imply a relatively low contribution to the likelihood function of the stock models.

FISHERY – INDEPENDENT SURVEYS

There was only one paper presented to address some of the meeting objectives on fishery-independent surveys. Thus, many of the issues remain unresolved. Much of the discussion on this section referred to potential improvements that the NEFSC could consider based upon the review panel’s understanding of the survey program. Reference was made to work by the March 2007 ICES Methods WG meeting, particularly on the treatment of zeros in surveys, which the NEFSC was encouraged to investigate at the working group’s next meeting in April, 2008. In addition to the comments below, subsequent to the meeting during the review of this report, the review panel recommends two additional items:

- Evaluate the survey design efficiency for a number of species. This would be the first step towards deciding whether or not the design can be improved or if models with covariates are a way forward. It should be noted that some initial work on this has already been done for flounders (NRC, 2000)
- Many of the deeper survey strata are narrow and thin and may only be allocated one tow. This complicates estimates of standard errors and confidence intervals. The use of post-stratification to address this should be investigated.

It was recommended that the NEFSC conduct a one-two day focused session on fishery – independent surveys to explore survey improvements.

1. Consider methods for estimation of abundance indices and precision from stratified random survey designs

A complete set of estimation and analysis functions have been implemented either as part of the standard software for the survey data or in an R package (Smith, 2006) available to NEFSC scientists. This software also enables researchers to evaluate the efficiency of the stratified random design in terms of increase of precision benefits of the strata and allocation scheme for the number of tows assigned to each stratum. For instance, it was noted that while the sampling plan can be optimized for individual species being surveyed, when one considers all species together, proportional sampling has been found to be optimal. Indeed, one of the primary advantages of stratification is not only a potential reduction of variance but achievement of broad spatial coverage of the sampling. Having said this, the NEFSC was encouraged to undertake a comparison of the optimal and current sampling coverage using software that is available in the R package (Smith, 2006).

Confidence intervals for survey mean and total estimates can be calculated using the conventional normal approximation or the more robust bootstrap confidence intervals. However, there have been issues with using the bootstrap or the normal approximation when there are small sample sizes and particularly when there is only one sample as can be the case for some of the small deep water strata.

Work still needs to be done on evaluating potential gains in precision from post-stratification. There was no discussion on what would be the basis for the new stratification.

2. Evaluate effects of missing strata samples on estimation of spatially and temporally consistent indices of abundance and consider model based methods for imputation of missing strata

Jacobson et. al. (D1) presented six hypotheses and associated analysis to address how environment and other spatial effects may have affected the survey estimates. This working paper stated that it addressed the fishery independent surveys and ecosystem data terms of reference. However, the main emphasis of the paper was on the environmental aspects and no analysis was directed toward dealing with missing strata samples and imputation. The analyses presented were mainly graphical and exploratory in nature. If these analyses are to be developed more fully at a later time, there are established statistical methods available in the literature for analyzing associations between species and environments that should be considered. In addition, a number of these prospective methods incorporate the survey design which would address a shortcoming of the presentation, as acknowledged by the author.

The analyses were confined to the NMFS trawl survey series and the strata groups used by the stock assessment analysts for their respective stocks. Questions about the impact of not including inshore strata where for some species, juveniles may occur, were met by showing that the inshore strata from state and other surveys are included in many cases.

There was also discussion concerning the validity of the groups of strata that were used for specific species and stock. While no specific groupings were shown as being inadequate, the

issue merits further investigation given the possibilities of changing distribution for some species given environmental changes. To that end, including strata now in response to changing distribution that may not have been covered every year in the past would necessitate some method of imputing past estimates for these strata. No specific methods have been used nor were any specified but the principle of including the uncertainty associated with the imputation in the estimates was acknowledged.

Potential impacts of changes in growth rates on catchability-at-age to the survey were also discussed as were possible density – dependent influences on survey catchability, both issues that require further examination.

3. Compare model vs design based estimators of abundance, including but not limited to geometric means, delta distribution, zero inflated Poisson, and zero-inflated negative binomial

At present, design-based estimates are being used for all GARM species. Improving the precision of design-based estimates usually involves improvements to the survey design. Given the multispecies nature of the survey, it is difficult to establish one survey design that is optimal for all the major target species of the survey.

An alternative approach for developing more precise estimates is to incorporate auxiliary covariates that are related to the distribution of specific species (e.g., depth). These types of estimates usually involve fitting a model to the data. Model-based estimates such as the Delta distribution has been used in the past for NMFS surveys. Generally, the small number of observations in each stratum has not allowed for the evaluation of the appropriateness of using the estimates defined for this distribution nor is it likely, based on theoretical work, that there will be significant gains in precision for sample sizes smaller than 30. Additionally, model-based estimates such as the Delta have not included auxiliary covariates explaining species distribution patterns.

Zero-inflated versions of the Poisson and negative binomial distribution offer the means to model the skewness noted for survey data as well as incorporate relationships with auxiliary covariates. These distributions have two kinds of zeroes, real zeroes possibly reflecting habitat where the target species is unlikely to occur and sampling zeroes as predicted by the Poisson or negative binomial distribution. Experience with these kinds of distributions is that auxiliary covariates (e.g., bottom type) are needed to differentiate between the two types of zeroes. Also, available maximum likelihood methods for estimating the parameters for the zero-inflated distributions have been found to be unstable but Bayesian MCMC approaches seem to be more useful.

The empirical likelihood approach of Chen et. al. (2004) combines design-based and model-based approaches, possibly allowing for incorporating a population model directly into the survey estimation.

There are a number of other design-based and model-based methods that allow for the incorporation of auxiliary covariates into the estimation to increase the precision but in all cases, the values for the auxiliary covariate needs to be known for the whole area and not just for where the trawl sampled. Surveys have collected auxiliary information on depth, temperature, etc. but usually at the sites where the tows were made and not over the whole survey area. Given that this kind of information is not available at this time, insights could be gained via simulation

studies of the different kinds of estimates available in the literature based upon investigations of potential candidates for auxiliary covariates currently collected.

4. Consider implications of sampling design and age-length keys for estimation of CAA in surveys

Bootstrapping approaches were suggested by the NEFSC as being an appropriate method for characterizing uncertainty in CAA but little detail was provided. There was some discussion about making sure that the bootstrap structure replicated the sampling scheme. The review panel cannot comment further on this objective.

5. Consider implications of subsampling procedures for CAA and total survey effort for detection of “true” zeros and the use of multi-year ALKs. Consider implications of subsampling procedures for maturation rates, length-weight relations, and sex ratios

No projects were reported here and little was said about planned work.

6. Consider implications of D1-D4 for species with different catchability rates

No projects were reported here and little was said about planned work.

INDUSTRY - BASED SURVEYS

In reviewing the industry – based surveys (IBS), the review panel noted the level of effort and funding devoted to them. Recognizing that these surveys were undertaken for specific purposes, which were generally achieved, careful consideration needs to be given about continuing these surveys to provide stock indices of abundance. The latter requires a long-term commitment to their support and it is important to evaluate whether or not this is best provided on these surveys or elsewhere in the science program in support of management.

1. Summarize list of IBS and cooperative research projects to date and incorporate as appropriate into the stock assessments

Industry-based surveys (IBS's) and other cooperative or collaborative resource surveys are increasingly being implemented in the US and elsewhere; an example from Europe is the Scottish Science-Industry Partnership scheme, which thus far has yielded valuable information on anglerfish and megrim around Scotland. Such surveys are generally set up to address issues that may not be answered well by traditional, long-running scientific surveys that were designed to achieve other purposes – examples of such issues might include location of spawning areas, or the stock distribution of species for which catchability in standardized survey gear is low. This implies that these projects can be of short duration. Once the objectives are successfully achieved, the project can be terminated.

Three such surveys were discussed at the meeting - the Maine-New Hampshire inshore groundfish survey (E2), the Gulf of Maine cod survey (E3), and the yellowtail flounder survey in Southern New England (E4). These had been previously peer-reviewed and it was the reports of

these reviews that were presented and discussed at the meeting. Although this was informative, it meant that the meeting was unable to make recommendations on the content, veracity and utility of the surveys, only possible after extensive analysis of the survey data, including evaluations of stock coverage, consistency with other stock indicators (such as NMFS surveys), and examination of survey variability. Specifically, the review panel could not comment on the potential suitability of the surveys for the generation of abundance indices, nor on their inclusion in any subsequent stock assessment, beyond a general statement that any time-series with less than five years is generally considered too short for these purposes, as is the case with the cod and yellowtail surveys but not the case with the Maine – New Hampshire survey which has been underway since 2000.

One other issue raised by the meeting was the multi-vessel design of the three surveys. Although efforts had been taken to standardize the sampling gear configuration, the use of several different vessels with different fishing characteristics was likely to have had an effect on the relative catchabilities of different parts of the survey.

2. Comment on use of IBS as measures of trend, scale, and/or relevant fine-scale biological information

Legault et. al. (E1) compared the stock dynamics suggested by two candidate surveys, the Southern New England yellowtail flounder IBS and the NEFSC bottom trawl survey. While the stock trends were broadly comparable, there were considerable differences at the level of individual strata. There are a number of possible reasons for this: the vessels and gear used may have different selection characteristics, the IBS gear was a trawl specifically designed to catch flatfish and set protocols were different from those of the NMFS survey. However, the most likely explanation for the differences is the higher density of tows in the IBS, which means that it is less prone to the effects of random noise.

While unable to comment on the surveys in detail, the review panel noted the types of information that IBS's are exceptional at providing. These include fish distributions, spawning areas, age-length keys, maturity and maturation rates, and other biological characteristics on a finer scale (in many cases) than that provided by more general NMFS surveys. The review panel encourages the further development of these surveys and considers further studies on their applicability to be valuable.

ECOSYSTEM DATA

1. Describe methods for detecting trends in average size, maturity and weight at length

The analyses by O'Brien et. al. (F1) and Sutherland et. al. (F2) examined temporal changes in gadoid lengths and weights at age of several GARM species. The first analysis employed a randomization test and the second a correlation analysis with Bonferroni adjustment. There was agreement in the observed trends for the flatfish stocks common to both studies. Many stocks exhibited long term declines in weights at age over time and, if persistent, have significant implications for biological reference points. Further, the analysis by Legault and Blaylock (F4) of a number of GARM species determined that the relationship between length and weight has changed in the population (fish are lighter recently) but not in the catch. While a number of suggestions were made to improve the above analyses, the broader concern remains that without

hypotheses on the causes of these patterns, it will be difficult to determine how to respond to them.

In an analysis of long-term trends in maturity at age of Georges Bank haddock employing a state – space model, Miller et. al. (F3) determined that while there were patterns in the data series, these were consistent with a random walk. In order to determine whether or not there were biological or other processes causing these, it would be necessary to identify causative hypotheses (e.g. density dependent change in maturity, declining temperature) and redo the analyses using the appropriate covariates. It would be worthwhile determining whether or not the observed variation in maturation was biologically feasible. Improvements to the model to ensure that its conclusions were robust include investigating the impact of the clustered biological sampling, use of a generalized mixed effects model and use of a different functional model for the maturity ogive (e.g. Gompertz).

Given that the patterns remain unexplained, the review panel recommends the estimation of maturity at age using a multi-year smoothing average, referring to the influential biological processes of each stock when selecting the size of the window. This approach allows for slow change in the maturity at age which may be due to some as yet unknown process but also by using a smoothed average, recognizes the possibility that the observed patterns may be purely random.

2. Identify primary time series of extant environmental data and describe methods used to derive estimates on appropriate spatial and temporal scales

The review by Hare and Friedland (F5) of physical, chemical and biological information highlighted the availability of large amounts of data in the Gulf of Maine area that could be used to derive indices of environmental components and processes for use in the GARM stock assessments. To derive these, both temporal and spatial amalgamation is required but this is somewhat dependent upon the problem being studied. The examination of recruitment processes would require different analyses than those investigating processes, such as growth and distributional changes, occurring in the adult phase. There are a number of opportunities for inclusion of this information that would be worthwhile to pursue. Regarding recruitment, studies on the Scotian Shelf and Georges Bank have shown that haddock recruitment is influenced by phytoplankton productivity, which in turn is influenced by climate change. There is a need to explore potential environmental drivers of the observed trend in length, weight and maturity at age to resolve whether or not such trends have any biological basis. Certainly, changes in the ocean environment no doubt have an influence on the structure and function of the Gulf of Maine area ecosystem and need to be taken into account when considering stock specific reference points. There is a need to explore, on a case by case basis, how productivity might change and what adjustments to reference points would be required.

The intent by the NEFSC to include environmental processes in the GARM III is consistent with national and international efforts to move towards an ecosystem approach to fisheries (EAF). This will require the sustained effort of a coordinated science program to implement, elements of which were highlighted at the meeting. To profile these efforts with management authorities, it was suggested that the GARM III assessment report include a ‘Ecosystem Context’ section summarizing trends of a suite of pertinent environmental indicators, similar to efforts undertaken elsewhere e.g. Scotian Shelf (DFO, 2003). Further, trends in this suite could be summarized using multivariate statistical techniques which highlight the dominant changes in the

ecosystem processes that have occurred. This approach might also allow identification of large scale changes, such as a regime shift from a groundfish to pelagic dominated ecosystem, which would have long term repercussions for ecosystem productivity and management.

3. Identify candidate measures of system-level productivity

Link and Overholtz (F6) and Link et. al. (F7) outlined a comprehensive program to integrate science on an ecosystem approach to fisheries into the GARM III. This consisted of four main elements: 1) estimation of the absolute abundance of the major species in the Gulf of Maine Area ecosystem, 2) the production potential of the fishery based on food chain processes, 3) estimates of Bmsy for exploited species (not just of GARM) in an ecosystem context and 4) modeling of the aggregate yield from the ecosystem. It is intended that the program will allow the GARM to comment on aggregate single stock yield projections in relation to overall ecosystem production and thus identify potential inconsistencies in single stock reference points with an EAF. For instance, it may be able to determine whether or not the rebuilding plans of many species are incompatible. Similar support for management decision making is already being provided to other regional councils (e.g. Pacific).

The initiative is ambitious and will require coordination of various science groups within the NEFSC prior to peer review at the April 2008 GARM. A number of the relevant datasets have never before been brought together in this manner and problems are to be expected. Indeed, each stock expert at the NEFSC is generally responsible for data collation, modeling, assessment and advice for his or her particular stock. Although this optimizes knowledge of one stock by the expert, it could hinder consideration of processes across stocks and thus calls for strong lab level coordination to fully address the ecosystem mandate of the GARM III. Notwithstanding this, the initiative was well received by the GARM and its efforts encouraged. Through it, the data needs of an EAF will be refined, including consideration of the required spatial and temporal scales of monitoring activities, uncertainties with historical fisheries statistics, and so on.

Many of the interactions amongst species occur during the early life history and are different from the processes that occur at the adult stage. As well, many of the current management issues involve the impacts of fishing on the benthic habitat. While efforts to model ecosystems have been underway for some time, the field is still relatively young and it is important not to 'oversell' its current capabilities. It is urged that ecosystem models be used within simulations to evaluate the relative performance of management strategies and to increase awareness and understanding of the implications of harvesting decisions.

RECREATIONAL LANDINGS AND DISCARDS

The GARM raised a number of issues with the recreational fishery of which time at the meeting did not allow in-depth exploration. The management of recreational fisheries is growing in prominence and while GARM species are not generally implicated, it is urged that the NEFSC conduct a focused session on GARM species to explore comprehensively all recreational fishery related issues.

1. Retrieve relevant landings and discard information from MRFSS databases

It was noted that the Marine Recreational Fishery Statistics Survey (MRFSS) had undergone a national review (NRC, 2006) which had identified serious problems that required resolution. Given that there is a national initiative underway to redesign the system to address these concerns, the review panel did not comment on the MRFSS database.

Terceiro (G1) summarized recreational landings and discard information for cod (Georges and Gulf of Maine) and winter flounder (Gulf of Maine and Southern New England) which is available in the MRFSS database since 1981. It was noted that recreational reports on haddock have been increasing in recent years. While the winter flounder assessment appears to incorporate the recreational data in an appropriate way, the cod assessments seem to downplay such catches. While recreational catch may be a minor component, to be thorough, inclusion of recreational landings and discards is required in the catch-at-age matrix of these assessments.

It was pointed out that recreational catch per unit effort is used as important indices of abundance in other species and areas (e.g. striped bass in the Mid-Atlantic) and might be important to consider for relevant GARM species.

2. Report measures of uncertainty for each species

Estimates of uncertainty in the recreational catch for cod and winter flounder were reported. Concerns were raised regarding the merging of commercial and recreational landings, as the first is collected via a census while the second is based upon sampling. The major concern is not necessarily the precision of the recreational information but rather whether or not the sampling is biased. The NEFSC needs to evaluate the sampling design of the recreational fishery to determine its statistical properties.

Live discards are now significant part of the recreational catch of some GARM species. It is assumed that the survival of these discards, which are often below the minimum legal size, is 100%. Some discard mortality is to be expected, especially for species with swim bladders e.g. cod. On the other hand, discard mortality is likely not as high as in the commercial fishery. While the review panel could not recommend specific estimates of discard mortality for recreational fisheries, it felt that some level between zero and that for the commercial fishery was appropriate. The NEFSC was encouraged to consult published studies on recreational discard mortality for use in this GARM. In the longer term, the NEFSC will need to undertake field studies of recreational discard mortality.

3. Identify appropriate ALKs for estimation of recreational CAA

Both the Gulf of Maine cod and SNE winter flounder assessments use NMFS survey age – length keys to estimate the recreational catch at age. Recognizing that the collection of otolith material from anglers is difficult due to the need to ‘spoil’ the fish, this practice appeared appropriate but could not be fully evaluated at the GARM. It was noted that these keys should be supplemented by commercially derived aging material as appropriate (i.e. commercial aging available for size ranges in recreational fishery).

GENERAL COMMENTS

The intent of the NEFSC to quantify the precision of each of the datasets considered at the review is laudable. While it was recognized that the combination of datasets with different sampling objectives and plans will make this task difficult, the end product will ultimately allow examination of the costs and benefits of the contribution of the various types of information to the assessment and thus to harvest advice. It will be possible to consider which data types (e.g. port sampling, observer, survey) are most critical to the assessment and what sampling rates of each of these is optimal. This will then guide the NEFSC on how best to direct the funding of these programs.

CONCLUDING REMARKS

This report represents the review of the significant efforts of scientists at the Northeast Fisheries Science Center on the data inputs (landings, discards, tagging, fishery independent and dependent surveys, ecosystem and recreational) for the GARM III. A considerable amount of information was considered in the meeting time available and consequently the review could only focus on the most important issues and highlight work that could be undertaken to address these. Many of the recommendations made by the review panel can be implemented in time to be included in the next GARM in February 2008. However, a number will require longer-term actions which the NEFSC is encouraged to pursue. In a few cases (fishery independent surveys and ecosystem data), the NEFSC was encouraged to hold internal meetings to advance scientific investigation of the issues that were discussed.

Overall, the meeting achieved its objectives to review the data inputs for this GARM and represents an important contribution to the remainder of the GARM III process.

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APPENDICES

Appendix 1. List of Participants

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Appendix 2. Terms of Reference

Purpose

Review the commercial and survey data that will be used in the stock assessments. Identify appropriate statistical methods for analyzing those data (including bycatch and discard issues, changes in growth rates and other life history traits, issues related to merging databases, etc.). Other sources of data to be considered are tagging programs for cod and yellowtail flounder, and Industry-Based Surveys. Candidate sources of data relevant to ecological and ecosystem considerations will also be described.

Emphasis will be placed on estimating precision and bias of data and derived quantities. Measures of uncertainty will be considered with respect to their implications for use in stock assessment models.

Objectives

Six (possibly 7) major sources of data will be examined:

A. Commercial Landings

1. Proration Methods for allocating dealer landings and port samples to Statistical and Stock Areas
 - a. Evaluate algorithms used to estimate assignment of statistical and stock areas for dealer records, based on Vessel Trip Reports (VTR) for 1994-2006
 - b. Consider implications of algorithm for use of biological samples to estimate Catch At Age (CAA) by stock area
 - c. Compare results of revised algorithm with landings from GARM II
2. Evaluate uncertainty in CAA using information from the realized sampling design for port samples, the Age-Length Key (ALK), and overall sampling intensity

B. Commercial Discards

1. Evaluate methods for estimation of discards by stock area and measures of uncertainty
 - a. Consider adequacy of sampling coverage by year and gear type and implications for measures of uncertainty
 - b. Test and apply model-based methods for estimating discards in strata without observer coverage
 - c. Compare and contrast alternative models for estimation of discards
 - d. Consider methods to hindcast estimates of discards for years prior to start of Observer Bycatch program
 - e. Comment on appropriateness of hindcast estimates and their implications for stock assessments
 - f. Consider use of length samples from observer samples and “borrowing” of appropriate age-length keys from appropriate sources (eg. Research Trawl Surveys)
 - g. Consider measures of accuracy (bias) for discard estimates

C. Tagging Data for Yellowtail Flounder, Cod, and Haddock

1. Do results of tagging experiments support existing stock definitions for cod and yellowtail flounder?
2. Can migrations among stock areas be quantified?
3. Develop appropriate analytical models for estimation of migration and fishing mortality
4. If possible, simultaneously estimate migration and fishing mortality rates for cod and yellowtail flounder from tagging data
5. Consider sources of uncertainty, particularly tag reporting rates, and commercial fishing effort
6. Consider use of tagging data to “inform” stock assessment

D. Fishery-Independent Surveys

1. Consider methods for estimation of abundance indices and precision from stratified random survey designs
2. Evaluate effects of missing strata samples on estimation of spatially and temporally consistent indices of abundance and consider model based methods for imputation of missing strata
3. Compare model vs design based estimators of abundance, including but not limited to geometric means, delta distribution, zero inflated Poisson, and zero-inflated negative binomial
4. Consider implications of sampling design and age-length keys for estimation of CAA in surveys
5. Consider implications of subsampling procedures for CAA and total survey effort for detection of “true” zeros and the use of multi-year ALKs. Consider implications of subsampling procedures for maturation rates, length-weight relations, and sex ratios
6. Consider implications of D1-D4 for species with different catchability rates

E. Industry-Based Surveys (IBS)

1. Summarize list of IBS and cooperative research projects to date and incorporate as appropriate into the stock assessments
2. Comment on use of IBS as measures of trend, scale, and/or relevant fine-scale biological information

F. Ecosystem Data for use in stock assessments

1. Describe methods for detecting trends in average size, maturity and weight at length
2. Identify primary time series of extant environmental data and describe methods used to derive estimates on appropriate spatial and temporal scales
3. Identify candidate measures of system-level productivity

G. Recreational Landings and Discards

Comment: Recreational landing of most stocks in the GARM have been negligible historically, but risen to important fractions of total removals for some stocks, particularly cod in the Gulf of Maine. In recent years, the MRFSS data can be compared to VTR data for the commercial charter vessels.

1. Retrieve relevant landings and discard information from MRFSS databases
2. Report measures of uncertainty for each species
3. Identify appropriate ALKs for estimation of recreational CAA

Appendix 3. Agenda

Monday October 29

0900 - 0920 Welcome and Introductions

0920 - 0940 Overview of GARM and objectives of this meeting

A. COMMERCIAL LANDINGS

0940 - 1010 Methods for allocating landings to stock area (WP A1: Wigley)

1010 - 1040 Discussion

1040 - 1055 Break

1055 - 1105 WP A2: Wigley

1105 - 1125 Discussion

1125 - 1155 Accuracy issues VTR, VMS, Dealer data (WPs A3, A4, A5: Nies, Palmer, Nies respectively, 10 min each)

1155 - 1225 Discussion

1225 - 1325 Lunch

1325 - 1345 Commercial Landings—Estimation of total numbers landed at age and its variance Working Papers A.6, A.7 (Legault-10 min, Miller 10 min)

1345 - 1415 Discussion

B DISCARD ESTIMATION

1415 - 1425 Discard Estimates for National Bycatch Report (WP B1: Wigley)

1425 - 1445 Discussion

1445 - 1515 WPs B6 and B2: Wigley

1515 - 1530 Break

1530 - 1600 Discussion

1600 - 1610 WP B4: Terceiro

1610 - 1630 Discussion

1630 - 1640 WP B5: Legault

1640 - 1700 Discussion

1700 - 1710 WP B3: Hendrickson

1710 - 1720 Discussion

1720 - 1730 Wrap up and Adjourn

Tuesday October 30

0900- 0915 Progress review and Order of the Day (Chair)

C. TAGGING DATA

Cod Tagging

0915 - 0935 Cod Tagging Data (WP C1: Tallack)

0935 - 0945 Cod Stock Boundaries (WP C2: Loehrke)

0945 - 1000 Cod Data Analysis (WP C1: Tallack)

1000 - 1020 Cod Modeling (WP C3: Miller & Tallack with WP C4 as background)

1020 - 1035 Break

1035 - 1115 Cod Discussion

Yellowtail Tagging

1115 - 1130 Yellowtail Tagging Data (WP C5: Cadrin et al.)

1130 - 1140 Yellowtail Movement-Mortality Analysis (WP C6: Cadrin)
1140 - 1150 Yellowtail Simulation (WP C7: Alade)
1150 - 1200 Yellowtail Mortality Analysis (WP C8: Wood)
1200 - 1230 Yellowtail Discussion
1230 - 1330 Lunch
1330 - 1430 Discard Estimation (B)follow up issues

E. INDUSTRY-BASED SURVEYS

1430 - 1500 Industry-based surveys (WPs E2, E3 and E4: Johnston)
1500 - 1545 Discussion
1545 - 1600 Break
1600 - 1610 Comparison of RI IBS with NEFSC survey (WP E1: Legault)
1610 - 1730 Discussion
1730 Adjourn

Wednesday October 31

0900 - 0930 Progress review and Order of the Day (Chair)

D. FISHERY INDEPENDENT SURVEYS

0930 - 0945 Fishery Independent Surveys - Overview (WP D2: Rago)
0945 - 1000 Break
1000 - 1030 Fishery Independent Surveys – WP D1: Jacobson)
1030 - 1125 Discussion

G. RECREATIONAL LANDINGS

1125 - 1135 Recreational Landings and Discards WP G1: Terceiro)
1135 - 1200 Discussion
1200 - 1300 Lunch

F. ECOSYSTEMS

1300 - 1320 Trends in biological parameters, eg. ave size, maturity, L-W etc. (WP F1: O'Brien)
1320 - 1350 Discussion
1350 - 1400 Trends in Flatfish (WP F2: Sutherland)
1400 - 1410 Discussion
1410 - 1425 State Space model for trend detection (WP F3: Miller)
1425 - 1445 Discussion
1445 - 1455 Observed vs Predicted weights (WP F4: Legault)
1455 - 1510 Discussion
1510 - 1525 Break
1525 - 1535 Review of Environmental and Ecosystem variables relevant to assessments (WP F5: (Overholtz, Friedland, Link, Hare)
1535 - 1540 Discussion
1540 - 1550 Background data relevant to food web dynamics (WP F6: Fogarty)
1550 - 1610 Discussion
1610 - 1620 Proposed analyses for Ecosystem Capacity Issues (WP F7: Fogarty)
1620 - 1630 Discussion
1630 - 1730 Review and Discussion
1730 Adjourn

Thursday November 1

0900 - 0915 Progress review and Order of the Day (Chair)
0915 - 1030 Landings Proration—Revisit/Discussion
1030 - 1045 Break
1045 - 1230 Discard Estimation—Revisit/Discussion
1230 - 1330 Lunch
1330 - 1400 Tagging Data—Revisit/Discussion
1400 - 1430 Industry Based Surveys—Revisit/Discussion
1430 - 1500 Ecosystemt Data--Revisit/Discussion
1500 - 1515 Break
1515 - 1645 Fishery Independent Surveys—Revisit/Discussion
1445 - 1530 Recreational Landings and Discards—Revisit/Discussion
1730 Adjourn

Friday November 2

0900 - 0915 Progress review and Order of the Day (Chair)
0915 - 0945 Report development
1030 - 1045 Break
1045 - 1230 Report development
1230 - 1330 Lunch
1330 - 1530 Summary and Assignments
1530 Adjourn

Appendix 4. Working Papers

- A1: Wigley S, Hersey P, Palmer J. 2007. A Description of the Allocation Procedure applied to the 1994 to present Commercial Landings Data.
- A2: Wigley S, Legault C, Brooks E, Cadrin, Col L, Hendrickson L, Mayo R, Nitschke P, Palmer M, Sosebee K, Terceiro M. 2007. Annual Comparisons of the trip-based allocated and the single-species prorated commercial landings, biological samples and numbers of landed fish at age
- A3: Nies T, Applegate AJ. 2007. Accuracy of Self-Reported Fishing Locations in the New England Multispecies Trawl Fishery
- A4: Palmer MC, Wigley SE. 2007. Validating the stock apportionment of commercial fisheries landings using positional data from Vessel Monitoring Systems (VMS)
- A5: Applegate AJ. 2007. Using VMS data to characterize fishing activity in the US yellowtail flounder (*Limanda ferruginea*) (Storer 1839)] fishery
- A6: Legault C, Brooks E, Seaver A. 2007. BioStat Bootstrapping for Estimating Uncertainty in Commercial Landings at Age
- A7: Miller T. 2007. Model-based estimation of numbers-at-length and(or) -age for commercial landings in the Northeastern United States
- B1: Blaylock J, Wigley SE. 2007. Summary of trips from the Northeast Fisheries Observer Program and Vessel Trip Report data
- B2: Wigley SE, Palmer ME, Blaylock J, Rago PJ. 2007. A Brief Description of the Discard Estimation for the National Bycatch Report
- B3: Hendrickson L, Nies T. 2007. Discard and gear escapement survival rates of some Northeast groundfish species
- B4: Terceiro M. 2007. Comparison of commercial fishery discard estimates for SNE/MA winter flounder
- B5: Legault C. 2007. Discard Estimation using Observer Data
- B6: Wigley SE, Rago PJ, Sosebee KA, Palka DL. 2007. The Analytic Component to the Standardized Bycatch Reporting Methodology Omnibus Amendment: Sampling Design and Estimation of Precision and Accuracy
- C1: Tallack S. 2007. A description of tagging data from the Northeast Regional Cod Tagging Program (3A) and preliminary applications of weighting and mixing analysis (3C)
- C2: Loehrke J, Cadrin S. 2007. A Review of Tagging Information for Stock Identification of Cod off New England
- C3: Miller A. 2007. Estimating instantaneous rates of regional migration and mortality from conventional tagging data
- C4: Miller A. 2007. A finite-state continuous-time approach for inferring regional migration and mortality rates from conventional and archival tagging experiments
- C5: Cadrin S, Westwood L, Alade J, Moser, Martins D. 2007. Yellowtail Flounder Tagging Data
- C6: Cadrin S. 2007. Movement-Mortality Analyses of Yellowtail Flounder Tagging Data
- C7: Alade L, Cadrin S. 2007. Evaluating the Precision and Accuracy of the Yellowtail flounder Movement-Mortality Model via simulation
- C8: Wood A, Cadrin S. 2007. Can survival be estimated from the yellowtail tag-recapture database? A preliminary analysis.
- D1: Jacobson LS, Correia, Blaylock J. 2007. Potential environmental and spatial effects on survey data and assessments for GARM stocks

- E1: Legault C, Keith C, Johnston D. 2007. Comparison of the Southern New England Yellowtail Flounder Industry Based Survey with the Northeast Fisheries Science Center Bottom Trawl Survey: Annual Trends and Distributions
- E2: Chouinard C, Beutel D, Legault C. 2005. Consensus Report of the Technical Review of the Maine Department of Marine Resources
- E3: Chouinard G, Weinberg K, McGovern J. 2006. Peer Review of Industry-Based Survey for Gulf of Maine Cod
- E4: Chouinard G, Martin M, Sowles J. 2007. Peer Review of the Southern New England Yellowtail Industry-Based Survey
- F1: O'Brien L, Jacobson L, Rago PJ, Traver M, Col L. 2007. Trends in Mean Length and Weight at Age for Selected Groundfish Stocks.
- F2: Sutherland SJ, McBride R, O'Brien L, Mayo RK, Pregracke SE. 2007. Recent Trends in Weight-at-Age of New England Flatfishes
- F3: Miller T, Jacobson L, O'Brien L, Legault C, Rago PJ. 2007. A state-space approach for modeling maturity as a function of time and age
- F4: Legault C, Blaylock J. 2007. Analysis of Recorded Sample Weight vs Length-Weight Equation Derived Sample Weight using Commercial Port Sampling and NEFSC Survey Data
- F5: Hare J, Friedland K. 2007. Review of Environmental and Ecosystem variables relevant to assessments: *In-situ* Oceanographic Data and Remote Sensing Sea Surface Temperature and Chlorophyll Concentration
- F6: Link, J, Overholtz WJ. 2007. Background Data Available for GARM3 Analyses of growth and Maturity
- F7: Link JS, Overholtz WJ, Fogarty M, Col L, Legault C. 2007. GARM3 System Capacity Analyses
- G1: Terceiro, M. 2007. Magnitude and precision of Marine Recreational Fishery Statistics Survey (MRFSS) estimates of the recreational catch of winter flounder and Atlantic cod

**Panel Summary Report
of the
Groundfish Assessment Review Meeting
(GARM III)**

Part 2. Assessment Methodology (Models)

By

Chairman: Robert O'Boyle

**Review Panel: José De Oliveira, Stratis Gavaris, Jim Ianelli,
Yan Jiao, Cynthia Jones and Paul Medley**

Report Date: March 25, 2008

**Meeting Dates and Location:
25 – 29 February 2008
Northeast Fisheries Science Center
Stephen H. Clark Conference Room
Woods Hole, Massachusetts**

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SUMMARY

Models to assess the status and productivity characteristics of 19 New England groundfish stocks being considered at the 2008 Groundfish Review Assessment Meetings (GARM) were reviewed at the Northeast Fisheries Science Center in Woods Hole, Massachusetts during 25 – 29 February 2008. The review considered the applicability of a number of modeling approaches (relative trends to age and length – based models) and examined the utility of statistical catch-at-age formulations to address specific issues on each stock. The latter included the ability of these models to address observed retrospective patterns, the potential causes of which were also considered at the meeting. The review focused on the key observational error and model process assumptions for each stock to determine which class of assessment model was most appropriate to use and provided guidance on model formulations to address specific issues for each stock. The sufficiency of the assessment models to provide Biological Reference Points was also discussed as were the implications of zeros in fishery independent indices.

This was the second meeting of a four part process, with the first on data inputs (29 October – 2 November 2007) and the remaining two on biological reference points (28 April – 2 May 2008) and review of the assessments (4 – 8 August 2008). The GARM process has been designed so that each review can inform subsequent ones.

The body of this report consists of the recommendations of a seven member review panel in response to the meeting's terms of reference. The report also includes a synopsis of each of the working papers presented at the meeting along with the associated discussion, during which suggestions and recommendations were made to address identified issues. The panel considered these in drafting this report.

Overall, the meeting successfully fulfilled its terms of reference and represents an important contribution to the GARM III process.

INTRODUCTION

This document is the summary report of the review panel (herein termed the ‘Panel’) of the Groundfish Assessment Review Meeting (GARM) on assessment methodology. The GARM is a regional scientific peer review process developed in 2002 to provide assessments for the stocks managed under the Northeast Multispecies Fishery Management Plan (Multispecies FMP). The first two GARMs took place in October 2002 (NEFSC, 2002a) and August 2005 (NEFSC, 2005) respectively. This GARM III is the most comprehensive to date, intended to provide peer reviewed assessments on 19 groundfish stocks managed by the New England Fisheries Management Council (NEFMC).

The four meetings of GARM III include:

- Data Inputs (29 Oct – 2 Nov 2007)
- Assessment Methodology (25 – 29 Feb 2008)
- Biological Reference Points (28 April – 2 May 2008)
- Assessments (4 – 8 August 2008)

The first three meetings are to establish the analytical formulations of the assessments to be used in the last meeting. The first meeting (NEFSC, 2007) focused on the data inputs (e.g. catch, sampling, surveys, etc) to be used in the assessments. The second meeting, which is the focus of this report, considered the assessment approaches to be applied to the datasets of each stock discussed at the first meeting (see Terms of Reference, appendix 1). The applicability of classes of assessment models, from relative trends to age and length-based models, was considered as well as the ability of the age-structured models to address observed retrospective patterns. Additional issues included treatment of zeros in the evaluation of fishery independent indices (e.g. surveys) and the capacity of assessment models to provide measures of stock status consistent with biological reference points (BRPs). The latter will be an important consideration for the third meeting, which will focus on the determination of the biological reference points used to guide management decision – making (see terms of reference, appendix 2).

Many of the assessments displayed similar issues, for instance the presence of retrospective patterns. The review first examined general issues applicable to all stocks by considering how these were pertinent to three case studies (Georges Bank yellowtail, white hake and Georges Bank cod). The lessons learned from these then informed discussion on the assessment model to use for each of the 19 stocks.

The meeting opened on Monday morning (see agenda, appendix 3) with an overview of the current assessment approaches and challenges facing the 19 groundfish stocks, with consideration of working papers (appendix 4) on potential factors responsible for retrospective patterns and the model implications of zeros in surveys in the afternoon. Tuesday morning was devoted to consideration of the ability of statistical catch-at-age (SCAA) models to address issues raised, particularly causes of retrospective patterns, in the Georges Bank yellowtail, white hake and Georges Bank cod assessments. Tuesday afternoon was devoted to consideration of working papers examining the presence and influence of partial recruitment assumptions on the assessments. Discussion on Wednesday further explored the issues in the assessments (retrospective patterns in Georges Bank yellowtail domed partial recruitment in Georges Bank cod and aging errors in white hake). Based on the discussions during the first three days, on Thursday and Friday morning, there was stock by stock consideration by the Panel of the most

appropriate formulations to use for each assessment. Unfortunately, an update on work by the Northeast Fisheries Science Center (NEFSC) to develop ecosystem models which will inform the next meeting on biological reference points, which has been planned for Thursday, could not be presented because of time limitations, although the text of the presentation was made available to the Panel. The last part of the meeting on Friday was devoted to the Panel reviewing its conclusions and discussing report assignments. The GARM review Panel consisted of José De Oliveira, Cynthia Jones, Paul Medley, Stratis Gavaris, Jim Ianelli and Yan Jiao. The first three reviewers were assigned to the review by the national Center of Independent Experts (see statement of work for these CIE reviewers in appendix 6) while the last three were invited by the NEFSC. All were invited based upon their extensive expertise and experience with the issues considered by the meeting. The list of meeting participants is provided in appendix 5.

The presentation highlight of each working paper and the ensuing discussion as recorded by assigned rapporteurs is provided in appendix 7. These were important reference material to the Panel in drafting its report.

It is important to comment on the effectiveness of the meeting to address its terms of reference. Other than Terms of Reference 5, the panel was presented with sufficient material to address the stated terms of reference. Some clarification is required for terms of reference 5. For each of the 19 groundfish stocks, terms of reference 5 called for

‘Assessment model that will be used to determine stock status and productivity characteristics until the next “benchmark” assessment is conducted. Where possible, apply the models to data (probably through 2006), to obtain current and historical estimates of F and B and estimates of uncertainty’

From the outset, it was apparent that in-depth review of the 19 assessments would not be possible. The approach taken at the meeting was to provide guidance on what class of model was most appropriate for each stock given the characteristics of the data (GARM III, 2007) and issues facing each assessment. Rather than focus on the software to be used, the Panel’s review focused on the formulation most appropriate to take account of observational errors and model assumptions. These formulation decisions were considered more important than the choice of software because most applications have the flexibility to accommodate the formulation variants. While the details of each assessment formulation (e.g. ages to use in plus group) were not discussed, there was considerable discussion and guidance provided at the meeting that would inform some of these detailed decisions. Overall, while time was not available for in-depth review of the details of each assessment, the guidance provided by the Panel was important at this stage of development of the analyses in establishing the class of model to be used in each assessment. From this perspective, the Panel considers that important aspects of terms of reference 5 were met. If the NEFSC requires an in-depth review of the assessment formulations, this will have to undertaken later in the process.

The Panel was concerned about the limited time it had during the meeting to develop its conclusions. The Panel had planned for a full day of consideration of its report on the Friday but the meeting’s agenda required the morning for completion of the discussion started on Thursday. While this requirement was understandable and perhaps unavoidable, review panels need time during meetings to consult. This needs to be factored into future GARM agendas.

Throughout the report, reference is made to a number of technical terms. The glossary provided in appendix 8 helps to clarify these terms.

PANEL RESPONSE ON TERMS OF REFERENCE

ToR 1. Applicability of one or more of the following modeling approaches to assess stock status (Index methods, Production Models, Age- or Length-based Models)

The Panel considers that model features required for the stocks considered in this GARM-III review must capture the underlying dynamics of populations and the key uncertainties about these and the associated data; capturing these uncertainties may require consideration of different model formulations. Models should be adequately conditioned on data so as to form the basis for the provision of advice. Appropriate consideration of uncertainty should allow risk assessment to be undertaken. Reference point generation and the ability to perform projections under alternative management options are also key features of prospective models.

A range of model classes was considered:

1. Relative trend models: These are models that consider trends in relative abundance and fishing mortality (F), and include the relative fishing mortality / replacement ratio approach of NEFSC (called “AIM”). The lack of catchability (q) estimates for this class of models limits its utility to inform management on absolute levels of allowable catch (i.e. TAC). They can however inform management on relative changes to existing TACs. Also, reference points have to be generated based upon expert judgment and on an *ad hoc* basis. There may be merit in investigating and comparing a more formal model fitting approach e.g. Glazer (2008, see next bullet), relative to the more exploratory, non-parametric approach of AIM.
2. Production models: These are essentially replacement yield models of the form: $B_{y+1}=B_y+Y^{rep}-C_y$ ¹, where Y^{rep} can take a number of forms, including a constant ($Y^{rep}=a$; Glazer, 2008), a linear ($Y^{rep}=a+bB_y$) or a quadratic ($Y^{rep}=rB_y[1-B_y/K]$; implemented in the NEFSC software ASPIC) form. These models can be used when age data are not available but have encountered problems when there has been depletion but no recovery in the time series. Caution is needed when using constant Y^{rep} for stocks for which there is no historical reported catch but there is evidence (e.g. anecdotal) that this could have been high or when the stock size has changed dramatically during the time period. In this situation, expert judgment may be needed to provide management with reference points based on these models.
3. Age-based models: These span the range from statistical catch-at-age to VPA-type models, and are the preferred approach when reliable age and growth data are available.
4. Length-and-age-based models: These are applied when age data are too limited to use age-based models, yet sufficient growth data (e.g. length frequency compositions) are

¹ B_y = biomass in year y, C_y = catch in year y and Y^{rep} is the function describing the replacement yield

available. However, it is important to evaluate stationarity when a growth model based on data from a restricted period is used.

Where data are lacking and there are conflicting hypotheses of underlying processes, the Panel noted the need to bound alternative states of nature by considering opposing extremes of plausible scenarios. Such an approach may require the consideration of multiple model formulations. If it leads to the consideration of competing models, then a risk analysis may be needed to inform decisions.

The software environment has important implications for what can be achieved. For example, a single software environment that can explore the diversity of data and assumptions is useful for comparative purposes. The use of simple models requires limited support, but also addresses a limited number of issues. On the other hand, more complex models require extensive, well-supported software (e.g. ASAP and SS2) that may limit broad access. Moderately complex approaches (e.g. ADAPT) require some support but are more widely accessible.

When moving from one class of models to another, or even from one formulation to another within the same class, it is important to document changes for fisheries managers. The Panel considers that this should be done by presenting results for the former approach (with new data), along with those for the new approach (with the same data). This allows the source of the change (whether new data or new model) to be clearly identified. It is important to provide rationale for any change in assessment models and explain differences in the results of the two approaches.

ToR 2. For certain stocks that are aged, utility of statistical catch-at-age vs. VPA based models with respect to Retrospective patterns, Flexibility to account for alternative parameterizations, Ability to incorporate external sources of information, especially tagging and environmental data and Ability to estimate parameters incorporating prior, external information

Age structured fish population models use observations on catch-at-age to determine population abundance-at-age. It is generally necessary to incorporate ancillary information to make this determination. Most commonly, the ancillary information comprises observations on abundance indices-at-age, e.g., from surveys or fishery catch per unit effort (CPUE). The catch and index observations may be used as amount-at-age or as split components of totals and proportions-at-age. The choice will influence how the error structures are handled. Assuming natural mortality is specified, a fully and freely specified age structured fish population model requires one population abundance parameter for each year class and one fishing mortality parameter for each age and year. It is generally not possible to reliably estimate all these parameters.

Two common approaches used to reduce the number of estimated parameters are referred to as Virtual Population Analysis (VPA) and Statistical Catch-at-Age (SCAA). VPA makes the assumption that the errors in the catch-at-age are negligible relative to the errors in other observations. This assumption may be held in situations where the catch is well monitored. Though not obligatory, to further reduce the number of parameters to be estimated, VPA frequently makes the assumption that the fishing mortality on the oldest age is a specified function, e.g. average, of the fishing mortality on younger ages. SCAA, on the other hand, makes the assumption that the fishing mortality is the product of an annual fishing mortality and an age

specific partial recruitment (PR). This assumption may be approximated in situations where the nature of the fishery has not changed substantially over years. Also, the SCAA dissociates the catch and index data from the model whereas in VPA, the “catch data” are bound to the algorithm for computing numbers at age. Both VPA and SCAA are approximations to the complex reality and are suitable as a basis for providing management advice.

For partial recruitment structure, index relationship to population, handling of natural mortality, and ability to incorporate ‘prior’ information on estimated parameters (Bayesian techniques), both VPA and SCAA are equally flexible. The principal consideration when comparing VPA and SCAA is the tradeoff between the magnitude of the error in the catch-at-age and the stability of the partial recruitment pattern over years. When the error in the catch-at-age is considered substantial, SCAA may be preferred. When the partial recruitment pattern is likely to be variable from year to year, VPA may be preferred. Often however, the results from VPA and SCAA do not differ substantially, suggesting that neither error in the catch-at-age nor departures from stable partial recruitment are critically important.

A more sophisticated variant of SCAA, referred to as semi-separable, relaxes the requirement for a stable partial recruitment pattern by allowing it to change over time. At the expense of having (usually many) more parameters, the semi-separable approach allows investigation to span the range from a VPA to a SCAA structure.

There are instances where, for some years of the analysis, the total catch is observed but the catch-at-age is unavailable. In these circumstances, only SCAA can be used to combine separate periods in the catch-at-age data. This may be of particular value for the estimation of reference points if there is an extensive initial period with total catch is observed but no catch-at-age data. Difficulties with a VPA application may also occur when errors in the catch-at-age are linked to some external or environmental observations.

An important issue in many fish stock assessments is the occurrence of retrospective patterns. These arise where the effect of removing recent data and re-running the assessment using earlier terminal years results in substantively different estimates compared to the result over the entire time period. These generally reflect incorrect model specifications or treatment of data and should be resolved. The panel reviewed results from a simulation experiment that investigated the performance of VPA and SCAA when retrospective agents were introduced and not accounted for in the model. The simulation operating model generated replicate observations which may have favored the SCAA approach because it used an underlying separable process for fishing mortality. A caveat on this is that the selectivity was length-based so the operating model was not entirely separable from an age perspective. Neither VPA nor SCAA were robust to the retrospective agents and their results displayed similar retrospective patterns. To properly address the retrospective patterns, it is necessary to know the true source, timing and magnitude of the effect (see section below on terms of reference 4). Uncertainty in point estimates should be carried forward to assist in judging the significance of the retrospective patterns. This may reveal that the estimates of uncertainty for one modeling approach contained the retrospective pattern residuals within confidence bounds more consistently than an alternate approach.

For many assessments reviewed at the meeting, the difference between results from a VPA and a SCAA approach were not the principal concern. Options for other model features had greater impact on results and deserve priority attention (see section below on terms of reference 5). The following table organizes these features and provides some guidance on the considerations for evaluation.

Model Feature	Variants (not comprehensive, reflects options considered at GARM III)	Considerations
<i>Structural Assumptions</i>		
Population Model	- annual time step (no within year dynamics) - homogeneous unit (no spatial sub-structure) - sex aggregated - sex disaggregated	- seasonal/spatial distribution of catches - sexual dimorphism
Natural Mortality	- assumed known and constant for all ages and years - age specific natural mortality	- demographics
Fishing Mortality	- separable as annual F and age specific PR - separable as annual F and age specific PR, time block breaks/random walk - separable as annual F and PR as function of age, time block breaks/random walk - separable as annual F and PR as function of length - calculated using catch equation, oldest age group PR estimated - calculated using catch equation, oldest age group PR conditioned on younger ages	- reliability of total catch - accuracy and precision of catch age composition - plausibility of constant PR for years in time block - support for PR pattern/assumptions
Index Catchability	- proportional, time invariant within block of years - proportional, time block breaks	- support for change if applicable
Index Selectivity	- age specific, time invariant within block of years - function of age, time invariant within block of years - function of length, time invariant within block of years	- support for selectivity pattern

<u>Error Assumptions</u>		
Catch-at-age, expressed as catch numbers at age	- errors assumed negligible - Errors iid after log transform - Errors lognormal - Errors Poisson	- residual diagnostics - influential observations - magnitude of mean square residuals
Catch-at-age, expressed as total numbers and proportions at age	- errors assumed negligible on combined (total and proportion) - errors iid after log transform on combined - errors lognormal on proportion, assumed negligible on total - errors lognormal on proportion, lognormal on total - errors multinomial on proportion, assumed negligible on total - errors multinomial on proportion, lognormal on total - errors Poisson on combined	- residual diagnostics - influential observations - magnitude of mean square residuals
Indices at Age, <u>expressed as</u> <u>abundance at age</u>	- errors iid after log transform - errors lognormal - errors Poisson	- residual diagnostics - influential observations - magnitude of mean square residuals
Indices at Age, <u>expressed as total</u> <u>and proportions at</u> <u>age</u>	- errors multinomial on proportion, lognormal on total	
Penalty/Constraint	- none - recruitment conforms to Beverton-Holt form, log error, steepness<0.98 - recruitment conforms to a generalized Ricker form, log error - first year abundance conforms to equilibrium condition - on curvature of PR/catchability function - von-Bertalanffy growth	- influence of constraints on estimates
Risk Analyses	- analytical confidence distributions - bootstrap confidence distributions - Bayesian posterior distributions - alternative states of nature	- confidence in measures of uncertainty

ToR 3. Implications of zeros in the evaluation of fishery independent indices

When abundance at age estimates in NMFS surveys result in stratified mean values of zero, standard operating procedures are to treat these values as missing. This was the approach reviewed by the ICES WGMG 2007 report (ICES CM 2007/RMC:04). However in a NMFS Office of Science & Technology review in 2006, reviewers recommended an interim approach to handling these zeros as small values instead, pending further study. This problem arises when surveys used for tuning do not capture specific age classes. The presence of zeros is particularly problematic as age-stratified survey mean abundances are log-transformed before being used in VPA. Three working papers showed the results of using alternate approaches instead of changing zeros to missing. The papers explored several scenarios, including: 1) using actual values, or truncating values below a cut-off to zero and 2) treating zeros as missing, or replacing the zeros 3) an arbitrary small value, or 4) 1/6 times the smallest non-zero value. The simulations in working paper 3.1 showed that replacing zero with small values such as in scenario 3 or 4 was inappropriate because it resulted in bias. Prior to these simulations, previous studies (e.g. using g-statistic; Berry 1987) had identified a constant to replace zero based on obtaining normal skewness and kurtosis. However, any small constant is given considerable weight with a log-transform, whereas the Panel agreed that the zeros contain little information on stock size beyond abundance below some threshold. The Panel was in consensus that replacing zeros with arbitrary constants was not supportable because simulation results show that output can be biased when this is done. There was discussion as to how else to handle zeros as this poses a problem for models when abundances are low.

As an alternative to replacing zeros with an ad hoc value, the Panel discussed the potential of using other transformations beyond the log transform as a way to avoid problems with zeros. Several potential transformations of the Box-Cox type were briefly discussed, specifically the square root transform². Such transformations can be used to stabilize the variance but may not always be appropriate; log transforms are from the same class of these transforms and have often been found to be suitable.

An additional approach would be to use other likelihood or quasi-likelihoods such as the Poisson or other distributions to handle zero-inflated models. Other distributions are used in modeling rare or elusive species and the Poisson has been previously used in fisheries. Multinomial (e.g. as implemented in the ASAP software), Conditional and Delta distributions have been used in other contexts and may or may not be appropriate for use when fitting populations trends from survey indices, depending on the situation. Changing to another distribution, such as the Poisson, has implications for q and variance estimation that would require further analysis and simulation. While some distributions, like the Poisson, can be fitted using iterative least squares, others, such as the negative binomial, do not have a simple relationship between the mean and variance and an additional dispersion parameter needs to be fitted as well as the mean.

The aggregation of age groups was seen to be advantageous particularly for older ages in which zero observations are more probable. One suggestion was to aggregate differently for any given year to better handle zero observations in these age groups. This has implications for the

² For example, a least squares general form would be $\sum (\sqrt{O_i} - \sqrt{E_i})^2$ preserving the linear relationship between the observed and expected variables

estimation of catchabilities at age (q) which would only be possible for consistently defined age groups over time.

The pattern of zero values is qualitatively useful in informing the assessment scientist that there may be a decline in the population or that there are issues with migration or some type of refuge, particularly as an adjunct to assessing the validity of using dome-shaped partial recruitment functions in the models. Even when data are omitted from the model fit due to the frequency of zeros, this pattern should be acknowledged and the original data presented.

The current NEFSC software which converts VPA to ASAP2 assumes a log normal likelihood for age composition data rather than a multinomial. The indices can also be entered in ASAP using the multinomial option, which could facilitate inter-model comparisons.

Altogether, the Panel considered that omitting zeros was a reasonable approach and that this was not a major issue for most assessments at this time. However, this issue could require further attention in the case of a declining sequence of biomass from surveys and would probably require identification of an alternative likelihood to the log-normal for survey data. As stated above, before being adopted, simulation should be conducted to explore the behavior of alternative formulations to address the presence of zeros in these data.

ToR 4. Potential factors responsible for retrospective patterns

Retrospective patterns result from structural errors in the stock assessment model. Where the error is consistent through time (e.g. a misspecification of natural mortality), a retrospective pattern will not occur. It will only occur when there has been a change within the time series of observations. There are four potential causes of retrospective patterns in age structured stock assessments:

- An unrecorded change in catches
- A change in natural mortality
- A change in the abundance index catchability (q)
- A change in fishery selectivity

In all cases, either the biomass has changed (changes in natural mortality and unrecorded catch) or is perceived to have changed (changes in catchability or selectivity) in a way that cannot be explained by the catch-at-age data, and therefore is a structural error in the model. Random noise is an unlikely cause, based on simulation analyses although it was hypothesized by a Panelist that mis-specification of the likelihood function could bring about retrospective patterns through influential data points.

One mechanism identified as a possible cause for retrospective patterns is when a survey of sessile species includes an area closed to fishing. When there is effectively no movement of the population between the closed and open areas, the part of the population in the closed area becomes unavailable to fishing and relatively more abundant than the part of the population outside the closed area. This causes an overall apparent change in the survey catchabilities. However, this is unlikely to be an important factor for groundfish.

The Panel notes that it is not possible to identify the cause(s) of the retrospective pattern from model diagnostics alone. Adjusting the model assumptions (e.g. altering survey q , catches or M) to remove the pattern does not guarantee the problem has been dealt with; the model may continue to be mis-specified. It is necessary to develop testable hypotheses concerning the cause,

timing and magnitude of the effect. Additional information and analyses that might assist in discriminating between hypotheses include:

- Repeating the catch-at-age analysis on a “moving window” of time series data over the full time series to identify the timing of the cause;
- Examining the model residuals for a non-stationary pattern;
- Comparing trends in commercial and survey CPUE;
- Comparing the magnitude of survey catchability estimates across species and areas;
- Comparing swept area biomass estimates from surveys with those from the assessment model.

Some solutions to retrospective patterns were considered by the Panel, which in certain circumstances, the following could resolve:

- Truncate the assessment time series to the most recent period to remove the retrospective pattern. Although the underlying problem may continue to exist, it has been dealt with in a consistent enough manner for the time series in question to inform the decision-making. The consequences of doing this on reference point determination will require attention at the next GARM meeting.
- Consider the use of robust likelihood approach, which could address the hypothesized cases where influential data points are causing the retrospective patterns (Fournier et al., 1991).

In considering the recommendations of the NEFSC report of the retrospective working group, the Panel concluded that:

- A retrospective analysis should always accompany a catch-at-age stock assessment to determine whether or not a retrospective pattern is present.
- Hypotheses that might explain the cause(s) for the retrospective pattern should be developed and form the basis for further research; these need to be communicated to decision – makers as major sources of uncertainty.
- Standardized criteria need to be developed to identify a statistically significant retrospective pattern. The statistical test presented at the meeting, based on identifying a pattern that was unlikely to be caused by random error, looked promising. The properties and power of the test should undergo further examination.
- Where there are strong grounds to reject the best single model, the alternative models (hypotheses) which explain the retrospective patterns should be used to evaluate the consequences of management decisions. The uncertainty needs to be communicated to managers and decision-makers, through decision tables and other types of risk analysis.

ToR 5. For each stock, assessment model that will be used to determine stock status and productivity characteristics until the next “benchmark” assessment is conducted. Where possible, apply the models to data (probably through 2006), to obtain current and historical estimates of F and B and estimates of uncertainty

General Considerations

In this section, for each stock, the Panel provides guidance on the class of assessment model that are suitable given the nature and availability of the relevant data. Often, there was no compelling evidence to choose between a VPA and SCAA formulation. The analyses presented at the meeting using comparable VPA and SCAA formulations generally behaved similarly. In situations where the Panel considered that one formulation was more suitable, the preference is stated.

Following this, the most influential model features that need to be resolved for each stock are stated in order of priority. These are generally, but not always, intended to address retrospective patterns observed in current assessment formulations.

A number of issues arose that are relevant to all stocks and are discussed first.

Estimation of Partial Recruitment

The estimation of the partial recruitment pattern on the older age groups was a recurring issue in a number of the stocks. However, while dome-shaped fishery partial recruitments on the older age groups may resolve retrospective patterns, it may also lead to what was termed ‘cryptic’ biomass – biomass generated by the model that has not been observed in either the fishery or surveys.

The Panel considers that the burden of proof should be to convincingly demonstrate that the fish exist in the population when not observed in the fishery and surveys, even if the model fit with dome-shaped partial recruitment is better. Patterson (2002) noted for highly parameterized models, fishing mortality tended towards zero while population numbers tended towards infinity. Other solutions can only be achieved by imposing some constraints on the models e.g. constraining fishing mortality on the oldest age group in each year to a fixed proportion of an average of fishing mortality over younger ages as in ADAPT and Laurec–Shepherd methods. This is another way of saying that additional information (data and / or assumptions) external to the model is required. At the very least, the consequences of adopting a dome-shaped as opposed to a flat topped partial recruitment should be documented for consideration in the management arena. When competing hypotheses of partial recruitment are being considered, all information, including external sources of data, should be examined to inform the merits of each. For example, it may be possible to disaggregate the plus group catch to assist in hypothesis testing. Analyses of tagged fish presented at the meeting offered promise for evaluating hypotheses about partial recruitment. A number of different hypotheses emerged at the meeting that could be formally investigated which the Panel encouraged.

When considering an SCAA formulation, it is often necessary to define blocks of time during which the separable assumption is likely to be met. However, care needs to be taken on how to define the transition between blocks. Abrupt changes in estimated partial recruitment may result from large errors in the observed data. Techniques (e.g. random walks) which constrain how much partial recruitment can vary between adjacent blocks of time should be explored.

The algorithm in the software of the NEFSC used to estimate the population numbers in the plus group gives rise to inconsistencies. It assumes that the fishing mortality on the plus group is some function of the fully-recruited fishing mortality in the same year and, using the Baranov catch equation, estimates plus group abundance from the catch numbers of the plus group. This does not recognize abundance contributions of non-plus group and plus group ages from the year previous. An appropriate algorithm is provided in Anon. (2003). Differences

between the two algorithms depend upon the size of the plus group as well as the assumptions made on the partial recruitment.

While the difference between the two algorithms is small when plus group catch is small, it can be important when plus group catch is large and / or when the partial recruitment is assumed to be domed.

Weighting of Model Components

When fitting models to data, weighting factors are often used to emphasize or de-emphasize components, e.g. less weight given to the index for age 1 relative to others because it is considered 'noisy'. The Panel did not extensively explore how to define weights but offers some observations, based upon discussion at the meeting.

Weighting may be internal or external. In the first case, the weights applied to the fit of each model component are based on the measure of fit of the model to the data and are iteratively updated during the estimation process. In these situations, it may be useful to define a minimum bound on the weighting (e.g. minimum variance) to ensure that no one model component draws an inordinate amount of the weighting.

External weightings may be derived from estimates of the variance in the input datasets (e.g. stratified variance in the survey dataset). In these cases, it is important to ensure that the estimate of the variance is precise enough to be useful. Small sample sizes can lead to imprecise estimates of the variance. It may be possible to generate externally derived weights based on a statistical analysis of trends in variance in the dataset (i.e. produce smoothed estimates of the variance used for weighting). This would have to be justified on a case-by-case basis. Another consideration is when the sampling variance does not fully characterize the total error, which may result in inappropriate weighting of components. This situation could be rectified by introducing an additional variance parameter to be estimated (Germont and Butterworth, 2001; Punt et al., 1997).

Ad hoc external weighting (choice of weights based upon non-statistical arguments) should be avoided. If expert judgment is required to establish external weightings, the rationale should be clearly documented and the impact of the choice should be described. Experimentation with alternative weighting may be a useful tool for exploration of the influence of components.

During the meeting, two different ways to implement external weighting were discussed. The first involved multiplying the component's measure of model fit (least squares or likelihood) by a constant (λ) while the second involved dividing the fit by a constant, typically a measure of the variance of the dataset under consideration. In some cases, both types of weighting were employed. The Panel considered that either approach, but not both simultaneously, is appropriate. Use of both approaches in the same model fitting process has the potential to confuse determination of what the real weighting is. It was noted that many assessment packages (e.g. ASAP, SS2) use the λ constant to turn on ($=1$) or off ($=0$) specific components of the objective function, which is an appropriate use of the term.

Biological Reference Points (BRPs)

The relative merits of estimating biological reference points internally (within the model fitting process) or externally (analyzing the assessment results to produce the BRPs) were discussed. One of the main considerations in determination of BRPs is characterization of the stock - recruitment relationship. Often the variability about this relationship is very high. Accordingly, the weighting of this component in the model fitting is low so that determining its

parameters internally will not greatly influence estimation of current stock size. Its real value is in estimation of BRPs. If the same data are used, internally (assuming non-informative priors) and externally derived BRPs would be expected to be similar.

A potential advantage of estimating BRPs internally, say within an SCAA formulation, is that it allows inclusion of years in which only catch data are available. This allows consideration of years of data early in the history of exploitation of a stock which can provide a perspective of long-term productivity. This potential advantage has to be weighed against the possibility that productivity has not remained stationary over such extensive time periods.

Estimating BRPs externally is a useful way to corroborate the BPRs estimated internally using the same dataset and is encouraged by the Panel. If differences between the two approaches are encountered, these should be investigated and explained.

Stock-by-Stock Assessment Formulations

The ordering of the stocks below conveys the Panel's overall sense of priority to address assessment issues. This is not the priority for undertaking the assessment which may be driven by management need. Rather, it is based on the Panel's understanding of the status of the current assessment formulation and the likelihood of improvements being made to it.

Gulf of Maine Cod

Fishery sampling and aging data are generally good. While the recreational catch contributes larger errors, on balance, the data are sufficient to employ an age – structured model assuming negligible errors in the catch-at-age.

There is only a weak retrospective pattern using the current VPA. However, there is a need to confirm the partial recruitment on ages five plus as this is particularly influential on the estimation of biological reference points and on stock status determination. The analyses presented at the meeting (working papers 2.2 and 2.3) indicated that the model fit to the data favored a domed partial recruitment. Resolution of the differences in the results with alternative partial recruitment patterns call for hypotheses on causative processes as well as external sources of information. Regarding the latter, the shape of the partial recruitment curve for the older ages could be investigated through more detailed examination of the dynamics within the plus group (age 7+) as well as analysis of the available tagging data. The consequences of either hypothesis on management advice should be explored through a risk analysis.

Southern New England, Mid-Atlantic Yellowtail Flounder

Given the good sampling rates and availability of aging information, the data are sufficient for an age-structured model. The Panel felt that negligible error in the catch-at-age could be assumed although this assumption may need to be relaxed for the recent time period.

There is a moderate retrospective pattern in the current VPA formulation that requires examination. Following the approach for the Georges Bank stock, it would be worthwhile splitting the survey time series to explore whether or not similar trends in survey catchability are present in Southern New England. If so, splitting of the survey time series could be a proxy for changes in survey catchability related to habitat use by yellowtail. Yellowtail might be occupying more preferred habitat due to environmental or other influences, causing survey catchability to increase. This hypothesis should be investigated.

The Panel noted the need to investigate long-term changes in stock productivity given the severe decline of the resource. This has implications for the determination of biological reference points. It could not comment on the details of this examination.

Cape Cod-Gulf of Maine yellowtail flounder

The Panel comments made for Southern New England / Mid-Atlantic yellowtail are also applicable to the Cape Cod, Gulf of Maine yellowtail stock.

Witch Flounder

Coefficients of variation on the landings-at-age overall are about 17%, there are no recreational catches and discards are low. The data are sufficient to use an age-structured model assuming negligible error in the catch-at-age. However, comparison with an SCAA model that allows for error in the catch-at-age may be useful in this case, following resolution of the retrospective issue.

While the current VPA formulation has been adequate in capturing the broad-scale dynamics of the stock, it has exhibited a consistent retrospective pattern that warrants exploration. The Panel could not comment on the nature of these explorations other than point out the potential sources of retrospective patterns made elsewhere in this report and the need to bring external sources of data to bear on identifying potential causative processes.

The Panel noted the desire of the NEFSC to use the ASAP software package to undertake these explorations. There are no compelling reasons not to switch from ADAPT to ASAP if this makes analyses easier.

Redfish

The data are sufficient for application of an age-structured model. This is important given the strong evidence for infrequent large pulses of recruitment which persist in the stock over decadal time periods. The Panel could not evaluate if error in the catch-at-age could be assumed negligible. This should be examined to determine if a SCAA approach would be more suitable.

The fishery may target abundant year-classes as they move through the stock. It will be important in the assessment to relax the separable assumption to allow for this possibility and explore if it is occurring.

In relation to biological reference points, internal estimation of the stock - recruitment relationship in a SCAA formulation will need to take account of both the stock's inherent productivity and the presence of episodic large year-classes. In relation to the former, steepness (h) can be inferred from redfish resources elsewhere (e.g. West Coast). In relation to the latter, the analysis should consider setting the assumed error around the stock - recruitment relationship (σ_R) at a low constant value (e.g. 0.2 or less) for years when there is limited age data (i.e. little information on year-class strength) and then to increase it to an appropriate higher constant value (e.g. 0.4 or higher) for periods when age data are more plentiful (Maunder and Deriso, 2003). The Panel considers that the sensitivity of the assessment to these stock - recruitment assumptions should be checked through comparison of the model results without them. In addition, the Panel considered that an externally-derived surplus production model should be investigated to evaluate the robustness of derived biological reference points.

Georges Bank – Gulf of Maine White Hake

The differentiation between red and white hake in the commercial fishery is an issue for this stock, particularly for discards which in some years can represent 50% of the catch, much of this being less than 60cm in length. While there is no commercial aging data since 2000, length frequency sampling is available for this period. Thus the data are sufficient for an age-structured model although negligible error in the catch-at-age cannot be assumed. A model should be used that can take advantage of the age and length frequency data available (e.g. SCALE). There is a potential for sexual dimorphism to confound this attempt at modeling, which should be considered in the model formulation if possible.

The species identification problem in catch samples for lengths less than 60 cm can be examined by consideration of species composition for these fish sizes in the survey dataset, calibrating these with available observer data.

Georges Bank – Gulf of Maine American Plaice

The data appear to be sufficient to undertake an age-structured model. However, the Panel could not evaluate whether or not the error in the catch-at-age could be assumed to be negligible. Since the discards are an important fraction of the catch and appear not to be well-determined, it is appropriate to assume the presence of error in the catch-at-age (e.g. SCAA).

The current VPA formulation exhibits a moderate retrospective pattern, the causes of which require examination.

There is a potential problem of conducting an assessment on the combined Georges Bank and Gulf of Maine stock subcomponents if the relative proportion of abundance of these stocks is not stable over time. The survey trends in the two areas should be examined; if they are similar, then a combined assessment of the two components should not be problematic. However, if the trends are different, there may be a need to partition the catch-at-age between the two stocks and conduct separate assessments on each assuming that there is negligible migration between the two populations.

Plaice growth rates have been observed to be different on Georges Bank and in the Gulf of Maine. This has consequences for the partial recruitment in each area. There is a need to validate the separable assumption of the SCAA when undertaking the assessment.

Georges Bank winter flounder

The Panel noted the improvement in commercial age and length sampling since 2000 although gaps in these data exist in the middle of the time series (1998-99). The data are sufficient to undertake an age - structured model but error in the catch-at-age may not be negligible. Thus, the stock is a candidate for a SCAA formulation.

The Panel could not assess the overall utility of a SCAA formulation without results to examine. The Panel recommended that one model approach be chosen and if there are no problems observed then there is no need to explore an alternative approach.

The Panel noted similar issues with the other two winter flounder stocks (Gulf of Maine and Southern New England) While each has its challenges regarding data availability and other issues, the NEFSC should consider whether or not a common class of models could be applied to all three stocks. This will not only facilitate comparison of stock dynamics but also lead to new insights in each assessment.

Gulf of Maine Winter Flounder

It was noted that year-classes that can be identified in the commercial and survey length compositions do not appear in the respective age composition. This may indicate smearing across year-classes in the age-length keys. As well, commercial sampling intensity has been low. Thus, while the data appear sufficient for an age-structured model, negligible error in the catch-at-age cannot be assumed. In addition, a formulation that takes advantage of the available length frequency information would be appropriate (e.g. SCALE).

The current VPA formulation exhibits a strong retrospective pattern. There was a suggestion that the causes of the retrospective might be related to sexual dimorphism, which could be investigated through a sex-separate model, although the report of the NEFSC Retrospective Working Group (working paper 4.1) indicated that a strong retrospective pattern could not be generated by sexual dimorphism alone. It will also be useful to corroborate model output by comparing fishing effort trends implied by the models with reported fishing effort.

Conflicting patterns between the recruitment and biomass time series were noted. To represent these inconsistencies in the data, a risk evaluation should be undertaken, which compares results between models weighted towards either the adult or the recruitment indices. The consequences of each weighting on harvest advice should be documented.

Southern New England Winter Flounder

The data appear to be sufficient for an age-structured model and information available suggests that negligible error in the catch-at-age can be assumed.

The current VPA formulation exhibits a strong retrospective pattern but seems to be transitory as it is not evident in recent years. Some event may have occurred in the mid 1990s to cause the retrospective pattern that is no longer occurring.

The causes of the historical retrospective patterns should be explored using the current assessment formulation. A possible change in the catch-at-age around 1994 could be checked to see if the retrospective was due to a single event related to this. If the retrospective pattern does not reappear with the additional years of data to the assessment, then there is no need for further exploration. If on the other hand, it does reappear, consideration should be given to splitting the survey time series pre and post 1994. Further, as discussed in the section on terms of reference 4, a robust likelihood approach might address the retrospective pattern if some of the indices have been very influential.

Georges Bank – Gulf of Maine Pollock

While there are issues with determining the age structure of the commercial catch in the Canadian and distant water fleet components in the 1960s and early 1970s, the data may be sufficient for use of an age-structured model post 1977. The Panel could not evaluate if the error in catch-at-age was negligible.

The Panel considered that the Relative Trend class of models is likely informative given the strong relationship between the relative fishing mortality and replacement yield for this resource and thus could be the basis of the 2008 assessment.

The Panel noted that suspected transboundary US / Canada migration will impact the assessment. Joint research on stock structure with the Canadian Department of Fisheries and Oceans has been proposed (TRAC, 2007).

The aging data may be informative about recruitment and could augment the Relative Trend analyses. This information should be evaluated and presented at the April GARM III review.

Georges Bank – Gulf of Maine and Southern New England- Mid-Atlantic Windowpane Flounder

Except for the fall 1999 NMFS survey, there is no commercial aging information for these stocks. Commercial and survey length frequency data are available that allow examination of the dynamics of recruitment and a plus group separately within an age structured model. A high percentage of the catch has been discarded, particularly since 2000 when it has been in excess of reported landings. It may not be appropriate to assume negligible errors in partitioning the recruitment and plus group, in which case SCAA would be more suitable.

While the current Relative Trends approach (AIM) appears to be adequate for the SNE-MAB stock, the Panel recommended exploring the use of SCAA in a Collie-Sissenwine formulation as the assessment model for the GOM / GB stock. There are benefits to using a common assessment framework for both stocks. Therefore, future assessments should consider a common model formulation.

Georges Bank Yellowtail

The data for this stock are sufficient to undertake an age - structured model assuming negligible errors in the catch-at-age.

A previous VPA formulation had exhibited a strong retrospective pattern. The Transboundary Resource Assessment Committee (TRAC, 2005) examined the causes of the retrospective pattern in detail and while not identifying the primary cause, developed an assessment formulation (termed the Major Change Model) that, through splitting the survey time series pre and post 1994 largely removed the pattern and was considered suitable as the basis for management.

There was nothing presented at this GARM III meeting which would lead to improvement of the Major Change Model and thus it should be the basis of the GARM III assessment.

Notwithstanding this, the primary cause of the retrospective pattern remains unresolved. As noted for SNE / MAB yellowtail, splitting of the survey time series could be a proxy for changes in survey catchability related to preferred habitat use by yellowtail, motivated by environmental or other influences. This hypothesis should be investigated for both stocks. If a mechanism for the apparent change in survey catchability in the mid- 1990s can be identified, this should be presented along with the current Georges Bank model.

While the partial recruitment pattern on the ages four-plus could be investigated with the Major Change Model, this issue was not identified as a concern during the TRAC benchmark review (TRAC, 2005). Model fits presented at this meeting that had not adopted the Major Change Model formulation, suggested dome partial recruitments in both the survey and commercial fishery. However, that analysis concluded that the problems indicated by the strong residual patterns, and most likely a strong retrospective pattern, should be resolved before considering the results on the partial recruitment. Further, a domed fishery partial recruitment is at odds with the results of tagging analysis presented at this meeting, which suggested no dome. There was discussion at the meeting on the potential confounding of the tagging results by other processes (e.g. gear avoidance, emigration, tag reporting rate), and although none of these appeared likely, there was insufficient time at the meeting to fully explore the alternatives. Thus,

while a domed partial recruitment on the older age groups appears unlikely, further exploration of external data could be undertaken to corroborate this.

If a SCAA formulation is considered, conducting the analysis using the catch and discards by separate fleet components may improve model fits as the separable assumption is more likely to be met within these.

Finally, overall improvements in the stock assessment of yellowtail may be gained by considering all three stocks (Georges Bank, Cape Cod – Gulf of Maine and Southern New England – Mid Atlantic) as a complex with migration between components. This is not suggested for immediate exploration.

Georges Bank Cod

The data are sufficient for an age-structured model in which it can be assumed that the error in the catch-at-age is negligible.

The current VPA formulation exhibits a weak to moderate retrospective pattern, the presence of which may be due to changes in the fishery partial recruitment since 1994. This may be related to major changes in management structures (e.g. closed areas, mesh size) made at the time. Model formulations that allow investigation of changes in partial recruitment, particularly with regards to the older age classes in the recent time period (post 1995) should be pursued.

Georges Bank Haddock

The data are sufficient for an age-structured model which assumes negligible error in the catch-at-age. It is noted that catch-at-age data for this stock is available as a continuous time series as far back as 1930 (Clark et. al, 1982). These data should be included in the assessment.

The current VPA formulation exhibits only a weak retrospective pattern. However, recent changes in haddock size at age (declining) have implications for the assumption of stationarity of survey catchability at age and for the estimation of BRPs which will have to be addressed in any age structured model. If a SCAA formulation is considered, a number of partial recruitment blocks throughout the assessment's time period will likely be required.

Regarding biological reference points, in addition to the general comments made above, the last time that a stock – recruitment relationship was examined for this stock (NEFSC, 2002), a non-parametric form had to be used due to a lack of convexity in the relationship. This will likely persist, suggesting that the relationship might better be considered externally to the assessment model.

Gulf of Maine Haddock

The data may be sufficient to undertake an age - structured model although it has not yet been processed. The Panel encourages completion of the processing of the relevant data as time is available. If this information is not processed before the next assessment is due, a Relative Trend class of models will have to be employed (e.g. AIM).

The spatial distribution of the catch and the surveys should be examined to determine whether or not the high landings and survey observations in the Great South Channel area are spill over from the Georges Bank stock. This may affect the perception of the productivity of this stock.

Ocean pout

Recent landings are bycatch in other fisheries. While length frequency sampling for discards has been good in recent years, there are no aging data available. Consequently, the data are not sufficient for an age-structured model.

While the current Relative Trends approach (AIM) could be used for the GARM III assessments, alternative models should be explored that both have a stronger basis in biology and more explicitly address uncertainty. These include age-structured models using life history parameters derived from literature and other external sources as well as Bayesian biomass dynamics models. The sufficiency of available age data to construct the growth relationship to support these models requires exploration.

There is only a weak relationship between Relative Fishing Mortality and Replacement Ratio, suggesting that the Relative Trends class of assessment models is not informative for reference points. It is possible that the stock's dynamics have been severely impacted by fishing historically, to the point that it may not be possible to determine the link between exploitation rate and productivity.

Atlantic Halibut

There is a long time series of landings data for this stock that could inform estimation of its productivity. Sampling intensity has been low and while length frequencies have been collected, there are no aging data. The data are not sufficient for an age-structured model.

The Panel suggests attempting a one parameter (for productivity) depletion analysis assuming a plausible landing level before 1893 and fit to available survey abundance trends. Notwithstanding this, 28 percent of halibut tagged in US waters are returned from the Canadian zone suggest that this stock should be assessed in collaboration with Canadian assessment scientists.

ToR 6. Sufficiency of the assessment models to estimate measures of stock status consistent with Biological Reference Points

There are model approach implications for methods to estimate biological reference points. The Panel spent little time evaluating assessment model considerations relative to BRPs directly, although a number of issues related to this were raised throughout the meeting. Some of the key issues identified were:

- Length of time series considered (the problem of shifting baselines)
 - Assessment of stock status generally relates to the most recent time period while the estimation of BRPs requires a longer term perspective of productivity
 - Inclusion of historical catch data has implications for BRPs and long-term changes in stock structure needs to be considered
 - Temporal changes in biological parameters (e.g. recent declines in growth) need to be taken into account
 - For long catch time series (e.g., redfish) deriving an appropriate treatment for historical recruitment pattern consistent with removals is critical
- The estimation of stock - recruitment relationships internally and externally to the assessment models (see also comments on BPRs in section on terms of reference 5)

- VPA and SCAA can estimate population stock-recruitment relationships integrated with survey and catch data and have the potential to estimate BRPs; SCAA can extend this analysis to years in the absence of a complete time series of catch-at-age data
- It is desirable that the approach selected provides reasonably consistent estimates of BPRs (i.e., inter-assessment variability should be low)
- Stock-recruitment assumptions are key for the estimation of biological reference points but less critical to the determination of current stock status. Also, the flexibility provided by both parametric and non-parametric estimation approaches should be considered
- Where possible, the Panel encourages estimating BRPs both internally and externally, comparing the results and explaining differences
- The potential for ambiguity when BRPs are estimated using expert judgment (e.g. biomass reference points for stocks assessed using AIM). The Panel recommends the development of a consistent and defensible basis for estimating BRPs using the Relative Trends class of assessment model. This includes a transparent basis for estimating scale
- The extent that a stock can be considered adequately managed as a “unit” (i.e., the area is at the margins of the natural range for a stock - e.g., Atlantic halibut)
- Overall multispecies production (to be more fully addressed at the BRP GARM).
 - Technical interactions (bycatch of co-occurring species) methods need to be pursued for practical management applications

The above points need to be kept in mind when applying assessment methods for estimating BRPs.

The Panel suggested an approach for age-structured models to evaluate the impact of fishing on a stock under minimal assumptions about the underlying productivity (e.g., stock-recruitment relationships). Specifically, the historical time series of recruitment estimates from a particular assessment could be used to compute the subsequent spawning biomass levels as if no fishing had occurred. If a stock-recruitment relationship is estimated, the original recruitment estimates can be adjusted by the ratio of the expected recruitment given spawning biomass (with and without fishing) and the estimated stock-recruitment curve i.e. the recruitment under no fishing modified as:

$$R'_t = \hat{R}_t \frac{f(S'_t)}{f(\hat{S}_t)}$$

where $\hat{R}_t$ is the original recruitment estimate in year t with $f(S'_t)$ and $f(\hat{S}_t)$ representing the stock-recruitment function given spawning biomass under no fishing and under the fishing scenario, respectively. This approach would be particularly useful where the stock-recruitment relationship is of the Ricker type, where recruitment begins to decline at higher stock biomass.

For example, application to Gulf of Maine cod using reference case estimates of recruitment, maturity and mean weights-at-age from the meeting working papers, are projected forward from age one but *without* F . Without any stock-recruitment effect, a current level of

“depletion” is about 26% (figure 1). Adding an adjustment due to a stock-recruitment relationship is likely to change this pattern to some degree, particularly if a Ricker stock – recruit model is used, as noted above. This technique can be used to test both the impact of fishing and the assumptions about the stock - recruitment relationship.

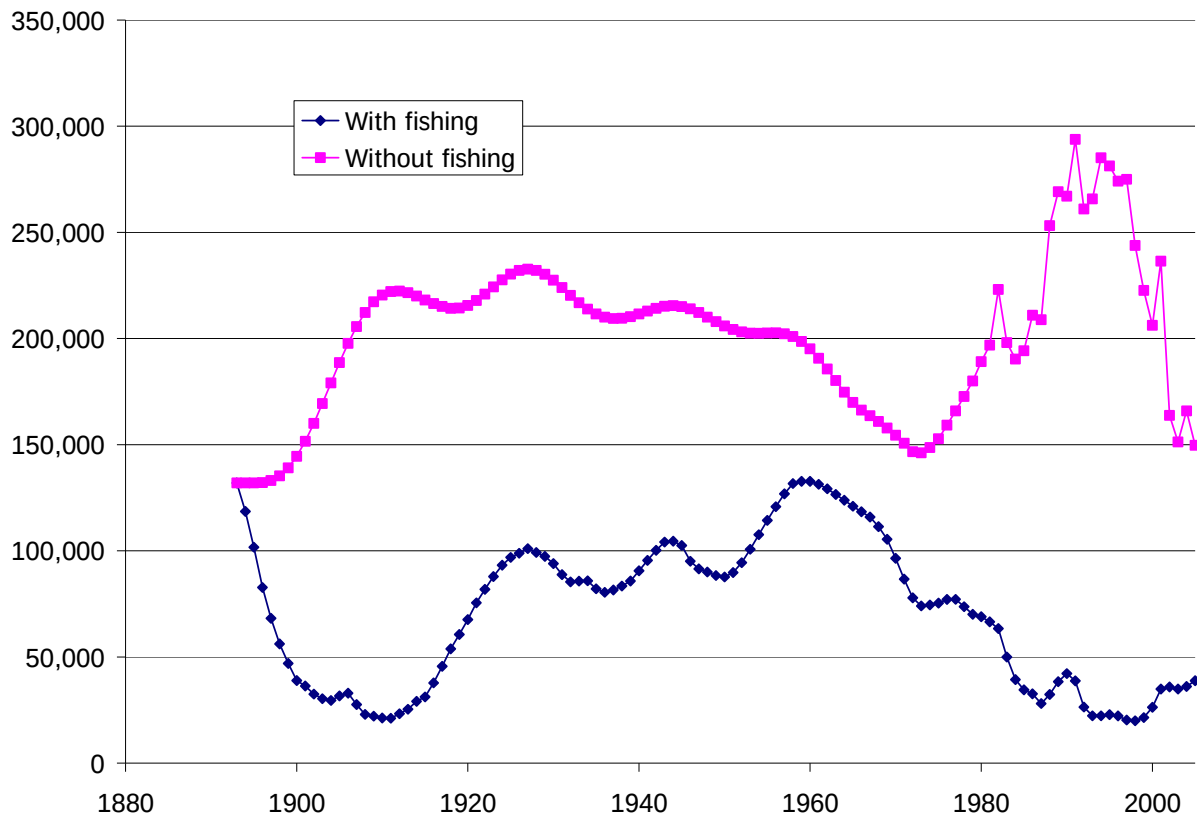


Figure 1. Historical spawning stock biomass for Gulf of Maine cod based on the reference model (with fishing) compared to estimates assuming natural mortality of 0.2 only (without fishing)

CONCLUDING REMARKS

The meeting required an extensive suite of working papers prepared by scientists at the NEFSC and substantial and in-depth discussions at the meeting itself. This was a very significant workload by the Center, which the Panel acknowledges being of very high quality. The Panel would also like to acknowledge the valuable contributions at the meeting made by all participants, particularly those of Doug Butterworth and Rebecca Rademeyer, who attended on behalf of the fishing industry. Finally, the Panel would like to thank Andrea Strout of the NEFSC who assisted the chair in preparing this report. All these contributions made it possible for the GARM III ‘models’ review to meet its terms of reference.

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APPENDICES

Appendix 1. Terms of Reference for the GARM-III Models Meeting

1. For each stock, consider the applicability of one or more of the following modeling approaches to assess stock status:
 - Index methods
 - Production Models
 - Age- or Length-based Models
2. For certain stocks that are aged, compare and contrast the utility of statistical catch-at-age vs. VPA based models with respect to the following criteria:
 - Retrospective patterns
 - Flexibility to account for alternative parameterizations
 - Ability to incorporate external sources of information, especially tagging and environmental data
 - Ability to estimate parameters incorporating prior, external information.
3. Address the implications of zeros in the evaluation of fishery independent indices.
4. Examine potential factors responsible for retrospective patterns.
5. For each stock, define the assessment model that will be used to determine stock status and productivity characteristics until the next “benchmark” assessment is conducted. Where possible, apply the models to data (probably through 2006), to obtain current and historical estimates of F and B and estimates of uncertainty.
6. Evaluate the sufficiency of the assessment models to estimate measures of stock status consistent with Biological Reference Points.

Appendix 2. Draft Terms of Reference for the GARM-III “Biological Reference Point (BRP)” Meeting (28 April – 2 May 2008)

1. For relevant stocks, determine the influence of retrospective patterns in parameter estimates (e.g., fishing mortality, biomass, and/or recruitment) from assessment models on the computation of BRPs and on specification of initial conditions for forecasting
2. Trends in Stock Productivity:
 - a.) For relevant stocks, identify trends in biological parameters (i.e., life history and/or recruitment) and assess their importance for the computation of BRPs and for specification of rebuilding scenarios
 - b.) If possible, summarize trends in pertinent environmental variables that might be related to the trends in those biological parameters relevant to BRPs
3. Ecosystem approaches to Gulf of Maine/Georges Bank fisheries:
 - a.) Determine the production potential of the fishery based on food chain processes and estimate the aggregate yield from the ecosystem
 - b.) Comment on aggregate single stock yield projections in relation to overall ecosystem production, identifying potential inconsistencies between the two approaches
4. Biological Reference Points (B_{target} , $B_{\text{threshold}}$, F_{target} , $F_{\text{threshold}}$):
 - a.) For each stock, list what the current BRPs and/or BRP Proxies are (e.g., B_{MSY} , B_{MAX} , F_{MSY} , $F_{40\% \text{MSP}}$, historical survey catch per tow, etc.), and give their values (i.e., typically from GARM II)
 - b.) For each stock, update or redefine BRPs or BRP proxies that will be used for stock status determination, and compute their expected values and precision. Note: These BRPs and their proxies must be comparable and consistent with outputs from the recommended assessment models from the GARM III “Modeling” Meeting
5. For each stock, identify appropriate models for forecasting and for evaluating rebuilding scenarios.

**Appendix 3. Draft Meeting Agenda of GARM III Models Meeting. Feb. 25-29, 2008,
Stephen Clark Conference Room, NEFSC, Woods Hole, MA**

Monday February 25

0900-0910 Welcome (Deputy Director)

0905-0910 Introductions

0910-0940 Overview of GARM and objectives of this meeting (Chair)

TOR #1: Applicability of Models to Assess Stock Status

0940 -1020 Overview of GARM species, data availability, assessments

Working Paper 1.1, 1.3 - (Rago)

1020-1040 Discussion

1040-1055 Break

1055-1125 Review of modeling approaches and rationale

Working Paper 1.2 - (Rago)

1125-1200 Discussion

1200-1300 Lunch

TOR #4 Examine potential factors responsible for retrospective patterns.

1300-1430 Report of Working Group on Retrospective Patterns in VPA

Working Paper 4.1 - (Legault)

1430-1515 Discussion

1515-1530 Break

TOR #3 Model implications of zeros in fishery independent indices.

1530-1600 *Working Paper 3.1 - (Legault)*

1600-1620 *Working Paper 3.2 - (Terceiro)*

1620-1640 *Working Paper 3.3 - Report of ICES methods working group (Legault)*

1640-1730 Discussion

1730-1800 Summary /Followup (Chair)

1800 Adjourn

Tuesday February 26

0900-0920 Progress review and Order of the Day (Chair)

TOR #2 Compare utility of statistical catch-at-age models

0920-0940 Overview of SCAA approaches—(Jacobson)

0940-1010 *Working Paper 2.1a – Georges Bank Yellowtail (Jacobson)*

1010-1030 Discussion

1030-1045 Break

1045-1115 *Working Paper 2.1b - White Hake (Sosebee)*

1115-1130 Discussion

1130-1200 *Working Paper 2.1c - Georges Bank Cod (O'Brien)*

1200-1230 Discussion

1230-1330 Lunch

1330-1445 *Working Papers 2.2, 2.5 - ASPM model - Georges Bank Yellowtail and Gulf of
Maine Cod – (Butterworth)*

1445-1530 Discussion

1530-1545 Break

1545-1600 *Supplementary paper and discussion on domed selectivity TOR 2. (Hart/Miller)*

1600-1630 *Working Paper 2.3* - Gulf of Maine Cod –ASAP model (Shepherd)
1630-1745 Discussion—GOM cod
1745-1800 Summary/Followup (Chair)
1800 Adjourn

Wednesday February 27

0900-0930 Progress review and Order of the Day (Chair)
 TOR #2 Compare utility of statistical catch-at-age models (cont.)
0930-1000 *Working Paper 2.4* - Comparative Simulation Tests—Overview (Legault/Brooks)
1000-1045 *Working Paper 2.4a* – Retrospective Pattern: GB Yellowtail (Legault)
1045-1100 Break
1100-1130 Discussion—GB Yellowtail
1130-1200 *Working Paper 2.4b* – Ageing Error: White Hake (Legault/Brooks)
1200-1230 Discussion—White Hake
1230-1330 Lunch
1330-1430 *Working Paper 2.4c* - Domed Selectivity: Georges Bank Cod (Legault/Brooks)
1430-1530 Discussion—GB cod
1530-1545 Break
1545-1730 General Review—SCAA/Simulation test
1730-1800 Summary/Followup (Chair)
1800 Adjourn

Thursday February 28

0900-0920 Progress review and Order of the Day (Chair)
 TOR #5 Recommendations on Model Selection for each stock
 TOR #6 Linkage to Biological Reference Points
0920-1000 *Working Papers 5.1, 6.1* - Model Recommendations/ Selection Criteria (Rago and Population Dynamics Branch)
1000-1045 Reviews by Species
1045-1100 Break
1100-1230 Reviews by Species (cont)
1230-1330 Lunch
1330-1430 Reviews by Species (cont)
1430-1530 Ecosystem Models for Reference Points—Progress Update (Fogarty/Link/Overholtz)
1530-1730 Revisit Topics as Needed
1730-1800 Synthesis and Report Planning (Chair)
1800 Adjourn

Friday February 29

0900-0930 Progress review and Order of the Day (Chair)
0915-1030 Follow-up Sessions if Necessary
1030-1045 Break
1045-1230 Report development
1230-1330 Lunch
1330-1600 Summary and Assignments
1600 Adjourn

Appendix 4. List of Working Papers for the GARM-III Assessment Methodology "Models" Meeting (25-29 Feb. 2008)

- 1.1** Rago, et al. 2008. Data Summary for Nineteen Groundfish Stocks in the Northeast U.S.
- 1.2** Rago, et al. 2008. Overview of Assessment Methods and Model Selection Criteria for Nineteen Groundfish Stocks in the Northeast U.S.
- M.1** Mayo R, Col L, Traver M. 2008. Data Summary of Catch and Abundance Measures. (for Working Papers 1.1 & 1.2)
- 1.3** Hendrickson L, Col L. 2008. Maps Showing NEFOP Sampling Coverage and Management Areas
- 2.1** Jacobson L, Legault C, O'Brien L, Sosebee K. 2008. Utility of Statistical Catch-at-age Models for Assessing Northeast Groundfish Stocks (a workshop report)
- 2.2a** Butterworth DS, Rademeyer RA. 2008. Statistical Catch-at-age Analysis vs ADAPT-VPA: The Case of Gulf of Maine Cod
- 2.2b** Rademeyer RA, Butterworth DS. 2008. Retrospective Analysis for the Gulf of Maine Cod ASPM Reference Case Assessment
- 2.3** Shepherd G. 2008. Comparison of ADAPT VPA and ASAP Models for Gulf of Maine Cod
- 2.4** Brooks L, Legault C, Nitschke P, O'Brien L, Sosebee K, Rago P, Seaver A. 2008. Evaluation of NMFS Toolbox Assessment Models on Simulated Groundfish Data Sets
- 2.5** Butterworth DS, Rademeyer RA. 2008. Application of and Age-Structured Production Model to the Georges Bank yellowtail flounder
- 3.1** Legault C, Seaver A. 2008. Simulation Studies of Issues Associated with Filling Zeros in VPA Tuning Indices
- 3.2** Terceiro M. 2008. The Treatment of "Zero" Observations in the Summer Flounder ADAPT VPA Calibration
- 3.3** ICES Resource Management Committee. 2007. Report of the Working Group on Methods of Fish Stock Assessment (WGMG)
- 4.1** Legault C, et al. 2008. Report of the Retrospective Working Group
- 5.1** Rago P, et al. 2008. Recommended Modeling Approaches by Stock Initial Proposals for Consideration by the GARM III Review Panel
- 6.1** Rago P, et al. 2008. Sufficiency of Models for Biological Reference Points

Supplementary Papers

- TOR 1** Gulf of Maine Winter Flounder SCALE Run 2
- TOR 2** Miller T, Hart D, Cadrin S, Jacobson L, Legault C, Rago P. 2008. Analyses of Tagging Data for Evidence of Decreased Fishing Mortality for Large Yellowtail Flounder
- TOR 2** Butterworth DS, Rademeyer RA. 2008. On Drawing Inferences Concerning Trends in Selectivity with Age from Tag-Recapture Information
- TOR 2** Jacobson L. 2008. Questions about the Adjusted Lognormal Error Distribution used in Calculating Goodness of Fit for Survey and Commercial Age Composition Data in Preliminary ASPM Models.
- TOR 2** Jacobson L. 2008. Pope vs Baranov

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Appendix 6. Statement of Work of Center for Independent Experts at GARM-III “Models” Meeting

General

The Groundfish Assessment Review Meeting (GARM) brings together stock assessment experts to peer review work on the status of 19 important fish stocks that are managed by the New England Fishery Management Council. GARM-III takes place in 2007-2008, and it will consist of four meetings that are cumulative in nature (i.e., successive meetings incorporate methods and results that were accepted at previous GARM-III meetings). Each meeting will have a chairman as well as external panelists. A brief description and dates of the four GARM-III meetings are given below:

1. “Data” Meeting (October 29 – November 2, 2007)

Review the commercial and survey data that will be used in the stock assessments. Identify appropriate statistical methods for analyzing those data (including bycatch and discard issues, changes in growth rates and other life history traits, issues related to merging databases, etc.). Other sources of data to be considered are tagging programs for cod and yellowtail flounder, and Industry-Based Surveys. Candidate sources of data relevant to ecological and ecosystem considerations will also be described.

2. “Modeling” Meeting (Feb. 25 – 29, 2008)

Determine the most appropriate stock assessment methods and models for each of the 19 stocks. Perform runs of those models to obtain results (historical and current estimates of F and B) based on commercial and survey data, probably through calendar year (CY) 2006. Evaluate retrospective patterns and their importance for status determination.

3. “Biological Reference Point (BRP)” Meeting (April 28 – May 2, 2008)

Update or redefine BRPs for each of the 19 stocks. Use data available through CY2006. Consider whether the BRPs are reasonable in light of results from the “Modeling” Meeting. Define the appropriate initial conditions for forecasting and rebuilding strategies, particularly with respect to trends in biological attributes, recruitment and survival rates. Comment on relevant ecosystem considerations as they relate to rebuilding strategies.

4. GARM-III “Final” Meeting (August 4-8, 2008)

Use all of the methods proposed from the previous three meetings, along with survey and catch information through CY2007, to estimate fishing mortality rates and biomass for each stock. Based on procedures from the BRP Meeting, finalize the BRPs, appropriate initial conditions, and biological assumptions related to forecasts. Determine the status of each stock.

This SOW applies specifically to the GARM-III “Modeling” Meeting, which will take place at the Woods Hole Laboratory of the Northeast Fisheries Science Center (NEFSC) in Woods Hole, Massachusetts, from February 25 -29, 2008. The meeting will have a chairman (non-CIE)

as well as external panelists, three of whom will be from the Center of Independent Experts (CIE).

Overview of CIE Peer Review Process

The Office of Science and Technology implements measures to strengthen the National Marine Fisheries Service's (NMFS) Science Quality Assurance Program (SQAP) to ensure the best available high quality science for fisheries management. For this reason, the NMFS Office of Science and Technology coordinates and manages a contract for obtaining external expertise through the Center for Independent Experts (CIE) to conduct independent peer reviews of stock assessments and various scientific research projects. The primary objective of the CIE peer review is to provide an impartial review, evaluation, and recommendations in accordance to the Statement of Work (SoW), including the Terms of Reference (ToR) herein, to ensure the best available science is utilized for the National Marine Fisheries Service management decisions.

The NMFS Office of Science and Technology serves as the liaison with the NMFS Project Contact to establish the SoW which includes the expertise requirements, ToR, statement of tasks for the CIE reviewers, and description of deliverable milestones with dates. The CIE, comprised of a Coordination Team and Steering Committee, reviews the SoW to ensure it meets the CIE standards and selects the most qualified CIE reviewers according to the expertise requirements in the SoW. The CIE selection process also requires that CIE reviewers can conduct an impartial and unbiased peer review without the influence from government managers, the fishing industry, or any other interest group resulting in conflict of interest concerns. Each CIE reviewer is required by the CIE selection process to complete a Lack of Conflict of Interest Statement ensuring no advocacy or funding concerns exist that may adversely affect the perception of impartiality of the CIE peer review. The CIE reviewers conduct the peer review, often participating as a member in a panel review or as a desk review, in accordance with the ToR producing a CIE independent peer review report as a deliverable. The Office of Science and Technology serves as the COTR for the CIE contract with the responsibilities to review and approve the deliverables for compliance with the SoW and ToR. When the deliverables are approved by the COTR, the Office of Science and Technology has the responsibility for the distribution of the CIE reports to the Project Contact. Further details on the CIE Peer Review Process are provided at <http://www.rsmas.miami.edu/groups/cie/>

Requirements for CIE Reviewers

Three CIE reviewers are requested to conduct an impartial and independent peer review in accordance with the Terms of Reference (ToR) herein. Each CIE reviewer's duties shall not exceed a maximum of 14 days conducting pre-review preparations with document review, participation on the SARC panel review meeting, editorial assistance for the SARC Chair, and completion of the CIE independent peer review report in accordance with the ToR and Schedule of Milestones and Deliverables. CIE reviewers shall have working knowledge and recent experience in the application of modern fishery stock assessment models. Expertise should include both the use of statistical catch-at-age and traditional VPA approaches. Experience with comparative studies of these approaches is especially valuable. Reviewers should also have experience in evaluating measures of model fit, identifiability, uncertainty, and forecasting. Some experience with groundfish (such as cod, haddock, flounder) population dynamics would be useful.

Specific Activities and Responsibilities

The CIE's deliverables shall be provided according to the schedule of milestones listed on page 5. The GARM Chairman will use contributions from the CIE panelists as well as from other external panelists, to produce the GARM Panel Summary Report. In addition, each CIE panelist will write an individual independent report. These reports will provide peer-review information for a presentation to be made by NOAA Fisheries at meetings of the New England and Mid-Atlantic Fishery Management Councils in 2008. The GARM Panel Summary Report shall be an accurate and fair representation of the GARM panel viewpoint on the quality and soundness of the science, methods and data with regard to each Term of Reference (see Annex 1). The report shall also contain recommendations for improvement that might be implemented in a future GARM meeting.

Charge to GARM panel

The panel is to determine and write down its viewpoint on the quality and soundness of the science, methods and data with regard to each Term of Reference (see Annex 1). Criteria to consider include whether: (1) the data are adequate and were used properly; (2) the analyses and models were appropriate and correctly accomplished; and (3) the conclusions are correct/reasonable. Where possible, the chair shall identify or facilitate agreement among the panelists regarding each Term of Reference.

During the course of the review, the panel is allowed limited flexibility to deviate from the results and recommendations of earlier GARM-III meetings. This flexibility may include minor alterations in procedures previously established at the peer review of the Data Methods Meeting in October 2007. Large scale changes, such as changing a stock definition would not be possible in view of the difficulties of implementing these changes in time available before the final GARM meeting in August 2008.

Furthermore, if the panel rejects certain assessment models, the panel should explain why those particular models are not suitable, and the panel should recommend suitable alternatives. If such alternatives cannot be identified, then the panel should indicate that the existing (status quo) models are the best available at this time.

Roles and responsibilities

Prior to the meeting (GARM chair and CIE panelists)

Review the reports produced by the Working Groups, and read background reports.

During the Open meeting (GARM chair)

Act as chairperson, where duties include control of the meeting, coordination, control, and facilitation of the presentations and discussions, and ensuring that all Terms of Reference of the GARM are reviewed and completely addressed.

During the question and answer periods, provide appropriate feedback to the assessment scientists on the sufficiency of the analyses and when possible, suggest improved approaches. It is permissible to discuss the working papers, and to request additional information to clarify or revise existing analyses, if that information can be produced rather quickly.

(CIE panelists)

For each model approach, participate in panel discussions on the quality and soundness of the science, methods and data with regard to each Term of Reference (see Annex 1).

During the question and answer periods, provide appropriate feedback to the assessment scientists on the sufficiency of the analyses. It is permissible to request additional information if it is needed to clarify or revise existing analyses, if that information can be produced rather quickly.

After the Open meeting (GARM CIE panelists)

Each panelist shall prepare an Independent CIE Report (see Annex 2). This report should comment on the quality and soundness of the science, methods, and data with regard to each Term of Reference.

If any modeling approaches are considered inappropriate, the Independent CIE Report should include recommendations and justification for suitable alternatives. If such alternatives cannot be identified, then the report should indicate that the existing modeling approaches are the best available at this time.

During the meeting, additional questions that are not in the Terms of Reference but which are directly related to the assessments may be raised. Comments on these questions should be included in a separate section at the end of the Independent CIE Report prepared by each panelist.

If a panelist feels that his/her comments are adequately expressed in the GARM Panel Summary Report, it will not be necessary to repeat the same comments in the Independent CIE Report. In this case, the Independent CIE Report can be used to provide greater detail on specific Terms of Reference or additional questions raised during the meeting.

(GARM chair)

The GARM chair shall prepare a document summarizing the background of the work to be conducted as part of the review process, and summarizing whether the process was adequate to successfully address the Terms of Reference. If appropriate, the chair will include suggestions on how to improve the process. This document will constitute the introduction to the GARM Panel Summary Report.

(GARM chair, CIE and non-CIE panelists)

The GARM Chair will take the lead in preparing, editing, and completing the GARM Panel Summary Report, based on contributions from the external panelists (CIE and non-CIE). The panelists and the chair will discuss their views on each Term of Reference and whether their opinions can be summarized into a single conclusion for all—or only for some—of the Terms of Reference. For TORs where a consensus view can be reached, the GARM Panel Summary Report will contain a summary of such views. In cases where multiple and/or differing views exist on a given Term of Reference, the GARM Panel Summary Report will note that there was no agreement and will specify—in a summary manner—what the various opinions are and the reason(s) for the different opinions.

The chair's objective during this Summary Report development process will be to identify or facilitate the finding of an agreement, rather than forcing the panel to reach an agreement if this is not possible.

The GARM Panel Summary Report (please see Annex 3 for information on contents) should comment on the quality and soundness of the science, methods, and data with regard to each Term of Reference.

If any modeling approaches are considered inappropriate, the GARM Panel Summary Report should include recommendations and justification for suitable alternatives. If such alternatives cannot be identified, then the report should indicate that the existing modeling approaches are the best available at this time.

The contents of the draft GARM Panel Summary Report will be approved by the CIE panelists by the end of the Summary Report development process. The GARM chair will finalize all editorial and formatting changes prior to approval of the contents of the draft GARM Panel Summary Report by the CIE panelists. The GARM chair will then submit the approved GARM Panel Summary Report to the NEFSC contact (i.e., SAW Chairman).

Schedule of Milestones and Deliverables

The milestones and schedule are summarized in the table below. No later than March 14, 2008, the CIE panelists should submit their Independent CIE Reports to the CIE for review³. The Independent Reports shall be addressed to “University of Miami Independent System for Peer Review,” and sent to Dr. David Sampson, via e-mail to David.Sampson@oregonstate.edu and to Mr. Manoj Shrivani via e-mail to mshivlani@rsmas.miami.edu

Milestone	Date
Open workshop at Northeast Fisheries Science Center (NEFSC) (begin writing reports, as soon as open Workshop ends)	Feb. 25 – 29, 2008
GARM Chair and CIE panelists work at the NEFSC drafting reports	Feb. 28 – 29
Draft of GARM Panel Summary Report, reviewed by all CIE panelists, due to the GARM Chair **	March 14
CIE panelists submit Independent CIE Reports to CIE for approval	March 14
GARM Chair sends Final GARM Panel Summary Report, approved by CIE panelists, to NEFSC contact (i.e., SAW Chairman)	March 21
CIE provides reviewed Independent CIE Reports to NMFS COTR for approval	March 28
COTR notifies CIE of approval of reviewed Independent CIE Reports	April 4 *
COTR provides final Independent CIE Reports to NEFSC contact	April 4

* Assuming no revisions are required of the reports.

** The GARM Panel Summary Report will not be submitted, reviewed, or approved by the CIE.

The SAW Chairman will assist the GARM chair prior to, during, and after the meeting in ensuring that documents are distributed in a timely fashion. NEFSC staff and the SAW Chairman will make the final GARM Panel Summary Report and Independent CIE Reports available to the public. Staff and the SAW Chairman will also be responsible for production and publication of the collective Working Group papers.

³ All reports will undergo an internal CIE review before they are considered final.

Acceptance of Deliverables

By 28 March 2008, CIE shall complete and submit the independent CIE peer review reports in accordance with the ToR, which shall be formatted as specified in Annex 2. Upon review and acceptance of the CIE reports by the CIE Coordination and Steering Committees, CIE shall send via e-mail the CIE reports to the COTRs (William Michaels William.Michaels@noaa.gov and Stephen K. Brown Stephen.K.Brown@noaa.gov) at the NMFS Office of Science and Technology by the date in the Schedule of Milestones and Deliverables. The COTRs will review the CIE reports to ensure compliance with the SoW and ToR herein, and have the responsibility of approval and acceptance of the deliverables. Upon notification of acceptance, CIE shall send via e-mail the final CIE report in *.PDF format to the COTRs. The COTRs at the Office of Science and Technology have the responsibility for the distribution of the final CIE reports to the Project Contacts.

Key Personnel

Contracting Officer's Technical Representative (COTR):

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Request for Changes

Requests for changes shall be submitted to the Contracting Officer at least 15 working days prior to making any permanent substitutions. The Contracting Officer will notify the Contractor within 10 working days after receipt of all required information of the decision on

substitutions. The contract will be modified to reflect any approved changes. The Terms of Reference (ToR) and list of pre-review documents herein may be updated without contract modification as long as the role and ability of the CIE reviewers to complete the SoW deliverable in accordance with the ToR are not adversely impacted.

ANNEX 1: Draft Terms of Reference for the GARM-III “Models” Meeting

(Last Revised: Oct. 31, 2007; A final draft will be distributed to the Panel prior to the meeting.)

1. For each stock, consider the applicability of one or more of the following modeling approaches to assess stock status:
 - Index methods
 - Production Models
 - Age- or Length-based Models
2. For certain stocks that are aged, compare and contrast the utility of statistical catch-at-age vs. VPA based models with respect to the following criteria:
 - Retrospective patterns
 - Flexibility to account for alternative parameterizations
 - Ability to incorporate external sources of information, especially tagging and environmental data
 - Ability to estimate parameters incorporating prior, external information.
3. Address the implications of zeros in the evaluation of fishery independent indices.
4. Examine potential factors responsible for retrospective patterns.
5. For each stock, define the assessment model that will be used to determine stock status and productivity characteristics until the next “benchmark” assessment is conducted. Where possible, apply the models to data (probably through 2006), to obtain current and historical estimates of F and B and estimates of uncertainty.
6. Evaluate the sufficiency of the assessment models to estimate measures of stock status consistent with Biological Reference Points.

ANNEX 2: Contents of GARM-III Independent CIE Reports

1. The Independent CIE Report should comment on the quality and soundness of the science, methods and data with regard to each Term of Reference. CIE panelists should consider whether the work provides a scientifically credible basis for developing fishery management advice. Scientific criteria to consider include: whether the data were adequate and used properly, the analyses and models were carried out correctly, and the conclusions are correct/reasonable.

If a panelist feels that his/her comments are adequately expressed in the GARM Panel Summary Report, it will not be necessary to repeat the same comments in the Independent CIE Report. In that case, the Independent CIE Report can be used to provide greater detail on specific Terms of Reference or additional questions raised during the meeting.

2. If any modeling approaches are considered inappropriate, the Independent CIE Report should include recommendations and justification for suitable alternatives. If such alternatives

cannot be identified, then the report should indicate that the existing modeling approaches are the best available at this time.

3. Any independent analyses conducted by the CIE panelists as part of their responsibilities under this agreement should be incorporated into their Independent CIE Reports. It would also be helpful if the details of those analyses (e.g., computer programs, spreadsheets etc.) were made available to the respective assessment scientists.

4. Additional questions that were not in the Terms of Reference but that are directly related to the assessments. This section should only be included if additional questions were raised during the GARM meeting.

ANNEX 3: Contents of GARM-III Panel Summary Report

1. The first section the report shall consist of an introduction prepared by the GARM chair that will include the background, a review of activities and comments on the appropriateness of the process in reaching the goals of the GARM. The next section will contain comments on the quality and soundness of the science, methods and data with regard to each Term of Reference. The GARM Panel should consider whether the work provides a scientifically credible basis for developing fishery management advice. Scientific criteria to consider include: whether the data were adequate and used properly, the analyses and models were carried out correctly, and the conclusions are correct/reasonable.

If the CIE panelists, the non-CIE panelists and GARM chair do not reach an agreement on a Term of Reference, the report should explain why. It is permissible to express majority as well as minority opinions.

2. If any modeling approaches are considered inappropriate, the GARM Panel Summary Report should include recommendations and justification for suitable alternatives. If such alternatives cannot be identified, then the report should indicate that the existing modeling approaches are the best available at this time.

3. The report shall also include the bibliography of all materials provided during the meeting and any papers cited in the GARM Panel Summary Report, along with a copy of the CIE Statement of Work.

The report shall also include as a separate appendix the Terms of Reference used for the GARM Models Meeting, including any changes to the Terms of Reference or specific topics/issues directly related to the assessments and requiring Panel advice.

Appendix 7. Presentation Highlights and Discussion

This appendix includes the presentation highlights provided by the senior author of each working paper along the rapporteur's notes of the ensuing discussion. In regard to the latter, the emphasis was to capture the main points made. Some rapporteurs used prose while others bullet style. There was only modest editing of these during preparation of this report. Notwithstanding this, the text give a sense of the main topics discussed, areas of agreement, and areas of future work. While these were referred to by the Panel, statements in this Appendix should not be considered the final conclusions of the Panel, which are stated in the body of this report.

Applicability of Models to Assess Stock Status

Rapporteur: Toni Chute

Working Paper 1.1: Rago P, et al. 2008. Data Summary for Nineteen Groundfish Stocks in the Northeast US

Presentation Highlights

The feasibility of any assessment model approach ultimately relies on the quality of underlying data. To that end this report incorporates the full set of data estimation improvements described and endorsed by the review Panel for the GARM Data Methods Meeting (October 29-November 2, 2007). The major revisions include:

- Improved methods for allocating landings to statistical area
- Revised approaches for estimation of total discards
- Improvements to software for estimation of landings at age

This document is a summary of the progress that has been made to date on the preparation of data for the Groundfish Assessment Review Meeting (GARM). The objective of this report is to provide the necessary background on the availability of data for each species, and to inform discussions on model selection. Each chapter includes a set of core tables that illustrate the available commercial landings and discards, recreational landings and discards, and survey indices. For species that are aged, additional information on biological samples and age composition is also provided. Not all of the age samples for 2007 have been processed.

Discard estimates and CVs are based on the SBRM methodology (based on a discard/kept of all species) described at the GARM Data Methods meeting in October 2007. In some instances, individual analysts varied the approach to more accurately account for known interventions that created large regulatory discards. For some species, discards were estimated using hindcast methods. A generalized database has been developed to facilitate the evaluation of alternative estimators. One of the important new aspects of this report is that measures of uncertainty in the discard totals are now estimated.

Recreational catch and landings have been revised by MRFSS and are summarized for 1981 to 2006. Compared to the more popular recreational species (e.g., striped bass) relatively few length frequency samples for groundfish are taken.

Standardized mean abundance and biomass (kg) indices are available for NEFSC spring (1968-2007), NEFSC autumn (1963-2007) and DFO spring (1986-2007) were summarized. The Massachusetts DMF spring and fall bottom trawl surveys (1982-2007) were also included for stocks that frequent inshore waters. Numbers at age were also estimated for appropriate stocks.

The data summaries are preliminary. In particular, discard estimates may be revised as the individual analysts review the underlying data in more detail. Some of the chapters include more complete, but preliminary, investigations of model performance. Such chapters do not constitute assessments but will be used as a starting point for more comprehensive analyses.

Working Paper 1.3. Hendrickson L and L. Col. 2008. Maps Showing NEFOP Sampling Coverage and Management Areas

Presentation Highlights

Groundfish discards are estimated for the 2008 GARM from trips sampled by fisheries observers from the Northeast Fisheries Observer Program (NEFOP). The spatial distribution of the observed tows from these trips is shown on a series of GIS maps, by gear type during 1986-2006, in relation to statistical reporting areas and the three groundfish closure areas (CAI, CA II, and the Nantucket Lightship CA).

Discussion on Working Papers 1.1 and 1.3

- The important issue for this meeting is to ensure that the assessment models consider the key processes of each stock through considering changes in management and depletion over time, discards, survey variability, and so forth rather than going over all the data. Key objectives include:
 - Comprehensive evaluation of the estimation error in landings, discards, surveys, and catch-at-age.
 - Four stocks will be used as case studies to highlight major components/processes: Georges Bank yellowtail flounder, Georges Bank cod, white hake, and Gulf of Maine cod. Patterns observed for these stocks may be generalized to remaining stocks.
 - Fish sizes have been changing over time too possibly as a result of several factors including fishing, environmental changes, density dependence and natural mortality; these patterns emerge across all stocks.
- Stock structure is defined by statistical areas which are informed by both the topography of the bottom and fishing areas.
 - Not all GB stocks have the same statistical areas associated with them; some GB stocks occupy statistical areas that other GB stocks do not.
 - Stocks are determined by both natural patterns of abundance and management areas. There is some migration between stocks and tagging programs for yellowtail flounder and cod show promise for quantifying not only the rate but the fluxes among populations.
 - The GOM has colder water and is not as productive as compared to GB
 - Survey strata for fishery-independent bottom trawl surveys are chosen to approximate the statistical areas used to quantify commercial landings data. Survey strata are based on additional information including depth and bottom type.
- Distant-water fleets exploited the resources very heavily until the Magnuson act in 1976.
 - Up to 500,000 metric tons a year were removed, much of it prior to the initiation of NMFS surveys. Large reductions in biomass right around the time of the NMFS surveys began.
- The reporting of landings has changed over time
 - Pre 1994 reporting was voluntary and supplemented with interviews, now it is a mandatory logbook system.
 - There are some problems determining the allocation of landings: e.g. where the fish were caught. These problems were addressed at the GARM Data meeting. Allocation to stock areas is less problematic.
 - Dealer records have not changed much, although now they are reported electronically.

- Observer coverage varies depending on circumstances such as a special access program and species. Overall coverage for groundfish ranges from 2 to 5%.
- Management has become more than just “a strong suggestion” and there have been some significant improvements in some species.
 - In 1994, it was planned to reduce the fishing by 50% in 5-7 years.
 - Closed areas were implemented in 1996, and rolling closures protect the stocks at certain times of year.
 - The closed area boundaries are heavily fished - 75% of haddock are caught within a few miles of the area boundaries.
- Discard estimation has been improved by stratifying the fleets and estimation by a discard to kept ratio.
 - Observer information is key
 - Hindcasting discard estimation is difficult; both observer and survey data are used.
 - With changes in management, discard patterns have changed over time.
 - The average kept weight and average trip duration seem to be the same whether an observer is on board or not.
 - The probability of capture, given the particular fleet, gear and area plus the management effects are used to estimate probable discard.
- Regarding NMFS survey sampling (over 45 years), there is evidence of abundance clustering over time (high Gini numbers).
 - The definition of the “stock area” is what is used when determining whether there is a high Gini index for a certain species, not the whole survey area.
 - In some cases, the high concentration may be due to spawning aggregations.
 - There is no evidence of bias in the survey, but the realized sampling design is not equally effective (i.e., precise) for all species.
- Number of tows within an area are used to calculate the measure of concentration (i.e. Gini index) , but some of the area within strata are not trawlable for a number of reasons
 - However, many untrawlable areas are only temporarily so.
 - Overall though, the survey coverage is generally good; there are not many holes.
 - Looking at areas of survey gear damage could point out where these untrawlable areas are.
 - Untrawled areas, if consistent over time, may not be that important.
- The definition of the plus group has changed over time due to the intensity of fishing, and changes in size of fish at age due to unknown causes.

Working Paper 1.2: Rago et al. 2008. Overview of Assessment Methods and Model Selection Criteria for Nineteen Groundfish Stocks in the Northeast US

Presentation Highlights

This report provides a summary of the assessment approaches that have been used to date for the 19 GARM stocks. Each section gives a brief overview of the methods that have been used to date, an evaluation of their strengths and weaknesses, and the prospects for implementing alternative approaches. This report complements the data and analyses summarized in Working Paper 1.1.

Model selection requires simultaneous consideration of multiple objectives. Alternative models should be technically superior in terms of modern statistical theory, flexibility to handle

heterogeneous data and processes, stability of results, and expanded scope of inference. Alternative models must also allow for the provision of scientific advice with respect to reference points. One aspect of particular importance in the Northeast US is stock rebuilding. The model must include a forecasting component or be linked with forecasting program. This is necessary for the evaluation of alternative management strategies. Such evaluations are also required as components of the economic impacts of alternative harvest levels. Finally, coordination of assessment approaches with states and Canada is important for jointly-managed species.

This report addresses the model selection issues for 19 stocks. Each section includes a brief description and history of current approach, its key strengths and weaknesses, and the feasibility of changing assessment models. At the 2005 GARM, only one stock was assessed using a forward projecting age-structured model. For this GARM there is a general tendency to consider the application of forward projection models for several stocks including Georges Bank and Gulf of Maine cod, Georges Bank haddock, all of the yellowtail stocks, and redfish, and white hake. For other species, the current age based assessment models are performing well and may not need further exploration. Several index-based assessments (e.g., white hake, Gulf of Maine haddock) may be upgraded to age or length based models.

Discussion on Working Paper 1.2

- Relative F equation
 - Catch over three years is average of index of abundance
 - Relative F approach is more of a descriptive tool, not to provide an assessment number.
 - Recruitment is not taken into account when using the averaged 3 indices, allow fish a few years to be caught, but the uncertainty in the survey is why there are 3.
 - In the first and last year of a time series the relative F estimate has a different basis ($n-1$, or 2 if $n=3$). All abundances are expressed in biomass, weight per tow.
- Placement of surveys in time may affect the way the data are smoothed since the surveys are conducted at different times of the year.
 - Spatial patterns in the survey data have not affected the definition of central tendency.
 - Finer scale changes in the surveys may change the apparent pattern of the fish.
 - Does one go back and look at the survey areas where the aggregated (high GINI number) fish are found to see whether it is in a specific place. This is not an issue in design-based surveys but knowing the variation from tow to tow may be helpful for the model
- Model vs. index-based assessment
 - ability to age all the species was important
 - Some sampling years were not good so a model had to be used to cover the times of poor age data.
 - Model selection needs to be assisted by considering the summary of data is available and what the time spans and ranges of data are
- Dealer data represent a near census of reported landings and have no sampling error in terms of biomass. Allocation of landings to area and age class are subject to the veracity of the VTR data and the intensity of biological sampling. Re area allocation, are the interviews and VTR comparable?

- The pre1994 interview program was a sampling program facilitated by expert judgment of the port agents.
 - Port agents would impute statistical area from trips, ports for unsampled trips.
 - Error in statistical area for catch is not huge, but the statistical area assignment is less certain than stock area.
- The magnitude and precision of total discards have important implications for model selection.
 - How accurate is the size frequency coming from the observers for the whole stock? Pretty good, but some of the CVs were pretty high for the catch
 - Overall, error in catch-at-age are probably small compared to the indices at age.
- What is the relative magnitude of error from all of the different data sources?
 - Stocks that have some data peculiarities are the ones that have special modeling needs
 - Are there any commonalities in the assessments that do not work? Generally for flatfish and stocks in the Gulf of Maine.
- Need to put some work into defining uncertainty in the catch (i.e., combining errors in commercial and recreational landings with imprecision of discard estimation).
- Replacement yield models
 - Considers replacement yield constant or as constant fraction of extant stock
 - Need to estimate the other parameters (catchability and population growth rate).
 - Need model to fit what is happening in the present, not what happened 20 years ago.
 - Could fit model to different periods of time (e.g. 5, 10, 15 years) in the historical dataset to examine model mis-specification
 - Paper by Glazer (2008) briefly presented and discussed

Potential factors responsible for retrospective patterns

Rapporteur: Susan Wigley

Working Paper 4.1: Legault C et al. 2008. Report of the Retrospective Working Group

Presentation Highlights

This report summarizes a wide range of work related to retrospective patterns in stock assessment, culminating in conclusions and recommendations. A retrospective pattern is a systematic inconsistency among a series of estimates of population size, or related assessment variables, based on increasing periods of data (Mohn 1999). This pattern of change in estimated values can have severe consequences for management of a stock, potentially resulting in depletion of a stock even though the assessments indicate the targets are being met. Retrospective patterns have been observed in some but not all of the stocks in New England, as well as other stocks around the world. Retrospective patterns are not limited to virtual population analysis, having been observed in a wide range of models including statistical catch-at-age models. Instead retrospective patterns are an indication something is inconsistent in the data or model assumptions. However, retrospective patterns are just one diagnostic for stock assessments and lack of a retrospective pattern does not necessarily imply that all is well.

Simulation analyses have demonstrated a number of sources for retrospective patterns, including, missing catch, an increase in natural mortality rate, or a change in survey catchability. The working group examined a number of potential methods to determine the source of a

retrospective pattern using simulated data, but was unable to do so. However, the working group found it does appear possible to identify the timing of an intervention which leads to the retrospective pattern in some cases. Similarly, a number of methods were examined to fix retrospective patterns. While the fixes did in fact remove the retrospective pattern, the new assessment was not always closer to the truth than the original assessment, even though the diagnostics of the new model were good. This means that caution must be exercised when applying any fix to an actual assessment to remove the retrospective pattern.

The working group recommends that stock assessment scientists always check for the presence of a retrospective pattern and that a strong retrospective pattern is grounds to reject the assessment model as an indication of stock status or the basis for management advice. The working group also recommended future research to be conducted on the topic to define objective criteria for acceptance of an assessment with retrospective patterns and to determine what type and level of adjustment in management advice is appropriate through management strategy evaluations.

Discussion on Working Paper 4.1

The simulations were useful in illuminating the complexity and importance of identifying the sources and timing of the retrospective patterns as well as indicating where further research could be directed. This research has a broad application because retrospective patterns can occur regardless of the analytic model and occur not only in Northwest Atlantic stock assessments but also in the Northeast Atlantic, Pacific and Southern Ocean stock assessments.

In addition to the sources of retrospective patterns examined through simulation [changes in catch, changes in natural mortality and changes in survey catchability (q)], it was noted that changes in partial recruitment could also cause retrospective patterns.

Informal meta-analyses which examined commonalities among stocks that exhibit retrospective patterns have been conducted; however, no consistent patterns among stocks have emerged with regard to source or timing. It was suggested that the meta-analysis be expanded to examine survey catchabilities among stocks and across areas.

It was also suggested that swept area values, instead of survey catchabilities, be used when investigating this source of retrospective patterns. The use of swept area values may be helpful in the interpretation of survey catchabilities because the values are cast in more realistic terms by translating the survey catchabilities into proportions that are scale-able and this may allow for easier detection of survey trends that could be at odds with the model. The expectation is that the survey values would be on the order of 1 or 2, not 10.

During the discussion, it was noted that while the timing of the change may be known, it may not be possible to determine which portion of the time series is 'true'. It is insufficient to simply split the series to remove the retrospective pattern because while this could remove or diminish the retrospective pattern, it will not necessarily lead to true estimates. To acquire the true value of the estimates, it is necessary to know both the time of the change and the source of the change.

It was pointed out that the simulations conducted to evaluate if retrospective patterns occur by random chance used both realistic noise values (similar to values observed in Northeast stock assessments) as well as unrealistically large noise values. Regardless of the noise level, there was no evidence that retrospective patterns occur by chance alone. It was noted that additional simulation work could be expanded to include correlated noise (e.g. year effects in surveys).

During the discussion of closed areas as a source of retrospective patterns, it was noted that closed area affects could be from regulatory closed areas or from a concentration of effort in a particular area while survey indices were derived from the entire area. It was emphasized that the source of retrospective patterns created by closed areas was limited to sessile animals because the simulations revealed that the retrospective patterns diminished when movement between the closed and open areas was added into the simulations.

Since retrospective patterns arise from a change within a time series, one possible solution to remove a retrospective pattern would be to shorten the assessment time frame. It was noted that shortening the time series used in the assessment is contrary to the belief that a longer time series is preferable; however, given a retrospective pattern, a shorter time series may provide more accurate estimates of current stock status. Using moving window was also discussed as an alternative to shortening the assessment time series. A moving window may also be beneficial in identifying the timing of the change.

When a retrospective pattern occurs, what action should be taken: use another model, shorten time period, or reject the assessment? No conclusion was reached.

Alternative states of nature are analogous to calculating the confidence intervals around estimates and provide estimate bounds for managers. It was emphasized that to properly determine the alternative states of nature, many analyses would be necessary to evaluate all possible sources when the source and timing of the retrospective pattern was not known.

The panel offered the following suggestions to analysts as they prepare their assessments:

- 1) check for retro patterns
- 2) evaluate diagnostics (not only retro patterns) and
- 3) use other auxiliary information when possible (CPUE, landings, etc.) to identify the source(s) and timing of a change(s) within the time series.

It may be possible to account for differences created by a retrospective pattern; however, it assumes the direction of the difference is known but without the knowledge of the source, there is no mechanism to indicate where the truth lies. Caution should be used.

Management strategy evaluations (MSE) were discussed regarding their ability to appropriately determine adjustment levels when providing management advice. The MSE will be limited because they will be conditioned on a given source and timing of the cause for the retrospective pattern. The MSE would have to be cast in a risk analysis framework in order to evaluate different types of adjustments.

The panel agreed that it is important to communicate the retrospective patterns to managers due to the implications of these patterns on reference points and advice on catch and projections.

Model implications of zeros in fishery independent indices

Rapporteur: Larry Jacobson

Working Paper 3.1: Legault, C. and A. Seaver. 2008. Simulation Studies of Issues Associated with Filling Zeros in VPA Tuning Indices

Presentation Highlights

Surveys occasionally do not encounter fish of a given age in a specific year. Since age-specific survey tuning indices are usually assumed to have a lognormal error, zeros are not

allowed. The NEFSC standard procedure is to treat the zeros as missing. However, during the 2006 review of the summer flounder assessment, it was claimed that this procedure introduces a bias into the assessment because no information is being presented to the model when the product of abundance and survey catchability for an age are low. No support was provided for this statement beyond this theoretical argument. An approach was recommended to fill the zeros with 1/6 of the smallest non-zero value in the series. It was claimed that this approach reduced the retrospective pattern in the assessment. This claim was later shown to be false. Many changes were made during the assessment with an end result of higher catch advice. This created a perception that filling the zeros causes higher catch advice and so it was requested that this approach be applied to the Northeast groundfish stocks as well. This working paper presents three studies demonstrating why zeros should not be filled.

The first study simply created a time series of abundance and then created deterministic indices with different detection levels for truncating low values to zero. It was shown that filling a sequence of zeros with any constant value introduces a bias by creating a flat index for these years when in fact the actual population is changing. The second study used a population simulator to create datasets for analysis by virtual population analysis under 4 scenarios: 1) all data is used, 2) tuning indices below a set value were truncated to zero and treated as missing, 3) same as case 2 except the zeros filled with a constant value of 0.01, and 4) same as case 2 except the zeros filled according to the 1/6 approach. Cases 1 and 2 had similar levels of bias while case 4 was highly biased relative to the known underlying population N and F . Case 3 had more bias than cases 1 or 2, but not as much as case 3. These simulations demonstrated no support for the claim that treating zeros as missing introduces bias and also showed that filling zeros with a constant can induce large biases. The third study (presented in the appendix) was a simple regression example to demonstrate why filling zeros with a constant can lead to bias. Random data were created and error added to “observed” values which were truncated to zero below some cut-off. When the zeros were treated as missing a regression of the log of observed and true values had a slope near one with the 90% CI of observations covering zero. When the 1/6 rule was applied, the slope of the regression was strongly bias with the 90% CI not covering zero even though it was nearly twice as large as case 1.

These studies concluded that making up data is bad. In the short term, treating zeros as missing is recommended. In the long term, a different error distribution should be found for use instead of the lognormal which allows for zero values. However, this distribution must allow for the truncation effect instead of just treating all zeros as the same value, as a square root transform would, for example.

Working Paper 3.2: Terceiro, M. 2008. The Treatment of “Zero” Observations in the Summer Flounder ADAPT VPA Calibration

Presentation Highlights

There is no consistent pattern in the identification of the additive constant that minimizes the absolute value of Berry’s (1987) g statistic. There is no strong relationship between the absolute magnitude of the index values, the length of the time series, the number of zeros, the magnitude of the smallest observed value, or any of the usual statistical moments of the series (mean, maximum, non-zero minimum, CV, skewness, kurtosis), and the value of the additive constant that minimizes g . Further, while the “one-sixth” of the minimum observed value was identified as the “best” additive constant in 5 of the 24 (21%) cases examined, this level is not

high enough to justify this approach as a reliable rule-of-thumb. In fact, the additive constant of 0.01 was identified as “best” for a higher percentage of series (6 of 24 = 25%). Given the inability to identify a constant that consistently minimizes g , the best rule is to maintain the current approach of making no adjustment and continue to treat “zero” observations as “missing.”

Working Paper 3.3: ICES Resource Management Committee. 2007. Report of the Working Group on Methods of Fish Stock Assessments (WGMG).

Presentation Highlights

The ICES Working Group on Methods of Fish Stock Assessments (WGMG) met in Woods Hole 13-22 March 2007. During the meeting, a working paper was presented on the topic of zeros in tuning indices. The WGMG discussed the working paper, but did not spend any additional time on the topic. It was noted that the ICES standard approach is to treat zeros as missing values when they occur in tuning indices. The WGMG concluded that a different error structure than the typical lognormal error should be developed which allows the use of zeros. However, simulation testing is required to ensure that such an approach is robust to outliers. The delta approaches were suggested but rejected, while a quasi-likelihood function with quadratic term deserves consideration. The WGMG concluded that one should not change data to fit the model, but rather change the model to fit the data.

Discussion on Working Papers 3.1, 3.2 and 3.3

Comments generally supported the conclusions given in the working papers. It was noted that zeroes in fisheries are more likely a problem of truncation than a problem of true zeroes. Sub-sampling and sample size are important factors in the occurrence of zeroes because, for example, in addition to sampling relatively rare large fish in length composition data, it is necessary to sub-sample relatively rare old ones in the age-length key to observe an old fish in catch-at-age data. A zero survey observation generally means that no fish were taken in a number of tows across a number of strata. The frequency with which zeroes occur may be critical because effects of omitting zeros rarely and at “random” intervals has different consequences than omitting long strings of zero values that occur when very young or old organisms become rare for long periods of time.

It was noted that Berry’s (1987) approach was designed for analysis of experimental data, rather than data used in stock assessments. Different approaches (other than logs) to transforming data may be optimal in stock assessment when zeroes are present. The possibility of using the square root transformation (which is applicable to zeroes and tends to standardize variance in lognormal data) was discussed but there was some concern about effects on the scale of the mean and variance as well as the fact that zeros would be treated the same regardless of the true level of depletion leading to their truncation. Over-dispersed Poisson or negative binomial distributions might be useful. It might be useful to vary the composition of the “plus” group for the youngest and oldest ages to eliminate zeroes at these ages. This has implications for the estimation of catchability at age which requires a consistent definition of the age group over time. These suggestions have promise but there was insufficient time to evaluate their merits prior to the GARM.

There was a suggestion to explore robust likelihood approaches to avoid excessive influence on model fitting to data affected by the presence of zeros.

Utility of statistical catch-at-age models

Working Paper 2.1. Jacobson L, C. Legault, L. O'Brien and K. Sosebee. 2008. Utility of statistical catch-at-age models for assessing Northeast groundfish stocks: Overview (a workshop report for sections 2.1a, 2.1b, 2.1c)

Rapporteur: Tim Miller

Presentation Highlights

A training workshop using the SS2 (Stock Synthesis, version 2) statistical catch-at-age stock assessment model for northeast groundfish was held at the Northeast Fisheries Science Center (NEFSC) in Woods Hole, MA during 4-7 February 2005. The workshop was successful in developing potentially useful but preliminary SS2 models for three example stocks. In particular, a model for white hake was developed that spanned a period with missing fishery and survey age data. Previous attempts to assess white hake using a variety of models were problematic. Estimates from an SS2 model for Georges Bank (GB) cod appear relatively precise, presumably because of high quality of the available data. Preliminary SS2 models for GB yellowtail flounder suffered from many of the same problems as VPA models in the last assessment and a number of different model configurations were explored in SS2 that help address these problems.

Experience at the workshop with all three stocks indicates that statistical catch-at-age models are applicable and promising for northeast stocks. SS2 and VPA estimates were generally similar, particularly when configured in similar ways. As exemplified by Georges Bank cod, the data available for northeast stocks are adequate for application of statistical catch-at-age models. In fact, data available for all three example stocks were more comprehensive than the data available for many stocks where statistical catch-at-age models are used routinely. Results for white hake show that statistical catch-at-age models may be useful for stocks with missing age data or stocks currently without an analytical assessment approach. The inherent flexibility of statistical catch-at-age models may be advantageous in dealing with difficult assessment problems and complex data, although results for GB yellowtail flounder indicate that there are no “silver bullets” and that some chronic issues are likely to persist.

Participants at the workshop agreed that SS2 was substantially more difficult to apply than the traditional ADAPT VPA and that training and technical support are absolutely necessary at the outset for new users. Events elsewhere show that even experienced users require technical support and access to the software development team on an ongoing basis.

Although it has been used around the world for a large number of stocks, SS2 was developed originally for relatively slow growing, long-lived and unproductive rockfish stocks on the west coast of North America with limited data and relatively low fishing mortality rates. A number of changes were made to the program to accommodate different circumstances in the northeast. Additional work along these lines will probably be required if SS2 is used for northeast groundfish.

Discussion on Working Paper 2.1

A point was raised that, as with SCAA models, recruitment could be estimated freely with VPA models which supported the presenter's assertion that VPA and SCAA can both be parameterized to model the same processes. Moving to the Baranov catch equation from the

Pope approximation was discouraged unless absolutely necessary because of computation burdens especially for Bayesian inferences. Shortening the time step is an alternative to maintaining the Pope approximation but this could increase the number of selectivity parameters. There was some disagreement about whether maximum likelihood estimation of the variance of deviations around the stock recruitment relationship was possible. However, the estimation of this parameter was thought likely to be biased.

One reviewer pointed out that knowledge of the relative weighting of the age composition of the landings and surveys would be helpful in determining the respective influences on the overall objective function in a SCAA model. It was also asserted that the variance of age composition residuals should roughly match the assumed variances. However, the method of dealing with effective sample size of age composition varies among researchers and currently, there is no consensus. Along with variance assumptions for the age composition, distributional assumptions should affect the estimation of parameters in SCAA. Finally, one reviewer suggested using Bayesian approach to help in treating uncertainty in different data components.

Working Paper 2.1. Jacobson L, C. Legault, L. O'Brien and K. Sosebee. 2008. Utility of statistical catch-at-age models for assessing Northeast groundfish stocks: Section a on Georges Bank Yellowtail

Rapporteur: Tim Miller

Discussion on Working Paper 2.1: Section a on Georges Bank Yellowtail

There was only limited discussion on this section of the working paper as much of the time available had been devoted to the overview.

Working Paper 2.1. Jacobson L, C. Legault, L. O'Brien and K. Sosebee. 2008. Utility of statistical catch-at-age models for assessing Northeast groundfish stocks: Section b on White Hake

Rapporteur: Ralph Mayo

Discussion on Working Paper 2.1: Section b on White Hake

Trends in residuals from surveys suggest a change in catchability (q) around 1985. This is likely the result of the doors changes; however there are no conversion factors available from the gear comparison studies.

The fishery selectivity declines sharply after 114 cm. This is likely due to large fish inhabiting deeper water unavailable to some gear types. The drop in survey selectivity may also be due to larger fish inhabiting deeper water out of range of the survey. It is also possible that the fishery may be operating in areas outside of the area covered by the survey.

When asymptotic selectivity was imposed on the fishery, model fit was poor. Therefore, flat top selectivity is not an option conditional on the rest of the model configuration, so additional work is required on the shape of the dome or on adjusting the other parts of the model configuration.

The assessment model generates numbers at age which are then converted to number at length to derive selectivity at length. In years with length compositions but no age compositions,

it is possible to use a growth model internally to convert age compositions to length compositions. This conversion can also be done externally using existing methods (e.g Kimura) using, for example, age data from adjacent years. Additional age data may be obtained from observed trips, although these otoliths have not aged.

Based on the plot of length vs. age, the variance of length at age seems large, especially for younger ages. The range of length at age represents the range from both spring and autumn surveys, leading to a wider range than if they were plotted by seasonal age.

Working Paper 2.1. Jacobson L, C. Legault, L. O'Brien and K. Sosebee. 2008. Utility of statistical catch-at-age models for assessing Northeast groundfish stocks: Section c on Georges Bank Cod

Rapporteur: Jessica Blaylock

Discussion on Working Paper 2.1: Section c on Georges Bank Cod

It was remarked that the VPA before this was working adequately, except that the retrospective pattern was a little high or moderate compared to other stocks.

There was discussion on the mimic-VPA model that showed a 180 degree 'flipped' pattern in all three stocks (GB Yellowtail, White Hake, and GB Cod) from the pattern exhibited by the SCAA model. However, further examination revealed that only the GB Cod exhibited this 'flipped' pattern. On this subject, it was pointed out that if the SS2 model had been parameterized to have the same biomass as the VPA, then the retrospective pattern would probably not have flipped between the two models.

On a procedural note, the Chairman reminded the panel that, for all 19 stocks, if the use of a new model is advised, it will be important to be clear about why the 'old model' is not as good as the 'new model'. Why did we change the model? What issues will be addressed better?

Concern was expressed about fitting the likelihood (fixed catch) and its influence on parameter estimation. Fixing the weighting so high ($\lambda = 100$) has a large influence on other parameters in the model. This was done here for both runs because of the assumption the catch was known.

The panel was reminded that these were exploratory runs, but that future sensitivity runs could be done. Suggestions included allowing for a dome-shaped selectivity pattern instead of forcing a flat-topped pattern, and setting selectivity and letting catch vary.

A suggestion was made to let selectivity follow a random walk across years, in the context of parameterizing the SS2 differently to mimic the VPA better. However, caution would be necessary since a change in selectivity implies a change in q .

There was consensus that caution would be necessary if going to a full length-based versus age-based model.

Supplementary Working Paper 2.1: Jacobson L. 2008. Georges Bank Yellowtail; Questions about the adjusted lognormal error distribution used in calculating goodness of fit for survey and commercial age composition data in preliminary ASPM models

Presentation Highlights

The likelihood of age composition data and details of calculation are important in SCCA modeling. For example, in preliminary SS2 models for Georges Bank yellowtail flounder,

results for recent years depend on whether the model solution favors (tends to fit) survey and commercial age composition data at the expense of survey trend data, or vice-versa. All approaches are approximate because the statistical distribution of age composition data is hard to specify and model misspecifications complicate the matter further. Still, it is important to understand and weight the advantages of the approach taken, particularly if it is new.

According to equation A21.9 in the working paper 2.2-a by Butterworth and Rademeyer, the negative log likelihood of survey and commercial age composition data in the preliminary ASPM for Gulf of Maine cod is:

$$-\ln(L^{CAA}) = \sum_y \sum_a \left\{ \ln(\sigma_{comm} / \sqrt{p_{y,a}}) + p_{y,a} [\ln(p_{y,a}) - \ln(\hat{p}_{y,a})]^2 / 2\sigma_{comm}^2 \right\} \quad A2.19$$

Where $p_{y,a}$ and $\hat{p}_{y,a}$ are observed and predicted proportions of the total catch age a during year y , and the standard deviation σ_{comm} associated with the catch-at-age, which is estimated in the fitting procedure using:

$$\hat{\sigma}_{comm} = \sqrt{\sum_y \sum_a \{ p_{y,a} [\ln(p_{y,a}) - \ln(\hat{p}_{y,a})]^2 \} / \sum_y \sum_a 1} \quad A2.21$$

Thus, the log likelihood term is calculated assuming that measurement errors in catch-at-age arise from a weighed log-normal distribution. Lognormal distributions are often used for catch-at-age data and not cause for concern. However, the weighting factor (i.e. the observed proportion $p_{y,a}$) for each age is unusual and has uncertain statistical properties that should be evaluated and explained. The text following equation A2.2.1 explains “*Punt (pers. comm.) advised weighting by the observed proportions (as in equation A2.19) so that undue importance is not attached to data based upon a few samples only.*”

The following are three concerns that occur to this reviewer immediately. First, the magnitude of the proportion $p_{y,a}$ has no necessary relationship to the number of samples. A very low observed proportion would naturally occur for a rare event in any number (small or large) of samples. Secondly, this approach gives zero weight to data in age composition bins with zero observations, even though the data likely contain valid and reliable information concerning the rarity of fish of that particular age. Finally, use of the observed, rather than the predicted, proportion implies that the observed proportions are more precise as estimates of the population proportion than the predicted ones. If the observed proportions are more precise, then why bother calculating the predicted values? In any case, the observed values probably include measurement and process errors that contribute variance that is not desirable in weights.

Discussion on Supplementary Working Paper 2.1

This paper was not presented to the meeting due to time constraints and thus there was no related discussion. It was however made available to meeting participants.

Working Paper 2.2a: Butterworth, D.S. and R.A. Rademeyer. 2008. Statistical Catch-at-age Analysis vs ADAPT-VPA: The Case of Gulf of Maine Cod

Rapporteur: Bill Overholtz

Presentation Highlights

The WP commences with an historical overview. In 2003, given an estimate of the spawning stock biomass (B^{sp}) in 2001 of only 27% of the corresponding level at MSY (B_{MSY}^{sp}) on the basis of an ADAPT-VPA assessment that used data from 1982 onwards only, the Gulf of Maine cod stock was classified as “overfished” in the context of the Magnusson-Stevens Act, and a recovery plan put in place. However, an alternative Statistical Catch-at-age (SCAA; alternatively termed Age Structured Production Model – ASPM) assessment at the time, which took account of survey data back to 1964, suggested that the stock was above B_{MSY}^{sp} . An independent panel appointed as part of the process to review this and other US Northeast groundfish assessments during that year recommended further investigation of this to better understand the difference. The WP addresses and discusses this issue together with a range of other (sometimes conflicting) suggestions made during a number of reviews of the assessment of this stock over the past decade. It finds that the primary reason for the different results is that the ADAPT-VPA assessment imposed asymptotically flat selectivity-at-age in circumstances where there is strong statistical evidence for dome-shaped selectivity in the data. Making allowance for this under either assessment method reverses perceptions that recent fishing mortalities have exceeded F_{MSY} , and robustly estimates B^{sp} relatively close to B_{MSY}^{sp} rather than below the threshold of $0.5 B_{MSY}^{sp}$ for an “overfished” (“depleted”) classification. Compared to the ADAPT-VPA approach which is limited to the period for which catch-at-age data are available, the SCAA/ASPM approach allows the longer series of research survey data available to be taken into account, thus providing a better basis to estimate management quantities linked to MSY-related targets, and doubling the related precision in some cases. Given that such targets play important roles in the implementation of the Magnusson-Stevens Act, the SCAA/ASPM approach would seem to be preferred over ADAPT-VPA for assessing this stock. The calculations conducted also point more generally to the need for care in treatment of the plus-group in analyses, as well as in use of the Beverton-Holt spawning biomass recruitment relationship which can lead to inappropriately low estimates of B_{MSY}^{sp} in certain circumstances, and to the importance of using flexible parameterizations of selectivity-at-age in SCAA/ASPM assessments to avoid possibly misleading impressions of the precision with which quantities such as natural mortality M can be estimated.

Discussion on Working Paper 2.2a

Discussions which followed are summarized in outline form below:

Statistical Distributions

- Does it matter which distributions one uses? The robustness to alternative statistical distributions can and possibly should be checked.

Ricker vs Beverton and Holt (BH) Stock - recruitment model

- Fitting problem at low stock size.
 - Limited number of observations at high stock size. Is there a decline in recruitment at high stock size? Problem arises if data suggest a negative correlation; BH cannot give a negative correlation; BH will give you a steepness of 1 in these circumstances.

- Presented formulation provides information on pristine stock size so it helps with the issue of no data at high stock size.
 - If a prior on steepness is assumed, the data are overweighted because of neglect of correlation effects
- Has S/R data from the VPA been considered for guidance? Not yet
- Does the ASPM have an S/R?
 - It must have since ASPM has production component built in: implies a S/R relationship
 - VPAs, however, are restricted to years with catch-at-age data.
- Parameterize the S/R directly?
 - Bayesian prior, every year there is a deviation from the mean of an S/R.
 - Intermediate world-search routine approximates randomization (random effects) (Maunder and Deriso, 2003)
 - An advantage of internal estimation is that the statistical error assumptions are internally consistent unless the S/R relation is mis-specified.
 - One aspect of mis-specification is the σ_r constraint (p. 52). Should autocorrelation be assumed in the S/R relationship? The current formulation of the model does not include autocorrelation in the residuals. Residuals from S/R are usually not randomly distributed.
- Is Rho fixed?
 - Yes run with a fixed Rho first.
 - Is there autocorrelation in the S/R data? Errors for several sources. Model cannot resolve, outliers rule the day.
 - Are S/R residuals usually autocorrelated (AC)? There is AC in the other data as well, if ignored you are overweighting. At end, this cannot be estimated, resulting confidence intervals are usually too narrow. Though there is often positive AC in residuals, attempts to estimate this in fitting sometimes introduces instability to the estimation.

GOM Cod example

- How about just running with the catches starting in 1893?
 - Was not considered practical because run times would be increase substantially. For true “virgin” biomass, it was suggested that the model would have to start 100-200 yrs earlier.
 - Looked at sensitivities for starting year, things don’t change much for management, but carrying capacity (K) change dramatically depending on starting point.
- Concern was expressed that the stock structure of cod had been compromised by excessive fishing on some components, particularly in inshore areas.
 - if true, then it is unlikely that the stock has recovered. Absence of inshore components is likely to impact BRPs.
 - What is tradeoff for including long-past history? Problem is in uncertainty. Long vs short-term uncertainty. Never know the past, but can use it, and sometimes need to use it. Starting in 1893, back to pristine in 1960, catches decreased and stock rebuilt. DeValpine and Hastings (2002) found that a Ricker model often fit better even when the BH was the true model. Highest biomass has poor recruitment. A concern if you have relatively few data points. Need a phase

plane plot to show chronology of data? All the high stock sizes are in the 1960s when the stock was being fished down quickly.

- One model run implies that initial biomass in 1893 was at 18-30% of virgin stock size; look at sensitivity runs
 - This value is not considered important because results wash out in first 20 years
 - Most recent years are very similar in most of the sensitivity runs
 - S/R plot only shows 1963 onward, the early points may not be representative of the S/R relationship because high stocks were quickly fished down, i.e., the reproductive potential of the larger stock biomasses may not have been realized.
- Reference points: Parametric or non-parametric S/R? Parametric forms are not mandatory, perhaps this is a case for nonparametric.
 - In the absence of a hypothesized mechanism to justify the overcompensation in a Ricker model, a BH model may be more appropriate.
- Landings: Modern statistics began in the 1930s.
 - 5Y data set starts in the 1940s
 - Data collection systems are different now
 - Perhaps should examine the landings series better and consider the impact of starting other than in 1893
- Likelihood: commercial landings are dominated by ages 5, 6, and 7. The plus group begins at age 7.
 - Using a higher plus group is probably not feasible due to small sample sizes
 - Can all the ages (beyond 7+) be examined for the stock assessment? Yes, this should be looked at. Data suggests a dome for commercial PR.
- Is Pope approximation equation working here? This approximation is known to breakdown at high F.
 - Working paper used Pope because NEFSC was using it at the time
 - Only becomes a problem in 1990, and doesn't seem to present a problem here in this ASPM assessment.
- Is selectivity changing in 2003-2006, it appears so from the bubble plots? Why is selectivity in the survey, which uses a liner, lower for younger ages than the commercial selectivity?
 - The model is based on what the data suggest.
- Why is survey selectivity higher on older fish?
 - Caution needed on two counts: curves are normalized, and correspondence with the data was the primary consideration
- GOM interventions: 1976, 1994, rolling closures, gears.
 - Many different characteristics in the data
 - The ASPM approach lets the data rule the day.
- High reference points for ASPM?
 - Fully selected Fs in ASPM model, not averages over a number of ages as usually quoted for VPA. Compare apples and apples
- Long versus short time series of data
 - Long series good for BRPs, but, may be good idea to use shorter series for status determination.
 - Full time series don't include discards, haddock is a good example, many millions of young fish were discarded pre-1960s. Sensitivities to this should be explored.

- Why do outputs shift back and forth between MLE and MCMC.
 - Acknowledged that results are presented in a mixed mode, Bayesian and frequentist
 - The penalized MLE are also the Bayesian posterior modes. Other Bayesian posterior quantities were not given in every case because of the computational burden, compared to the posterior mode which is much more quickly computed.
- Sensitivity analysis: Management parameters are highly skewed, are priors overly influential?
 - Management parameters are just outputs.
 - The only priors that are informative in the ASPM are on S/R residuals. Uniform prior distributions for S, k, h are all uninformative.
 - Skewness could be real.
- Results: data pre 1982, likelihoods are different for different approaches.
 - Yes, because different data were used. Can't compare two models with different data in AIC sense.
- Clarification: Model used bounds for priors in ADMB.
- MSY calculations: Are S/R functions in R/S units? Intersection point on SR curve, comes from a per recruit perspective. Slope of the replacement line. (The equation relevant to this discussion was subsequently found to have been inadvertently omitted from an appendix in Working Paper 2.2a).
- How much does the choice of a S/R model affect the results? A number of sensitivity tests reported in the paper address this question.)
- Scaling: if you assume a Ricker with poor recruitment in early years, then scale is higher. If all due to catch, then scale is lower. Need to look at sensitivities.

Working Paper 2.3: Shepherd G. 2008. Comparison of ADAPT VPA and ASAP models for Gulf of Maine cod

Rapporteur: Bill Overholtz

Presentation Highlights

Gulf of Maine cod stocks were most recently assessed for GARM II using an ADAPT VPA (Mayo and Col 2006). The same input data was used in a forward projecting catch-at-age model (ASAP) (Legault and Restrepo 1998) for comparison purposes. The ASAP model was setup to evaluate five selectivity scenarios: model 1 selectivity was the average (geometric mean) from the last three years in the VPA; model 2 was a fixed equilibrium selectivity pattern used in the yield per recruit calculations; model 3 was a flat-top pattern fitted to ages 1-5 and held constant (1.0) for ages 6-7; model 4 was a fitted using a single logistic curve; and model 5 was a dome shaped selectivity pattern fitted using a double logistic model.

The ASAP model produced fishing mortality and abundance results very similar to the VPA. Among the configurations examined, the selection curve fitted with a single logistic model had the best diagnostics. However, strong retrospective patterns in the ASAP models suggests further examination is needed to determine if alternative configurations would provide a better model fit.

Discussion on Working Paper 2.3

- Compare retrospective pattern for various model formulations of ASAP.
 - Why are the patterns different? Abundance depends on younger ages, SSB driven by older ages.
- ASAP or other forward projecting models
 - What is the effect of choosing time blocks for selectivity?
 - Model results often sensitive to assumed timing of transitions between blocks.
 - ASAP has no dependence between time blocks. Some models introduce a random walk approach that constrains the rate of change in selectivity between adjacent time steps.
- Likelihood: double logistic had highest likelihood
 - Model 5 had the highest total log likelihood.
 - Does single selectivity pattern apply? Yes
- How many blocks in the ASAP? One block for all models. Fits to catch-at-age must be poor? Yes, but improved for later part of the time series.
- SSB? ASAP had peak in 1989, VPA acts as a smoother. Can't answer at this point. Rivard wts were used for SSB, Start up approach may account for the differences.
- What was the minimum age of the plus group in ASAP? Age 7.
- How were the means estimated for the 7+ age group? They are weighted averages based on observed values.

Working Paper 2.5: Butterworth, D.S. and R.A. Rademeyer. 2008. Application of an Age-Structured Production Model to the Georges Bank yellowtail flounder

Rapporteur: Tim Miller

Presentation Highlights

The WP provides the results for a Reference Case application of ASPM to the Georges Bank yellowtail flounder, together with those for three sensitivities. Strong residual patterns in the fits to survey indices of abundance, particularly to that for the Canadian DFO Spring survey, raise concerns about the compatibility of the population model and these indices. The model fits strongly favor domed over asymptotically flat selectivity. Selectivity assumptions are key to estimates of stock status, with fits to a fully flexible selectivity parameterization indicating the resource to be effectively at its MSY level B_{MSY}^{sp} , whereas the imposition of asymptotically flat selectivity sees the stock estimated to be below the “overfishing” threshold of $0.5 B_{MSY}^{sp}$.

Discussion on Working Paper 2.5

There were only points of clarification made with discussion held off until after the follow-up dome-selectivity analysis of tagging data presented by Tim Miller.

Supplementary Working Paper TOR 2: Miller, T, D. Hart, S. Cadrin, L. Jacobson, C. Legault, and P. Rago. 2008. Analyses of tagging data for evidence of decreased fishing mortality for large yellowtail flounder

Rapporteur: Liz Brooks

Presentation Highlights

We performed two analyses of yellowtail tagging data from an ongoing cooperative NMFS tagging study. The first compares expected probability of recovery by age class for tagged fish based on estimates of age-specific fishing mortality by Working Paper with the observed proportions of recoveries (by sex) for different length classes (and approximate corresponding ages) in the yellowtail tagging data. In the second analysis, we fit a series of finite-state continuous-time models to the yellowtail flounder tagging data to estimate different fishing mortality parameters by length class at release while also estimating migration and natural mortality rates along with reporting probability and a scalar to adjust fishing mortality in the first month after release. None of our analyses showed evidence of decreased selectivity for large yellowtail flounder.

Discussion on Supplementary Working Paper TOR 2

- Presentation stated dimorphic mortality could be contributing to differential return rates between males and females
 - It was queried whether there was evidence or published results to this fact. Presenter replied that the survey has skewed sex ratio at older ages, and also pointed to tagging results (Cadrian et al) that suggest lower recovery rate of males—which could be explained by higher natural mortality on males (among other possible explanations).
- Presentation offered clarification regarding the net flux in movement (instantaneous rates) versus the realized difference in abundance between the three regions (given vastly different stock sizes in each area).
- Reviewer asked for the size bins for the 3 size classes—those values were not immediately available.
 - Motivation for specifying the break points was to examine the veracity of the dome proposed in working paper 2.5 rather than to attempt to estimate the true selectivity at size.
- Reviewer asked for clarification on the negative correlation between M and reporting rate; reviewer asked for the difference in high reward value
 - It was clarified that there was a \$100 instant winner for high reward, but a regular tag got put into a once-a-year \$1000 lottery.
 - A question asking for the difference in reporting rate, assuming high reward equaled 100% reporting and 60% reporting of regular tags
 - It was also stated that the overall recovery rate is 13% (presumably for all tags, both high and regular reward).
- A question was asked regarding detection probability for the tags; it was responded that the fish go through a filleting machine, and that they have gotten returns from the processors, so the tags could be missed at sea but landed fish would most likely have tags detected.
- It was asked whether they were to use this information to recommend information in assessments (regarding scale of F in assessments) or just to inform on PR.
 - Were the data meeting conclusions suggesting that these rates of Fishing Mortality were most precise and should be used to check assessment results?
 - What are we supposed to do with the different F at the end from assessment vs. the tagging data?

- Clarification was made that the tagging data were to inform the assessment, and in particular in this case, it was informing as to partial recruitment rather than providing estimates of F.
- Regarding estimated movement (pattern and magnitude), it was noted that the high rate of perceived movement could be a result of where the fish were tagged (i.e. right on the border between SNE and GB).
- Question regarding mixing of one month only after release
 - hypothesis of fully mixed after one month had not yet been tested, but it could be tested by modeling two periods, allowing the first period to vary in length, and then determining when the mixing coefficient in the second period became statistically non-significantly different from 1.0.
- A question was asked about recoveries in closed areas? A conclusion (second bullet) was that no evidence for emigration of yellowtail to un-fished areas (however this bullet related to areas outside the three stock boundaries).
 - This bullet referred to the dome selectivity resulting from a closed area.
- Another question was asked about tag reporting in the case of discards? This would decrease the reporting rate.
 - It noted that they did receive tags from the scallop fleet, and that those recoveries were not only from observed trips.
 - Presenter also noted that only very small amounts of yellowtail flounder were retained in scallop fishery.

Supplementary Reply TOR 2: Butterworth, D.S. and R.A. Rademeyer. 2008. On Drawing Inferences Concerning Trends in Selectivity with Age from Tag-Recapture Information

Rapporteur: Liz Brooks

Presentation Highlights

The WP shows that the implications of dome shaped selectivity for tag recovery proportions as a function of age depend on whether the drop in selectivity at large age arises from a gear selection effect or is surrogating emigration. A simple extraction of summary statistics from tag-recapture data, including a measure of mean tag return time, is suggested to throw further light on the mechanisms actually in play for various stocks, as current high estimates of M from tagging studies may be consequences of failing to take account of emigration to outside the fishing area.

Discussion on Supplementary Reply TOR 2

- Presentation suggested that fish behavior, specifically swimming strength of older fish, could create a dome shape.
 - It was pointed out that if one extended the “strong swimming” argument further, one would expect eventually that selectivity of slow swimmers would continuously decrease availability of slow swimmers until you only have fast swimmers surviving.
- Presentation also suggested that emigration from the fishing grounds would make fish unavailable and could also generate a dome-shaped selectivity.
 - Reviewer asked about the fact that estimated migration rates were low (as a means of arguing against emigration masking selectivity). Presenter suggested that there could be some confounding between reporting rate and an emigration rate. There was

- debate regarding mean time to recovery and confounding between emigration and reporting rate.
 - It was explained that this has been investigated (mean time between release and recapture) and that no age-specific differences could be found.
 - Presenter countered that mean time to recovery would also be low if emigration occurred.
- It was noted that the Miller et al. model incorporates the time specific info by modeling recaptures individually.
 - While the presenter's mathematics provides an informative check, the Miller model can incorporate these same sorts of features.
- It was interjected that these hypotheses don't sound biologically plausible for yellowtail.
 - Presenter agreed that *a priori* these hypotheses sound far more plausible for cod.
 - One still needs a hypothesis to explain the disappearance from both survey and fishery at 4-5 year olds.
 - It was suggested that a more credible explanation is a higher M on males from age 3 on.

Working Paper 2.4: Brooks, L., C. Legault, P. Nitschke, L. O'Brien, K. Sosebee, P. Rago and A. Seaver A. 2008. Evaluation of NMFS Toolbox Assessment Models on Simulated Groundfish Data Sets.

Rapporteur: Tim Miller

Presentation Highlights

A simulation study was performed to evaluate the performance of five NOAA Fisheries Toolbox assessment models (AIM, ASPIC, SCALE, VPA, and ASAP). Data sets corresponding to three representative groundfish stocks (Georges Bank yellowtail flounder, Georges Bank cod, and white hake) were simulated with PopSim, a simulation program in the Toolbox. For each simulated stock, a base case data set was produced as well as three data sets with a known error. There were 12 data sets in total (three stocks with four data sets each) and for each data set, 100 random realizations were generated with PopSim. Each model performed an "assessment" on the simulated datasets, and the results were compared with the "true" value (i.e., the known parameter values used to generate the data sets). Results for each model in each of the 12 cases were summarized with respect to bias and precision (CV). The base case served as a benchmark to determine how well each model could replicate the truth, and as a point of comparison for model performance on the data sets with known error. In general, no model was a clear winner in all cases. Data sets that reflected errors associated with sampling (aging error or number of length samples) were best handled by models that either did not use age (AIM) or models that incorporate error into catches (ASAP). The VPA, because it matches catch exactly, suffered the most bias and had the poorest precision in these cases. However, when the source of error introduced a "break" in the time series (as in all of the yellowtail flounder cases), none of the model configurations was robust to the effect. The "east coast" approach of tuning to age-specific survey indices appears to be robust to the shape of the selectivity function. In the case of misspecification of the fleet selectivity (assuming logistic when it is dome), both forward and backward projecting models were impacted, but the effect was only apparent at the oldest ages

(as would be expected). ASPIC failed in all simulated data sets, but this was due to the nature of the simulated data (all of which were one-way trips), and not to deficiencies in the model.

Discussion on Working Paper 2.4: Overview

There were only a few clarifications on the generalities of the presentation before getting into the specific sections.

Working Paper 2.4: Brooks, L., C. Legault, P. Nitschke, L. O'Brien, K. Sosebee, P. Rago and A. Seaver A. 2008. Evaluation of NMFS Toolbox Assessment Models on Simulated Groundfish Data Sets. Section a on Georges Bank Yellowtail

Rapporteur: Tim Miller

Discussion on Working Paper 2.4: Section a on Georges Bank Yellowtail

In general, ASAP and VPA performed similarly with regard to bias and precision, but ASAP is somewhat more flexible. For Georges Bank Yellowtail, it was pointed out that other work that simulated data over longer time series showed bad fits of ASPIC as well.

One participant wondered whether the differences in the behaviors of the models was related to the weightings of different data components was the cause. It was pointed out that a simpler model like AIM would put zero weight on some data components. One panelist wondered whether changes in the signal could be picked up with the age-structured models, but the presenter pointed out that, while this is true, which data component was the cause would still be unknown. However, one reviewer pointed out that detecting these changes is more difficult with the simpler model AIM, but perhaps this could be modified to do so. It was also pointed out that the behavior of SCALE not being any better than other models was somewhat surprising since selectivity is set up as a function of length in POPSIM.

Working Paper 2.4: Brooks, L., C. Legault, P. Nitschke, L. O'Brien, K. Sosebee, P. Rago and A. Seaver A. 2008. Evaluation of NMFS Toolbox Assessment Models on Simulated Groundfish Data Sets. Section b on White Hake

Rapporteur: Ralph Mayo

Discussion on Working Paper 2.4: Section b on White Hake

Poor performance of AIM relative F estimates is likely to have been a re-scaling problem associated with conversion procedures used to back transform relative F to original units. Ageing error per se should not have an influence on AIM results since it uses pooled estimates of biomass.

Working Paper 2.4: Brooks, L., C. Legault, P. Nitschke, L. O'Brien, K. Sosebee, P. Rago and A. Seaver A. 2008. Evaluation of NMFS Toolbox Assessment Models on Simulated Groundfish Data Sets. Section c on Georges Bank Cod

Rapporteur: Jessica Blaylock

Discussion on Working Paper 2.4: Section c on Georges Bank Cod

Some clarification was provided as to the plus group in this analysis (10), in relation to the dome selectivity pattern.

There was discussion concerning why ASAP did not do better with the fleet domed PR. This was because a single logistic growth was estimated, so the flat-topped pattern was forced. This was accepted to be an important question, and that one should also look at the confidence intervals in this context.

Recommendations on Model Selection for each stock

Working Paper 5.1: Rago P, et al. 2008. Recommended Modeling Approaches by Stock Initial Proposals for Consideration by the GARM III Review Panel.

Rapporteurs: Mike Palmer and Kathy Sosebee

Presentation Highlights

This Working Paper provides a review of initial recommendations of analysts for preferred assessment models. The appropriate assessment model for each stock is influenced by attributes of the species and their fisheries, and the ability of the model to capture the salient features of the stock dynamics. A primary consideration is the availability of age data. Before 1995 the selection of models for Northeast groundfish was less complicated because fishing mortality greatly exceeded natural mortality and incoming cohorts were quickly fished out. Various management measures reduced fishing mortality and altered the spatial pattern of fisheries. In particular, large closed areas on Georges Bank differentially affected more sedentary species which would benefit from the reductions in F afforded those fish which remained in closed areas. Increases in abundance for some stocks such as Georges Bank yellowtail flounder and haddock were dramatic. As population age structure broadened, the importance of model features such as plus groups became more important as the number of ages in the plus group increased. Model assumptions that were tenable under high F became less so with reduced F . This has motivated the exploration of a class of forward projecting models that allow greater flexibility for characterizing recent trends and extension of assessments back to periods when landings were much greater.

Individual stock dynamics were summarized with six-panel plots that illustrate the relationships among survey abundance, catches, relative F and replacement ratios. High correlations between the replacement ratio and relative F suggest that the population's rate of growth is responsive to the rate of removal. In turn this suggests that parametric models may be applicable. Disparities that arise at the end of a time series are also important and may be indicative of process changes that lead to retrospective patterns.

These recommendations herein will be reconsidered during the meeting as the results of alternative models and simulation tests are reviewed by the Review Panel.

Two appendices were included. The first examined statistical properties (mean, CV, Gini indices, and estimated design effect) of the NEFSC fishery-independent bottom trawl surveys. The second provided an overview of the AIM (An Index Method) model and an example application.

Working Paper 6.1: Rago P, et al. 2008. Sufficiency of Assessment Models to Estimate Measures of Stock Status Relevant to Biological Reference Points

Presentation Highlights

The definition of Biological Reference Points (BRP) for fish stock is an essential component of stock assessment. Measures of abundance and harvest rates derived from assessment models are compared to standards that constitute desirable states for each stock. These states are designed to achieve maximum sustainable yield and may include some consideration of uncertainty in estimation. For stocks that are subject to mandatory rebuilding programs, the assessment model must produce outputs that can be forecast under various harvest scenarios. This working paper summarizes the basic approaches for estimation of BRPs associated with the candidate models and highlights special considerations associated with reference point estimation.

Biological reference points can be derived as part of the model identification and estimation process. These can be called internal estimates of BRPs as they rely on specification of stock recruitment relationship within the assessment model. The derived parameters can either be used to directly define reference points or, where analytical solutions are more complicated, to parameterize simulation or forecasting models to derive BRPs and measures of uncertainty. Internal estimates are advantageous since they incorporate the full uncertainty of the model estimation. This can also be a disadvantage when the model does not fit particularly well. In these cases, the BRPs can be unstable, varying with minor changes in model configuration.

“External” estimators of BRPs use model outputs of abundance, SSB, recruits and fishing mortality as inputs to stand-alone models. In the Northeast these include stock recruitment models (SRFIT), yield per recruit models (YPR), and stochastic population projection models (AGEPRO). The SRFIT program uses AIC methods to identify appropriate models from either Beverton-Holt or Ricker stock-recruitment models with and without correlated error terms. When an acceptable model can be defined, standard approaches can be used to estimate F_{msy} and B_{msy} values.

If none of the parametric models are acceptable, a nonparametric method is used to estimate proxy values for F_{msy} and B_{msy} . These proxies are derived by combining standard yield per recruit (YPR) and SSB per recruit (SSB/R) methods with model based estimates of absolute recruitment. Model parameters can be used to define appropriate partial recruitment vectors for YPR analyses leading to estimates of F_{max} . F_{max} serves as a proxy for F_{msy} . SSB/R estimates for $F=F_{max}$ can be multiplied by some function of the recruitment time series to obtain an estimate of SSB_{msy} or B_{msy} . The term “some function” can imply a simple mean of the recruitment series, a measure of central tendency, or a restricted . Consideration of ecosystem conditions, trends in other populations or evidence of environmental trends can be relevant. A simplified overview of the candidate models used for estimating stock status and their relationship to biological reference points is provided.

Discussion on Working Papers 5.1 and 6.1 (stocks ordered as per working paper 6.1)

Georges Bank Cod

The Panel recommended inclusion of historical catch (back to 1930s) and surveys (back to 1963) in the calculation of biological reference points to provide additional information on stock productivity. Presence of the retrospective pattern in the VPA suggests that after 1995, there may have been changes in the fishery selectivity. There were major changes to the management structure (closed areas, mesh size) at this time which may explain these changes. The Panel felt that model formulations should be examined which investigated changes to the selectivity curve, particularly with regards to the older age classes in the recent time period (post 1995). No preference was given to whether changes in selectivity were examined in a VPA or SCAA model.

Georges Bank Haddock

The Panel recommended including catch (landings and discards) back to 1930's referring to the VPA performed on historical data in Clark et al., 1982. It was also recommended that model formulations be explored that consider changes in selectivity over time with a particular focus on the recent time period. A recommendation was made by the Panel to explore a domed shaped selectivity pattern though the specifics were not discussed. It was pointed out that recent changes in size at age will have ramifications on the calculation of the biological reference points. There was discussion on a parametric vs. nonparametric fitting of the stock recruit relationship, noting that a non-parametric approach was chosen the last time biological reference points for this stock were discussed (NEFSC, 2002b) which suggests that this may be required again. This requires exploration.

Georges Bank (GB), Southern New England -Mid-Atlantic (SNEMA) and Cape Cod- Gulf of Maine (CCGoM) Yellowtail Flounder

The Panel did not recommend any changes to the current Major-Change Georges Bank VPA model (split survey q's). This is the same model formulation accepted during the most recent TRAC benchmark review (TRAC, 2005). The Panel supported efforts to build on the current formulation of the model to resolve observed retrospective patterns. The Panel recommended splitting the time series for the SNEMA and CCGOM stocks to resolve observed retrospective patterns in these assessments. The suggested areas of exploration included (1) investigation of spatial differences in the survey selectivity and/or environmental covariates (temperature) which may explain changes; (2) partial recruitment of the plus-age groups (particularly with regards to the uncertainty in the catch-at-age of the SNE stock); (3) using selectivity blocks; (4) changes in productivity/regimes over time (particularly with regards to severe decline of SNEMA stock). There was some concern that the Major-Change model is not based on an accepted causative process but rather based upon removal of the retrospective pattern. The Panel felt that their responsibility was to recommend which models can be used to offer sound management advice. The Panel made no recommendations on whether explorations should be performed with ASAP or ADAPT which is a software choice based upon ease of use.

Gulf of Maine Cod

The panel discussed whether there was large error in the catch-at-age (CAA). Large recreational catch may result in larger than normal error in CAA. Inclusion of discards may also

increase the error due to management actions (i.e. 30 lb trip limit in 1999). However, the coefficients of variation (CVs) on ages 3-5 in the landings are less than 10% while other ages are between 20 and 30%.

There is a weak and inconsistent retrospective pattern for this stock, although the formulation of VPA tends to produce some high fishing mortality (F) on certain ages.

It may be worth changing the assumption on F at oldest age to explore dome-shaped partial recruitment. If a dome appears, a hypothesis is needed to explain the domed selectivity. It may be useful to conduct a risk analysis on the assumption of a dome when flat-topped and vice versa. It may also be useful to examine the tagging data for independent confirmation of a dome and it may be useful to extend the age composition to explore the dome hypothesis.

The Panel found no compelling reason to switch models other than extending the series of catch and survey back in time when reviewing biomass reference points. The landings data prior to the 1930s may not be useful since these data were prorated using stock splits which may or may not have been the most appropriate values. Even with VPA, stock size estimates may be hind-cast using survey data back to 1963 to develop reference points.

Formulation of stock-recruit relationship is important for reference points including whether the relationship is fit internal to the model or externally. The Ricker model provided a good fit but there are may be other issues such as the extreme peak in recruitment (1987 year class). The value for gamma ranged from 0.5 to somewhat over 1. The Panel recommended estimating reference points both externally and internally to examine if there is a difference or if either are appropriate.

Witch Flounder

The Panel recommended exploring the reasons for the retrospective pattern that is seen in this stock. There are no compelling reasons to switch from VPA to SCAA unless this would make it easier to do the exploration.

American Plaice

The Panel discussed the potential problem of combining the data for the Gulf of Maine and Georges Bank portions of the stock. If the relative proportion between the two areas is stable, it is not a problem to combine them. The Panel recommended examining the survey trends for the two areas separately. If the trends are similar, the assessor could continue with a single catch-at-age in either VPA or SCAA. If the trends are different, there is a need to separate the CAA into two areas. Since the discards may not be well-determined, it may be better to move to an SCAA but the separability assumption needs to be explored.

Gulf of Maine Winter Flounder

The Panel recommended exploring the SCALE model since the year-classes which seem to track in the length composition do not appear to track in the age composition. There may be some smearing in the age-length keys. The sex ratio effect on the retrospective pattern was very slight if there were very strong differences between sexes. Something else appears to be causing the pattern. The Panel recommended examining implied fishing effort resulting from the model compared to reported effort in the area. There appear to be conflicting patterns between the recruitment time series and the biomass time series. A risk evaluation may be needed to choose between the consequences of believing one or the other.

Southern New England Winter Flounder

The Panel recommended exploring the reason for the retrospective pattern. It appears that it may be a transient effect that may now be gone. If additional years of data do not make the retrospective pattern reappear, then nothing more is needed. If the pattern reappears, then the assessor should split the survey series at a reasonable time (e.g. 1994). It may be useful to examine if a robust likelihood might remove the retrospective pattern because some of the indices may be very influential as years in the retrospective analysis are dropped.

Georges Bank winter flounder

The Panel recommended exploring age-based assessment with ASPIC as fall-back model. It felt that the stock is a candidate for a separable model (SCAA) due to the uncertainty in the CAA during the middle of the time series. However, without first examining results, it was not possible to assess the utility of this approach. The Panel recommended that one approach be chosen and if there are no problems observed then there is no need to explore an alternative approach.

White Hake

The Panel recommended assessing white hake using the SCALE model. It was recognized that there exist problems differentiating between red and white hake in the commercial fishery, particularly with regards to discards. The Panel recommended that the speciation problem should be examined by using survey data to speciate small (< 60 cm) fish and calibrate these results with observer data. There is a potential for sexual dimorphism that may confound a SCALE model and this should be considered. The Panel recommended using all available information as SCALE allows tuning to age data. To ensure that a bridge exists from AIM to SCALE, the Panel recommended running SCALE on the existing data set.

Pollock

The Panel recommended staying with AIM for the current assessment but to provide reasonable justification for selection of reference points. The Panel recommended exploring a state-space production model and examining recruitment variability. The desire for US / Canada scientific collaboration was noted, particularly on the stock assessment.

Redfish

The Panel had questions on the current state of the fishery. It was clarified that there is currently no market. The historical market was driven by a few-centrally owned vessels and once these vessels left the fishery, they were not replaced. Current commercial groundfish gear does not catch sufficient fish to supply a market and there exists no small mesh targeted fishery. Use of an age-structured model was recommended based on strong evidence for infrequent large pulse recruitment which persists for decadal time periods. The major recommendations for model formulation were to relax separable assumptions and use a S / R steepness estimate from west coast species (e.g., Pacific ocean perch), allow σ_R to vary (and go large), but make σ_R small where data are uncertain. The Panel expressed a desire to see an SCAA run performed as a check of the current RED model. An additional suggestion was to investigate an externally derived surplus production model (e.g., Jacobson approach).

Ocean pout

The Panel recommended exploring other models that consider uncertainty in the relative F (e.g., Glazer, 2008) and/or better incorporate available biological information on the species life history parameters such as a Bayesian biomass dynamics model or catch-at-age model with fixed parameters. It was felt that these approaches could be useful in providing management advice. Sufficiency of available age data upon which to construct a growth relationship to support the later recommendation should be explored.

Gulf of Maine / Georges Bank (GOM/GB) and SNE / MA Windowpane Flounder

Discards are important for both stocks. The Panel recommended exploring the use of SCAA in a Collie-Sissenwine formulation as the assessment model, particularly for the GOM/GB stock as AIM is problematic. For SNE/MA windowpane flounder, AIM is an acceptable model.

Gulf of Maine Haddock

The Panel recommended exploring an age-structured model if time permits. Otherwise, AIM is acceptable. The Panel recommended exploring the spatial distribution of the catch and the surveys to determine if the high values of landings and survey catches may be spillover from the Great South Channel area. This may affect the perception of the productivity of this stock. There appears to be a difference in survey selectivity between fall and spring possibly due to large fish spawning in the spring in areas not sampled by the spring survey.

Halibut

The Panel recommended extending the model to fit to the survey trend and input of a productivity parameter and landings prior to 1893. This probably should be assessed with the Canadian coastal stock of halibut as tagging studies have shown large migrations to Canadian waters.

Appendix 8. Glossary of Terms

Term	Definition
Age-structured Models	Class of assessment models which incorporates age and sometimes size information into the estimation of stock status
Biomass Pool Models	Class of assessment model which does not consider the age structure of a stock but rather describes the relationship between its standing biomass, changes in this due to losses (natural mortality) and additions (recruitment and growth) and yield. The ASPIC software package is commonly used for these models.
Catchability	The parameter (q) relating an index of abundance (e.g. survey) to the stock abundance or $I = q N$. It is thus a measure of the survey's ability to sample the stock. Generally, the higher the parameter q , the more 'catchable' the fish. The catchability can be either of a group of ages or specific to a defined age e.g. survey catchability at age 5. Typically, changes in q are considered over time while changes in q over age are synonymous with selectivity (a combination of gear vulnerability and availability).
Relative Trends models	Class of assessment model which does not include a parameter for catchability (q) and thus only describes relative as opposed to absolute trends in stock size and fishing mortality. The terms 'index-based' and an 'index method' (AIM) have been used for these models although most assessment models use indices.
Partial Recruitment (PR)	The degree of availability of a stock's age or size group to fishing with one time period on a zero to one scale. Thus a PR of 1.0 for age 5 fish indicates that all age 5 fish are available to being caught – they are 'fully recruited' to the fishery. A PR of 0.5 for age 5 fish indicates that this year – class is only 'partially recruited' to the fishery as only 50% are available to being caught. PR, sometimes called selectivity, is a function of gear vulnerability and availability.
Plus group	Aggregation of data on year classes above a specific age into one grouping. For instance, an age five plus group indicates that the data (e.g. population or catch numbers) on all age five and older fish are aggregated into this group.
Retrospective Pattern	Systematic under - or over – estimation of stock related parameters (typically abundance, biomass and fishing mortality) produced by assessments as additional years of data are added. For instance, an assessment in 2003 might estimate the 2003 fishing mortality to be 0.4 while the assessment in 2008 might estimate the now historical fishing mortality to be 0.8. This under-estimation of fishing mortality by the assessment model, if systematically consistent, is termed a retrospective pattern.
Risk Assessment	Formal process which uses the impact of an hypothesis and the probability of this hypothesis to measure the risk of specified objectives not being met.
Selectivity	The degree of availability of an age or size group of fish to a survey or fishing. When scaled to the group fully selected, this and the partial recruitment are equivalent.

Selectivity blocks	Blocks of years in assessment tables in which the selectivity at age is considered to be the same for all years. Validity of the ‘Separable Assumption’ is a key feature of the sub-class of assessment models which allows error in the catch-at-age (e.g. SCAA)
Separable assumption	The fishing mortality on an age or size group is considered to be the product of two terms – one age and the other time (typically year) related. The fishing mortality is ‘separable’ into an age and time effect. This assumption is typically employed in the class of assessment models which allow errors in the catch-at-age (e.g. SCAA).
Statistical Catch-at-age (SCAA)	Assessment model which allow errors in the catch-at-age. Using values on stock abundance at some age for each year class, and fishing mortality derived from a separable assumption for specified selectivity blocks, calculates population abundance at age. Comparisons between predicted and observed catch-at-age and abundance indices are made for model fitting. ASAP and SCALE are software packages which allow exploration of this sub-class of model.
Stock - recruitment Relationship (S/R)	Relationship between a stock’s spawning biomass and the ensuing recruitment. Two of the most widely assumed S/R relationships are that of Beverton & Holt and Ricker. They differ in the degree of density dependence assumed occurring in the stock, with the latter having a stronger negative relationship between density dependence and stock size.
Virtual Population Analysis (VPA) And Cohort Analysis (CA)	Assessment models which assume negligible error in the catch-at-age. Using values on stock abundance at some age for each year class and the observed catch-at-age, calculates population abundance at age. Comparisons between predicted and observed abundance indices are made for model fitting. VPA and CA differ by the precise form of the calculating catch equation. ADAPT is a software package used to implement VPA.

**Panel Summary Report
of the
Groundfish Assessment Review Meeting
(GARM III)**

Part 3. Biological Reference Points

**By
Chairman: Robert O’Boyle
Review Panel: Michael Bell, Stratis Gavaris, Vivian Haist, Stuart
Reeves and Grant Thompson**

**Including Presentation Highlights for each Working Paper written
by the lead Assessment Scientists**

Report Date: 6 June 2008

**Meeting Dates and Location:
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SUMMARY

The Biological Reference Points which will be used in the assessments and rebuilding plans of 19 New England groundfish stocks being considered in the 2008 Groundfish Review Assessment Meetings (GARM) were reviewed at the Northeast Fisheries Science Center in Woods Hole, Massachusetts during 28 April – 2 May 2008. The review considered the influence of retrospective patterns in parameter estimates (e.g. fishing mortality, biomass, and/or recruitment) from assessment models on the computation of biological reference points and on the specification of initial conditions for forecasting. It also considered recent and historical trends in the productivity of each stock, including trends in pertinent environmental variables that might be related to the trends in those biological parameters relevant to the biological reference points. In relation to the latter, the review considered the overall production potential of the fishery based on food chain processes and commented on aggregate single stock yield projections in relation to overall ecosystem production. The majority of the review focused on updating or redefining the fishing mortality and biomass threshold reference points or proxies for each of the 19 stocks.

This was the third meeting of a four part process, the first being on data inputs (29 October – 2 November 2007), and the second on assessment models (25 – 29 February 2008). These three meetings will inform the review of the assessments to be undertaken during 4 – 8 August 2008. The GARM process has been designed so that each review can inform subsequent ones.

The body of this report consists of the recommendations of a six member review panel in response to the meeting's terms of reference. The report also includes a synopsis of each of the working papers presented at the meeting along with the associated discussion, during which suggestions and recommendations were made to address identified issues. The Panel considered these in drafting this report.

Overall, the meeting generally fulfilled its terms of reference and represents an important contribution to the GARM III process.

INTRODUCTION

This document is the summary report of the review Panel (herein termed the ‘Panel’) of the Groundfish Assessment Review Meeting (GARM) on biological reference points (BRPs). The GARM is a regional scientific peer review process developed in 2002 to provide assessments for the stocks managed under the Northeast Multispecies Fishery Management Plan (Multispecies FMP). The first two GARMs took place in October 2002 (NEFSC, 2002a) and August 2005 (NEFSC, 2005) respectively. This GARM III is the most comprehensive to date, intended to provide peer reviewed assessments on 19 groundfish stocks managed by the New England Fisheries Management Council (NEFMC).

The four meetings of GARM III include:

- Data Inputs (29 Oct – 2 Nov 2007)
- Assessment Methodology (25 – 29 Feb 2008)
- Biological Reference Points (28 April – 2 May 2008)
- Assessments (4 – 8 August 2008)

The first three meetings are to establish the analytical formulations of the assessments to be used in the last meeting. The first meeting (NEFSC, 2007) focused on the data inputs (e.g. catch, sampling, surveys, etc) to be used in the assessments. The second meeting considered the assessment approaches to be applied to the datasets of each stock discussed at the first meeting. The third meeting, which is the focus of this report, focused on the fishing mortality and biomass biological reference points (BRPs) to be used in the assessments and rebuilding plans of the 19 GARM III stocks (see Terms of Reference, appendix 1). The meeting also considered the influence of retrospective patterns in parameter estimates from the assessment models on the computation of the BRPs and on the specification of initial conditions for forecasting. It considered recent and historical trends in the productivity of each stock, including trends in pertinent environmental variables that might be related to the trends in those biological parameters relevant to the biological reference points. In relation to the latter, the review considered the overall production potential of the fishery based on food chain processes, estimated the aggregate yield from the ecosystem and commented on aggregate single stock yield projections in relation to overall ecosystem production.

After introductions (see meeting participants, appendix 2) on Monday morning, the meeting started (see agenda, appendix 3) with an overview of the methods and estimates of the current BRPs. Stochastic simulation in rebuilding projections and the consequences of these for BRPs was then discussed. This was followed by consideration of the working papers to address terms of reference 2 (trends in stock productivity). Much of the Monday afternoon was devoted to consideration of the working papers for Terms of Reference 3 (ecosystem approaches) with the day ending with discussion on two working papers on specific aspects of Terms of Reference 4. On Tuesday morning, working papers on terms of reference 1 (influence of retrospective patterns) were first considered with the rest of the meeting until Thursday afternoon devoted to terms of reference 4 (BRPs by stock). No working papers were explicitly devoted to addressing Terms of Reference 5 (forecasting models). On Friday, the Panel held a closed session on the contents of its report. The GARM review Panel consisted of Mike Bell, Vivian Haist, Stuart Reeves, Stratis Gavaris, Grant Thompson and the chair, Robert O’Boyle. The first three reviewers were assigned to the review by the national Center of Independent Experts (see

statement of work for these CIE reviewers in appendix 4) while the last three were invited by the Northeast Fisheries Science Center (NEFSC). All were invited based upon their extensive expertise and experience with the issues considered by the meeting.

The presentation highlights of each working paper (appendix 5) and the ensuing discussion as recorded by assigned rapporteurs are provided in appendix 6. These were important reference material to the Panel in drafting its report.

The focus of the meeting's review was the BRPs for each of the 19 groundfish stocks. No attempt was made to review the status of the 19 stocks, which are the terms of reference of the August GARM, although the results from models to assess status are used in models to derive BRPs. The meeting often considered a range of models and made recommendations that could result in changes to the BRPs to be considered at the August GARM review. The review focused its attention on fishing mortality and biomass MSY reference points and their proxies.

PANEL RESPONSE ON TERMS OF REFERENCE

ToR 1. Influence of retrospective patterns on the computation of BRPs and on specification of initial conditions for forecasting

Retrospective patterns in assessment results may be caused by an unrecorded change in catches, a change in natural mortality, a change in the abundance index catchability (q) and/or a change in fishery selectivity. To properly account for a retrospective pattern, it is necessary to know the cause. The Panel recommends that plausible hypotheses about the cause of a retrospective be investigated and an adjustment to account for the retrospective should be made if possible. There may be cases however, where an acceptable adjustment cannot be made, leaving assessment results that display retrospective patterns of a magnitude that is consequential.

There is currently no generally agreed methodological approach that can be used to develop a basis for management advice that accounts for a retrospective pattern in the assessment results. The Panel reviewed analyses that addressed only the latter aspect of terms of reference one (methods for adjusting initial conditions for forecasting when the stock assessment exhibits a retrospective pattern). Two approaches were considered

- adjust the fishing mortality (F) in the quota year by the amount of retrospective seen in the F and
- adjust the initial population to account for the retrospective pattern seen in the population numbers

The latter approach has more merit, is easily implemented and can be applicable for evaluation of rebuilding scenarios, and therefore it was favored by the Panel. While it may be imprudent to adjust for a retrospective pattern without having determined the cause(s), basing management advice on assessment results that display a retrospective pattern implicitly assumes that the terminal estimates are in error whilst the calculated values back in time are correct.

In relation to the determination of stock status, in cases where an acceptable adjustment to the assessment model cannot be made (leaving assessment results that display retrospective patterns of a magnitude that is consequential), the Panel recommends the following practice:

- adopt the default that the terminal estimates are in error whilst the calculated values back in time are correct
- check the age specific retrospective patterns to determine the age range where the magnitude is consequential
- adjust the population numbers for the terminal year of the Virtual Population Analysis (VPA) (initial year of the projection) to account for the retrospective pattern seen in the population numbers
- conduct projections using the adjusted population numbers

The burden of proof is placed on the analyst to demonstrate that an alternative practice performs better. Further, it is suggested that performance against the rebuilding trajectory be checked more frequently for stocks that display a consequential retrospective.

While there were no specific analyses on the influence of retrospective patterns in assessment results for the computation of BRPs, results were presented for several stocks using both models that displayed a retrospective and models that used ‘split’ survey indices to account for the retrospective. Most of these models used a VPA, but not all. In general, the patterns in the stock - recruitment relationships were not altered greatly by the adjustments made to account for the retrospective pattern.

Thus, in relation to the derivation of BRPs, in cases where an acceptable adjustment to the assessment model cannot be made (leaving assessment results that display retrospective patterns of a magnitude that is consequential), the Panel recommends that corrective measures do not have to be taken for the computation of BRPs.

ToR 2. Trends in Stock Productivity

A majority of the GARM III stocks show appreciable trends in recent growth (length- and weight-at-age) and maturation, with a general trend towards reduced growth and delayed maturation. The relative influence of density-dependent and environmental factors on these life history characteristics has not been assessed; compilation of a number of environmental variables for GARM III will facilitate further work in this area, possibly with a meta-analysis approach to increase statistical power.

For most GARM III stocks, BRPs were calculated using the mean of the most recent five years for weights-at-age, partial recruitment (fishery selectivity), and maturity ogive. Where there were no long-term trends in some of these parameters (most commonly the maturity at age), the whole time series was used. These should provide the best estimates of short to medium term stock productivity, and are therefore appropriate for BRP calculations. For stocks that exhibit strong recent trends (eg. GB haddock weight-at-age) the five year averages may not be appropriate for stock projections or rebuilding scenarios. For those cases, the most recent estimates or forward projection of the trends may provide more accurate estimates of future (short-term) life history parameters.

For the GARM III stocks, the recruitment series used to calculate BRPs were selected to reflect the long-term stock productivity. A number of the stocks exhibit poor recruitment and low spawning stock abundance in recent years, and it is unclear if the reduced recruitment is caused by environmental or stock conditions. If lower recruitment is the result of a shift in environmental conditions which persists, BRPs calculated based on higher average recruitment levels may be unattainable. However, the burden of proof must lie on demonstrating that recent

lower average recruitment is related to environmental changes rather than low spawning stock abundance, before adjustments are made to BRPs.

Stock projections and rebuilding scenarios should use the same recruitment assumptions as used in calculating BRPs. However, environmental or depensatory stock-recruitment effects may imply that short-term rebuilding targets are unattainable even with no or little fishing pressure.

ToR 3. Ecosystem Approaches to Gulf of Maine / Georges Bank Fisheries

The Panel noted the following key conclusions from the five working papers presented:

WP3.1 (worldwide cross-system comparison): “Results from this study suggest that on an ecosystem basis, current biomass management targets (B_{MSY}) for GARM, pelagic, and elasmobranch fishes are not unreasonable. The current targets compare favorably with the results of current and historical studies in the region and are also in general agreement with results of many studies for other worldwide ecosystems.”

WP 3.2 (energy budget contextualization): “It is unclear if B_{MSY} for all species will be energy limited from a systemic perspective.... We conclude that this method and the results from it, although interesting, remain inconclusive to answer the primary question. That is, although we may have achieved balance of the network, some structural caveats and misunderstandings of this modeling package likely remain on our part.”

WP 3.3 (aggregate surplus production estimation): “Overall the results from both surplus production modeling approaches suggest that the expected aggregate yield is lower, the B_{MSY} biomass is lower and the overall fishing mortality rate should be lower for the GARM stocks as a whole than is suggested from the single species results.”

WP 3.4 (aggregate and multi-species production simulation): “With respect to the main question at hand — can we have all species at B_{MSY} simultaneously?— these results imply that we may not. Particularly as seen in the differential fishing scenario, it is possible to have all members of a group at or close to their K (and by extension B_{MSY}), but likely not all groups at that level (K or $K/2$) simultaneously.... Additionally, the aggregate scenarios produce more conservative results than the MS (i.e. multispecies) simulations, implying that there may be some systemic or model structural limitations in the aggregate that are more fully captured than when a more species-specific approach is employed.... The main point of this work is to emphasize the importance of including species interactions.... Often harvest was the lowest source of fish ‘loss’ compared to species interactions.”

WP 3.5 (fishery production potential): “If we take a mean trophic level of the catch of 3.2 and a 30% exploitation rate, then the MSY levels in the partial accounting above comprise 83% of the estimated production potential.... These estimates do not include allowance for landings of species not included in partial accounting above. Nor do they include discard levels for all species. This suggests that the available demand will be exceeded in both cases when these considerations are taken into account.... Despite the

drop in primary production required over the last two decades, the concomitant drop in mean trophic level results in an overfished classification in 2005.”

These observations and the discussions at the meeting led the Panel to the conclusions below relevant to Terms of Reference 3.

a. Determine the production potential of the fishery based on food chain processes and estimate the aggregate yield from the ecosystem

The working papers provided a range of estimates of fishery production potential (MSY in kt):

WP (model)	GARM species	Pelagic species	Elasmobranchs	Total
3.1	197	354	18	569
3.3	126	422	59	607
(group ASPIC)				
3.3	n/a	n/a	n/a	579
(aggregated ASPIC)				
3.3	110-125	363-445	n/a	473-570
(multi-species)				
3.5	n/a	n/a	n/a	1,550-1,855

The Panel considers that the working papers represent a commendable effort on the part of NEFSC scientists and that the success of this effort in producing the above estimates is evidence of the utility of the methods used. However, the Panel also agrees with the caveats provided in the working papers and therefore suggests that the above estimates be viewed as preliminary, pending the results of further investigations which the authors have proposed to conduct.

b. Comment on aggregate single stock yield projections in relation to overall ecosystem production, identifying potential inconsistencies between the two approaches

The working papers provide evidence in support of multiple, and occasionally conflicting, hypotheses regarding the relationships between estimates produced by single-species and multi-species or aggregated models. For example, WP3.1 found that estimates of B_{MSY} obtained from single-species models were generally concordant with estimates obtained by cross-system comparisons; whereas WP3.2 found the results to be inconclusive; WP3.3, WP3.4, and WP3.5 found that the ecosystem is unlikely to be able to sustain all stocks at their single-species B_{MSY} levels simultaneously. However, the authors of these working papers generally feel that “the aggregate production model results for GARM species are the elements most immediately applicable for evaluating GARM species reference points from a multispecies/ecosystem perspective”. The aggregate production model for the GARM species provided in these working papers results in an aggregate B_{MSY} estimate that is about one-half the value obtained by summing the estimates from species-specific production models, while the aggregate MSY is about two-thirds the value obtained by summing the estimates from species-

specific production models. The aggregate F_{MSY} estimate (0.17) is also indicated to be lower than most estimates from single-species models, although the comparability of F_{MSY} values from production models and age-structured models is not clear, due to the effects of partial recruitment (selectivity) and it is based on a biomass rather than a numbers currency.

As with TOR 3a, the Panel considers that the working papers represent a commendable effort on the part of NEFSC scientists and that the success of this effort in producing the above estimates is evidence of the utility of the methods used. Most of the results seem to suggest that current estimates of B_{MSY} are too high. Although the Panel believes that these results are too preliminary to implement at the present time, a precautionary approach would suggest that further research be encouraged and expedited to determine if this finding is correct. The authors have proposed to conduct such research, and the Panel endorses this proposal. In particular, the Panel suggests that future research should involve a formal Management Strategy Evaluation, including consideration of statistical uncertainty. Given that most of the working papers seem to indicate that the sum of single-species B_{MSY} levels cannot be sustained, and given that most of the GARM III stocks are currently somewhat below B_{MSY} , another aspect of the question meriting further investigation concerns the mechanism(s) by which the ecosystem was able to support pre-overexploitation levels of biomass for the GARM III stocks in the first place.

ToR 4. Biological Reference Points by Stock

General Considerations

Overfishing and Overfished Biological Reference Points

For the management of the GARM III stocks, status determination with respect to overfishing and overfished is evaluated using F_{MSY} or its proxy and B_{MSY} or its proxy respectively. If a stock is determined to be overfished, a rebuilding fishing mortality (F) must be specified that achieves a 50% chance or greater that spawning stock biomass (SSB) will exceed B_{MSY} in the prescribed time frame. Fishing at F_{MSY} will not necessarily result in a 50% chance that equilibrium SSB will exceed B_{MSY} if the error distributions for stochastic processes are not symmetric. This observation has led to a perceived inconsistency. This perceived inconsistency was addressed in the working papers by adopting a particular estimator of B_{MSY} based on stochastic long-term projections with the recruitment stream feeding into the projection empirically by resampling from all or a subset of the observed recruitments, or parametrically by putting lognormal error on the predicted recruitment at F_{MSY} . This procedure (herein termed ‘stochastic projection’) was used for determining the biomass reference points of the 19 GARM III stocks under review. The estimator of B_{MSY} adopted in the working papers was the median long-term SSB obtained when the stock is fished at the deterministic estimate of F_{MSY} . In some cases, the resulting estimates of B_{MSY} were greater than the deterministic estimate of B_{MSY} , by varying amounts, while in others, the resulting estimate of B_{MSY} was less than the deterministic estimate. While addressing the perceived inconsistency, the Panel notes the following complications with the procedure:

- Federal Guidelines for National Standard 1 under the Magnuson-Stevens Fishery Conservation and Management Act (Restrepo et al., 1998) explicitly define F_{MSY} as the

constant F that maximizes long-term average (not median) yield and B_{MSY} as the long-term average (not median) stock size when the stock is fished at F_{MSY} . While the Guidelines allow for the use of proxies in cases where information is insufficient to estimate the quantities contained in the definitions directly, the Panel wondered whether changing the biomass BRPs from “average” to “median” might pose a difficulty in terms of compliance, given that estimation of the average does not require any more information than estimation of the median.

- The stochastic projection may place high reliance on the dispersion of an empirical cumulative frequency distribution that is based on few observations. Characterizing dispersion is generally more demanding than characterizing central tendency. For the parametric approach, it is necessary to assume a distributional form for the errors, typically lognormal, and the results are sensitive to the reliability of the estimate of the variance for this distribution. This complicates interpretation of the B_{MSY} proxy and may be contentious.
- When no parametric model of the stock-recruitment relationship is considered suitable for BRP estimation (as was the case for all or nearly all of the GARM III stocks reviewed), mean SSB is straightforward to compute, being simply the product of average recruitment and SSB/R. Moreover, in the case where the recruitment distribution is lognormal, the ratio between stochastic B_{MSY} and deterministic B_{MSY} is straightforward, being $\exp(\sigma^2/2)$. Computation of median SSB, on the other hand, requires stochastic projection as described in working paper 4.2 (AGEPRO), and there is no simple formula for the ratio between stochastic B_{MSY} and deterministic B_{MSY} .

The Panel noted that, when no estimate of the stock-recruitment relationship is available and the recruitment distribution is lognormal, simulations indicate that the median SSB is typically very close to, albeit less than, the mean SSB. This suggests that the estimates of B_{MSY} provided herein are, for the most part, likely to be close to the estimates that would have been obtained had the mean been used rather than the median.

The Panel therefore decided to accept the estimates of B_{MSY} provided by the stochastic projections, but suggested that the NEFSC consider the following alternatives when preparing the final assessments:

- Estimate B_{MSY} by the mean rather than the median; and
- In cases where an estimate of the stock-recruitment relationship is available, estimate F_{MSY} by maximizing the long-term average yield rather than the long-term deterministic yield.

The Spawning Stock Biomass – Recruitment Relationship and Estimation of BRPs

The specification of F_{MSY} and B_{MSY} relies on a stock recruitment relationship. In making recommendations for reference points of F_{MSY} or its proxy and B_{MSY} or its proxy, the Panel adopted the following procedure as the default:

- If the recruitment and spawning stock biomass derived from the assessments are informative about a relationship, the Panel recommended use of the stock-recruitment relationship to

compute F_{MSY} and B_{MSY} using the parametric projection approach (herein termed the ‘parametric’ approach)

- If the recruitment and spawning stock biomass derived from the assessments are not informative about a relationship, the Panel recommended use of $F_{40\%MSP}$ as a proxy for F_{MSY} (NEFSC, 2002) and a B_{MSY} proxy computed using the stochastic projection approach (herein termed the ‘non-parametric’ approach)

The burden of proof was placed on the analyst to demonstrate that an alternative approach to that used by the Panel is more appropriate. Unfortunately, the recruitment and spawning stock biomass derived from most assessments did not display compelling support for any particular functional form of stock recruitment relationship and parameters are generally poorly determined. Therefore, the non-parametric approach was generally adopted. This required inspection of the stock – recruitment relationship to choose the stream of recruitment for the stochastic projection. Specifically, it required a decision on whether or not there was a spawning stock biomass (herein termed ‘breakpoint’) below which recruitment would be diminished. It also required determination of whether or not exceptionally large year-classes occurred which were unrelated to the size of the spawning stock biomass. In these cases, recruitment may be due to some other, perhaps environmental, process. To choose the recruitment stream for the non-parametric stochastic projections, the Panel initially visually inspected the stock – recruitment relationship to determine the breakpoint SSB and then undertook a more objective scan of the recruitment time series to identify the break point as that which minimized the residual variance after taking mean values either side of this break point (‘razor analysis’). The latter resulted in some changes to the breakpoints identified through visual inspection.

On a related note, addressed previously in association with ToR 2, long-term productivity changes stimulated by broader ecosystem changes can influence the relationship between recruitment and spawning stock size. When the Panel considered the recruitment time series to use in the estimation of the BRPs, its choices were more related to data and model estimation issues than potential long-term changes in ecosystem and stock productivity. While the Panel admitted that changes may have occurred, firm evidence was required to suggest that BRPs have changed due to environmental factors rather than fishing impacts. If this could be demonstrated in the future, down-weighting of historical information in the estimation of the BRPs to better reflect productivity conditions both current and in the period of rebuilding would be appropriate.

Overview of Stock-by-Stock Biological Reference Points

The models, data and analytical approaches used to estimate the current BRPs are provided in Table 1. Many of these were developed in reviews held in 1998 (NEFMC, 1998) and 2002 (NEFSC, 2002). Two things become evident in comparison with the models, data and approaches used to update the BRPs at this meeting. First, while some of the stocks originally had BRPs based upon index approaches (e.g. Gulf of Maine haddock), many of these are now based upon age-structured models. This was not possible in all cases (e.g. windowpane and Ocean pout) due to data and/or modeling constraints. Second, the data sets for some of the stocks were extended considerably back in time (1913 for redfish and 1893 for Atlantic halibut). Regarding the model of the stock-recruitment (S-R) relationship, as noted above, the Panel adopted a non-parametric approach for many of the stocks. Only in one case was a parametric approach taken (halibut). The non-parametric derived BRPs were generally based upon a fishing

mortality at 40%MSP (except for redfish) which provided spawning stock biomass per recruit (SSB/R) and in turn, with the chosen recruitment time series (indicated for each stock below), provided the biomass target (B_{MSY}) and yield (MSY) reference points. For the index-based stocks, generally the Relative F - Replacement relationship was inspected for statistical significance and if deemed useful, the biomass reference point proxy was based on survey kg/tow for a period of time when the Replacement Ratio was equal or greater than one. The details on the process of identifying BRPs for these data-poor stocks can be found in the respective working papers of the meeting.

Table 2 provides a comparison of the current with the new BRPs developed at this meeting. Note that the biomass reference points are estimated using the stochastic projection approach noted above. On first glance, it will appear that many of the newly estimated biomass reference points are lower and the fishing mortality reference points higher. Unfortunately, one cannot make a direct one-to-one comparison between the old and new BRPs due to changes in weights and partial recruitment at age. If through a combination of low growth rates and management regulations, the fishery has increasingly exploited older individuals, one would expect, based upon yield per recruit considerations that the fishing mortality reference point would increase. The Panel noted that the communication of the GARM III BRPs by the NEFSC to managers and industry will require careful comparison of these with the current BRPs to ensure that the true nature and reasons for the changes are apparent.

Tables 1 and 2 refer only to the fishing mortality and biomass MSY reference points.

Table 1. Models, data and approaches used to estimate biological reference points both current and developed at the GARM III ‘BRP’ review; stock units are as per text and biomass units are in metric tons

A. Current

Species	Stock	Model	Data used	S_R Model	Bmsy or proxy	Fmsy or proxy
Cod	GB	VPA	1978-2000	Parametric	BH SSBmsy	BH Fmsy
Cod	GOM	VPA	1982-2000	Parametric	BH SSBmsy	BH Fmsy
Haddock	GB	VPA	1931-2000	Non-parametric	SSB/R (F40%MSP) avg R	F 40% MSP
Haddock	GOM	AIM	1963-2000	Equilibrium point	Fall RV msy (5100t) Frep (0.23)	Rel F at Rep
Yellowtail Flounder	GB	VPA	1973-2000	Non-parametric	SSB/R (F40%MSP) avg R	F 40% MSP
Yellowtail Flounder	SNE/MA	VPA	1973-2002	Non-parametric	SSB/R (F40%MSP) avg R	F 40% MSP
Yellowtail Flounder	CC/GOM	VPA	1985-2002	Non-parametric	SSB/R (F40%MSP) avg R	F 40% MSP
American Plaice	GB/GOM	VPA	1980-2000	Non-parametric	SSB/R (F40%MSP) avg R	F 40% MSP
Witch Flounder		VPA	1982-2002	Non-parametric	SSB/R (F40%MSP) avg R	F 40% MSP
Winter Flounder	GB	ASPIC	1963-2000	NA	SP Bmsy	SP Fmsy
Winter Flounder	GOM	VPA	1982-2002	Parametric	BH SSBmsy	BH Fmsy
Winter Flounder	SNE/MA	VPA	1982-1998	Parametric	BH SSBmsy	BH Fmsy
Redfish		RED	1952-1999	Non-parametric	SSB/R (F40%MSP) avg R	F 50% MSP
White Hake	GB/GOM	ASPIC & AIM	1964-2000	Equilibrium point	SP Bmsy	Rel F at Rep
Pollock	GB/GOM	AIM	1963-2000	Equilibrium point	Fall RV	Rel F at Rep
Windowpane Flounder	GOM/GB	AIM	1963-2000	Equilibrium point	Fall RV	Rel F
Windowpane Flounder	SNE/MA	AIM	1963-2000	Equilibrium point	Fall RV	Rel F at Rep
Ocean Pout		Index Method	1968-2000	Equilibrium point	Spring RV	Rel F at Rep
Atlantic Halibut		None	1893-1997	NA	External: MSY/F0.1	Proxy F 0.1 MSY (300t)

B. GARM III

Species	Stock	Model	Data used	S_R Model	Bmsy or proxy	Fmsy or proxy
Cod	GB	VPA	1978-2006	Non-parametric	SSB/R (40%MSP)	F40%MSP
Cod	GOM	VPA	1982-2006	Non-parametric	SSB/R (40%MSP)	F40%MSP
Haddock	GB	VPA	1931-2006	Non-parametric	SSB/R (40%MSP)	F40%MSP
Haddock	GOM	VPA	1977-2006	Non-parametric	SSB/R (40%MSP)	F40%MSP
Yellowtail Flounder	GB	VPA	1973-2006	Non-parametric	SSB/R (40%MSP)	F40%MSP
Yellowtail Flounder	SNE/MA	VPA	1973-2006	Non-parametric	SSB/R (40%MSP)	F40%MSP
Yellowtail Flounder	CC/GOM	VPA	1985-2006	Non-parametric	SSB/R (40%MSP)	F40%MSP
American Plaice	GB/GOM	VPA (2005)	1980-2004	Non-parametric	SSB/R (40%MSP)	F40%MSP
Witch Flounder		VPA	1982-2006	Non-parametric	SSB/R (40%MSP)	F40%MSP
Winter Flounder	GB	VPA	1982-2006	Non-parametric	SSB/R(40%MSP)	F40%MSP
Winter Flounder	GOM	VPA	1982-2006	Non-parametric	SSB/R (40%MSP)	F40%MSP
Winter Flounder	SNE/MA	VPA	1982-2006	Non-parametric	SSB/R (40%MSP)	F40%MSP
Redfish		ASAP	1913-2006	Non-parametric	SSB/R (50%MSP)	F50%MSP
White Hake	GB/GOM	ASAP	1963-2005	Non-parametric	SSB/R (40%MSP)	F40%MSP
Pollock	GB/GOM	AIM	1963-2007	Visual interpretation	External	Rel F at replacement
Windowpane Flounder	GOM/GB	AIM	1975-2007	Visual interpretation	External	Rel F at replacement
Windowpane Flounder	SNE/MA	AIM	1975-2007	Visual interpretation	External	Rel F at replacement
Ocean Pout		Index Method (1998)	1968-2007	Visual interpretation	External	Rel F at replacement
Atlantic Halibut		Surplus production	1800-2006	Implied	Internal	F0.1

Table 2. Fishing mortality and biomass biological reference points both current and developed at the GARM III 'BRP' review; stock units are as per text and biomass units are in metric tons; c/i refers to index-based method (catch / index)

A. Current

Species	Stock	Model	Bmsy or proxy	Fmsy or proxy	MSY
Cod	GB	VPA	216,800	0.18	35,200
Cod	GOM	VPA	82,800	0.23	16,600
Haddock	GB	VPA	250,300	0.26	52,900
Haddock	GOM	Landings & Survey	22.17 kg/tow	0.23c/i	5,100
Yellowtail Flounder	GB	VPA	58,800	0.25	12,900
Yellowtail Flounder	SNE/MA	VPA	69,500	0.26	14,200
Yellowtail Flounder	CC/GOM	VPA	12,600	0.17	2,300
American Plaice	GB/GOM	VPA	28,600	0.17	4,900
Witch Flounder		VPA	25,250	0.23	4,375
Winter Flounder	GB	ASPIC	9,400	0.32	3,000
Winter Flounder	GOM	VPA	4,100	0.43	1,500
Winter Flounder	SNE/MA	VPA	30,100	0.32	10,600
Redfish		RED	236,700	0.04	8,200
White Hake	GB/GOM	AIM	14,700	0.29	4,200
Pollock	GB/GOM	AIM	3 kg/tow	5.88 c/i	17,600
Windowpane Flounder	GOM/GB	AIM	0.94 kg/tow	1.11 c/i	1,000
Windowpane Flounder	SNE/MA	AIM	0.92 kg/tow	0.98 c/i	900
Ocean Pout		Index Method	4.9 kg/tow	0.31 c/i	1,500
Atlantic Halibut		None	5,400	0.06	300

B. GARM III

Species	Stock	Model	Bmsy or proxy	Fmsy or proxy	MSY
Cod	GB	VPA	143,343	0.25	30,220
Cod	GOM	VPA	71,150	0.23	14,936
Haddock	GB	VPA	164,300	0.34	35,000
Haddock	GOM	VPA	5,995	0.45	1,360
Yellowtail Flounder	GB	VPA	46,000	0.25	10,000
Yellowtail Flounder	SNE/MA	VPA	27,600	0.26	6,300
Yellowtail Flounder	CC/GOM	VPA	8,310	0.24	1,820
American Plaice	GB/GOM	VPA (2005)	20,828	0.18	4,317
Witch Flounder		VPA	10,863	0.22	2,195
Winter Flounder	GB	VPA	15,500	0.25	3,400
Winter Flounder	GOM	VPA	3,557	0.27	854
Winter Flounder	SNE/MA	VPA	37,608	0.26	9,658
Redfish		ASAP	239,309	0.04	8,951
White Hake	GB/GOM	ASAP	56,500	0.21	7,000
Pollock	GB/GOM	AIM	2.00 kg/tow	5.76 c/i	11,516
Windowpane Flounder	GOM/GB	AIM	1.14 kg/tow	0.62 c/i	700
Windowpane Flounder	SNE/MA	AIM	0.33 kg/tow	1.53 c/i	500
Ocean Pout		Index Method (1998)	4.94 kg/tow	0.76 c/i	3,754
Atlantic Halibut		Surplus Production	70,000	0.04	2,800

Stock-by-Stock Biological Reference Points

Georges Bank (GB) Cod

The current BRPs are based upon a VPA conducted upon the 1978 – 2000 dataset. In the GARM III ‘models’ review (NEFSC, 2008), it was noted that the data were sufficient for an age-structured model which assumed negligible error in the catch-at-age. A weak retrospective pattern was present.

A range of models on which to base updated BRPs was considered at this review. Given a more pronounced retrospective pattern in the ASAP, the VPA on the 1978 – 2006 dataset (with a mid-1990s split in the times series of all survey tuning indices) was selected as the most appropriate model for BRP estimation.

The revised F_{MSY} (0.25) for Georges Bank cod was based on the fishing mortality (F) that produced 40% of the unfished level of spawning biomass per recruit (herein termed $F_{40\%MSP}$). The yield/SSB per recruit calculations used mean weights, maturities and partial recruitment at age during 2002-2006. There are no obvious recent trends in these parameters. The revised B_{MSY} (143,343 t) was derived using $F_{40\%MSP}$ together with a stochastic projection (AGEPRO) drawing from the cumulative frequency distribution of all recruitments produced by spawning stock biomasses of 50,000 t or greater. This sub-set of the recruitments was used to reflect the higher productivity apparent at larger stock sizes observed earlier in the time series. The 50,000 t breakpoint was confirmed as that which minimized the residual variance after taking mean values either side of it (‘razor’ analysis). The resulting revised MSY for the stock is 30,220 t.

While the stock assessment on which these reference points are based has not yet been fully reviewed (and it will be updated with recent data in August), it indicates that recent SSB has been at a low level. This is likely to continue to result in low recruitment unless the stock can be rebuilt to a higher and more productive level. The rebuilding deadline for this stock (2026) reflects the recent low productivity of the stock.

Gulf of Maine (GOM) Cod

The current BRPs for Gulf of Maine cod are based upon a VPA using 1982 – 2000 data. The revised BRPs are based on $F_{40\%MSP}$ using the entire recruitment series (1982-2006) from a VPA. The VPA exhibits a weak retrospective pattern with no systematic trends that would cause concern for stock projections or rebuilding scenarios. The revised F_{MSY} and B_{MSY} proxies are 0.23 and 71,150 t respectively. The associated MSY is 14,936 t.

While the Panel considers the new VPA as an adequate basis for the determination of stock status and BRP revision, it noted the need to confirm the partial recruitment on ages five and older as this is particularly influential on the estimation of biological reference points and on stock status determination. An alternative BRP analysis of the Gulf of Maine cod data, using a statistical catch-age model variant (an Age-Structured Production Model - ASPM) and a longer catch series (1893-2006) provided support for the assumption of domed selectivity at age for both the survey and the commercial fishery. Alternatively, when a higher natural mortality rate was assumed ($M=0.3$), model fits were statistically equivalent for the asymptotically flat and domed survey selectivity assumptions. Both the alternative natural mortality rate and alternative selectivity assumptions will effect BRP calculations and estimates of current status relative to the BRPs.

Tagging analyses were conducted to attempt to distinguish between the domed and flat-top selectivity assumptions. A tagging model that partitioned tagged fish into three length

categories and estimated length-specific natural mortality rates, fishing mortality rates, and movement rates was fitted to Atlantic cod tag release-recovery data. Results from this analysis were inconclusive in terms of distinguishing between the two selectivity assumptions because parameters of the tagging model are confounded (e.g. low tag recoveries in a size group can be explained by higher natural mortality rates, fish moving to an area with lower exploitation rates, or lower tag reporting rates). An integrated approach, incorporating the tag release and recovery data with the catch-at-age analysis, may allow resolution of the model selection question. It was noted that the tagging analysis suggests a higher natural mortality rate. Model selection criteria of ASPM model runs accepted larger values of natural mortality with flat – top selectivity. However, the higher natural mortality estimates from the tagging analysis could be aliasing for lower reporting rates or higher tag-induced mortality.

On balance, reiterating the conclusions of NEFSC (2008), the Panel felt a flat-top partial recruitment assumption should be the default unless there is compelling evidence that older fish are not caught by the fishery. Further, a flat-top survey catchability at age is preferred unless there is a plausible explanation for older fish to avoid the survey gear or to have emigrated out of the survey area. The VPA model was fit to a limited range of fishery catch ages and survey ages (ages 2 to 6). For the August 2008 assessment, analyses with data extended to include older ages should be investigated to evaluate their utility to better determine the partial recruitment on older ages. Additionally, VPA explorations should examine a higher natural mortality assumption. Other natural mortality assumptions that could be explored include higher rates for older ages or density dependent mortality such that mortality rates are higher in years (such as recently) with low stock abundance.

Georges Bank (GB) Haddock

The current BRPs are based upon a VPA conducted upon the 1931 – 2000 dataset, which was updated to 2006 for this review. In the GARM III ‘models’ review (NEFSC, 2008), it was noted that the data were sufficient for an age-structured model which assumed negligible error in the catch-at-age. A weak retrospective pattern was indicated as being present with one of the key concerns being recent changes in haddock size at age (declining). Further, difficulties with using a parametric stock – recruitment relationship (NEFSC, 2002) were noted with exploration of a non-parametric form likely required.

Based upon analyses presented at this meeting, the 1931 – 2006 VPA was considered an adequate basis on which to base BRPs. However, inspection of the stock-recruitment relationship confirmed, as noted by NEFSC (2008), that BRPs should be estimated using a non-parametric approach. Thus the F_{MSY} proxy was established as $F_{40\%MSP}$ (0.34), taking into account recent declines in weights at age and partial recruitment. In relation to the latter, the Panel noted that when exceptionally large year – classes have previously moved through this stock (e.g. 1963 and 2003 year-classes), weights at age have declined and subsequently increased. It is thus possible that the current changes in weights at age and partial recruitment are transitory due to the size of the 2003 year-class.

The B_{MSY} proxy was based upon a stochastic projection (AGEPRO) at $F_{40\%MSP}$ and the expected distribution of recruitment at the biomass proxy. Inspection of the long time series of spawning stock biomass and recruitment indicated that the stock generally experiences moderate but highly variable sized year-classes at SSBs greater than 75,000 t. Below this, the probability of small year – classes appears to increase. Thus, the BRPs are based upon year-class sizes observed at greater than 75,000 t SSB.

The other important feature of recruitment into this stock is the appearance from time to time of exceptionally large year-classes (e.g. 1963 and 2003). These dominate productivity of the resource for a number of years after they enter the fishery. However, they do not appear to be related to the size of the spawning biomass. It is possible that a number of linked environmental factors are responsible for these exceptional year-classes. The Panel noted the ‘mixed recruitment’ nature of this stock and determined that for the estimation of BRPs, that the 1963 and 2003 year-classes should not be included in the analysis. This assumes a long-term sustained level of stock productivity without the necessity of relying upon the incidence of exceptionally large year-classes. When the latter occur, they can be taken advantage of on a yield per recruit basis.

Thus, the B_{MSY} proxy using recruitment where spawning stock biomass exceeded the 75,000 t breakpoint but excluding the 1963 and 2003 year-classes was 164,300 t with an associated MSY of 35,000 t.

Gulf of Maine (GOM) Haddock

The current BRPs for this stock are based on an index-based (AIM) assessment of the 1963 – 2000 dataset. While the GARM III ‘models’ review (NEFSC, 2008) considered this approach an adequate basis for revised BRPs, it encouraged efforts to process data sufficient for an age-structured approach. This work was done for this review and new BRPs for the stock are based on a VPA using catch-at-age data for 1977-2006. Unlike the AIM assessment, the VPA takes account of the decreased weight-at-age seen in recent years.

The VPA indicates SSB supported by a few strong cohorts. A strong residual pattern is seen in the fit of a Beverton-Holt stock-recruitment relationship with the resulting parametric F_{MSY} being very high. Therefore, a non-parametric approach to estimating BRPs was adopted. The B_{MSY} proxy (5995 t) was chosen as the median of stochastic projected (AGEPRO) SSB values after 50 years of fishing at $F_{40\%MSP}$ (0.45). Recruitment values were drawn from a sample including estimates hindcast back to 1962 using age one abundance indices from the NEFSC fall survey but excluding the exceptionally strong 1962 year-class and recruitment estimates associated with SSB less than 3,000 t (breakpoint based on 1986-1996 SSBs). The associated MSY is 1,360 t.

The Panel noted that the high value of $F_{40\%MSP}$ is contingent on the partial recruitment pattern in the most recent five years. The gear used by the commercial fishery changed in 2002 from 6 inch diamond mesh (which is still used in the Georges Bank fishery) to 6.5 inch square mesh, which resulted in greater escapement of mature haddock. Haddock taken by the recreational fishery, which accounts for an increased proportion of landings in recent years, are also relatively large. The selectivity change estimated by the VPA and incorporated in the BRP analyses, reflects substantial escapement of mature fish. This implies that the spawning biomass at $F_{40\%MSP}$ is composed of very young fish. It was noted that the current analysis indicates that Gulf of Maine haddock have lower weights at age than the Georges Bank stock. As well, the age at 50% maturity was also lower for Gulf of Maine as compared to Georges Bank haddock.

Comparisons with the Georges Bank haddock stock suggest that current productivity of the Gulf of Maine stock may have changed. Estimates of SSB for the two haddock stocks shows that, since 1988, the Gulf of Maine haddock SSB has been a lower proportion of Georges Bank SSB than during the years prior to 1988. It is also important to note that the perception that the Gulf of Maine stock is currently rebuilt may depend heavily on the contribution of the strong 1998 year-class.

Georges Bank (GB) Yellowtail Flounder

Current BRPs for this stock are based upon a VPA using 1973 – 2000 information. New BRPs for this stock are based on an update of the so-called ‘Major Change’ VPA (TRAC, 2005). In this assessment, the survey series are split between 1994 and 1995, which results in reduced retrospective patterns in biomass and fishing mortality estimates compared to the base VPA with no split. Except for minor changes to the catch-at-age data (principally discards), the assessment is an update of that applied in 2005. Data for 1973 to 2006 were included in the assessment, and recruitment estimates were hindcast back to 1963 based on regression of VPA estimates on the NEFSC Fall survey index at age one.

Initial exploration of potential BRPs used geometric means of the upper range of hindcast estimates to derive priors for unfished recruitment in fitting Beverton-Holt stock-recruitment curves. Values of F_{MSY} based on these curves were much higher than $F_{40\%MSP}$. Given the extrapolation of the stock-recruitment curve well beyond the range of observed SSB, the Panel preferred to use a non-parametric approach to setting BRPs. Recruitment estimates for SSB greater than 5,000 t (breakpoint), including the hindcast values, were considered representative of productivity at higher stock levels. The B_{MSY} proxy (46,000 t) was chosen as the median of stochastic projected (AGEPRO) SSB values after fishing for 50 years at $F_{40\%MSP}$ of 0.25. The associated MSY is 10,000 t.

The BRPs depend on the hindcast recruitment estimates to provide insight into productivity at higher stock levels than are observed during the time-series of the VPA. It was suggested that inverse variance weighting could be used in the estimation of mean recruitment based on hindcasting. More fundamentally and as time permits, the Panel recommends that the hindcast recruitments be projected forward to assess whether they are consistent with the recorded catches. It would not be possible to fully validate the hindcast estimates, but catch should at least indicate the minimum recruitment levels required to support them. Further, the Panel recommends that the relationship of hindcasted recruitment with SSB be explored to check whether the non-parametric approach to estimating BRPs has fully represented the potential for increased productivity at higher stock levels.

The biological basis for the Major Change model is not yet understood. The Panel commented that caution is required in treating converged VPA estimates as an absolute criterion of reality – removal of retrospective pattern does not guarantee that the assessment results are more correct. However, the Major Change model provides the soundest available foundation on which to base management advice. The BRPs for this stock are not dependent on the presence or absence of retrospective pattern, since the estimated stock-recruitment relationship is very similar between the Major Change and the base VPA. Nevertheless, further long-term research is advisable into the basis for retrospective pattern and its removal.

Southern New England –Mid Atlantic (SNE/MA) Yellowtail Flounder

Current BRPs for this stock are based upon a VPA using 1973 – 2002 data. New BRPs for this stock are also based on a VPA. This differs from the previous assessment principally in the change of plus-group definition from age 7+ to age 6+ and in minor changes in the catch-at-age data. Data for 1973 - 2006 were included in the assessment, and recruitment estimates were hindcast back to 1963 based on the relationship between VPA estimates and NEFSC Fall survey indices at age one.

The parametric stock-recruitment relationship based on the VPA results is very uncertain and highly influential on the BRP estimates. BRPs were thus based upon a non-parametric approach using VPA recruitment estimates for SSB greater than 5,000 t (breakpoint). The B_{MSY} proxy (27,600 t) was chosen as the median of the stochastic projected (AGEPRO) SSB values after fishing for 50 years at $F_{40\%MSP}$ (0.26). Hindcast estimates were not included in the recruitment sample for projection. They extended well above the range of ‘observed’ recruitments and may not be representative of current stock productivity. The associated MSY is 6,300 t.

The Southern New England – Mid-Atlantic yellowtail flounder stock is at the southern end of the range for the species, where it may be more subject to environmental changes affecting productivity and other biological characteristics. Given the sustained low level of recruitment experienced by the stock since the early 1990s, it may not be possible to rebuild to the predicted B_{MSY} level under current conditions.

Cape Cod – Gulf of Maine (CC/GOM) Yellowtail Flounder

The Cape Cod – Gulf of Maine yellowtail flounder stock is the smallest of the three GARM stocks of this species. Current BRPs are based upon a VPA using 1985 – 2002 data. New BRPs for this stock are also based on a VPA. This differs from the previous assessment principally in the change of plus-group definition from age 5+ to age 6+, in minor changes in the catch-at-age data and in the addition of two new survey series from the Maine-New Hampshire inshore survey. Data for 1985 - 2006 were included in the assessment, and recruitment estimates were hindcast back to 1977 based on the relationship between VPA estimates and NEFSC Fall survey indices at age one. This approach was consistent with that used for Georges Bank yellowtail. Sampling limitations (related to inshore strata) prevented extending the hindcasting series back to 1963.

As with the other yellowtail stocks, the parametric stock-recruitment relationship based on the VPA results is very uncertain and highly influential on the BRP estimates. Parametric estimates of F_{MSY} based on a Beverton-Holt stock – recruitment relationship are very high. The Panel preferred $F_{40\%MSP}$ as a proxy for F_{MSY} . The revised BRPs are based on a non-parametric approach, using the full time series of recruitment estimates, including the hindcasted values. Reduced recruitment at low SSB were not evident from a stock-recruitment relationship, and the hindcasted recruitments were all within the range of values estimated by the VPA. The B_{MSY} proxy (8,310 t) was chosen as the median of the stochastic projected (AGEPRO) SSB values after fishing for 50 years at $F_{40\%MSP}$ (0.24). The associated MSY is 1,820 t.

Unlike Georges Bank yellowtail flounder, the hindcast recruitment estimates were within the range of ‘observed’ values and hence did not provide a perspective on stock productivity at SSB levels higher than those estimated for the VPA time period. In this sense, the hindcast estimates were less informative for derivation of BRPs. Nevertheless, as recommended for the Georges Bank stock, it would be worthwhile to assess as time permits, whether the hindcast recruitments are consistent with the recorded catches.

Georges Bank – Gulf of Maine (GB/GOM) American Plaice

The last assessment for the plaice stock was undertaken in 2005 on the 1980 – 2004 dataset. Due to data availability issues, this analysis could not be updated in time for this review. In lieu of this, an updated F_{MSY} proxy ($F_{40\%MSP}$) of 0.18 was derived using partial recruitment estimates from the 2005 VPA and weights at age from NMFS spring surveys averaged over

2003-2007. Since 2002, there have been increases in fishery mesh sizes which are likely to change the partial recruitment and thus the BRPs.

Recruitment from the full time series of the VPA was used along with the F_{MSY} proxy in a stochastic projection (AGEPRO) to provide an updated B_{MSY} proxy of 20,828 t and an MSY of 4,317 t.

These BRPs should be considered provisional as the assessment and thus BRPs will be updated at the August GARM III review.

Witch Flounder

The current BRPs for the witch flounder stock were derived from the results of a VPA for 1982 – 2002 using a non-parametric approach for the stock – recruitment relationship. The BRPs derived at this review were also based upon a VPA using the 1982 – 2006 dataset and modified to address a retrospective pattern as noted at the GARM III ‘models’ review. The latter could not comment on the nature of the retrospective pattern other than point out that it could be due to potential sources indicated elsewhere in its report (NEFSC, 2008). The NEFSC undertook explorations of the source of the retrospective but could not identify a specific cause. It was noted that a number of management measures came into effect in the mid-1990s that could be implicated. Notwithstanding this, as has been done for a number of other GARM III stocks, the survey time series was split for the VPA calibration which appeared to largely address the retrospective pattern, caused by an as yet unknown process. This is a discussion for the August GARM III review as the modification is influential on the determination of stock status and the rebuilding schedule, but not the derivation of BRPs.

The non-parametric approach to determination of BRPs was continued at this review due to the observed negative relationship between recruitment and spawning stock biomass.

Thus the B_{MSY} proxy of 10,863 t for this stock was derived using a F_{MSY} proxy of $F_{40\%MSP}$ (0.22) and the recruitment from the full VPA time series (1982-2006) in a stochastic projection (AGEPRO). The resulting MSY is 2,195 t.

Georges Bank (GB) Winter Flounder

Current BRPs for the Georges Bank winter flounder stock are based upon a surplus production model (ASPIC) using 1963 – 2000 data. The GARM III ‘models’ review noted that this stock is a candidate for an age-structured analysis and consequently a VPA for 1982 – 2006 was undertaken for this meeting. It exhibited well-behaved retrospective and residual patterns and was considered a suitable basis for the derivation of BRPs.

When examining the Beverton and Holt stock-recruitment relationship using data from the VPA, it was noted that the fit was highly dependent upon the assumed level of asymptotic recruitment (R_0). The Panel considered that the data were not informative of the form of the relationship between recruitment and spawning stock biomass and chose a non-parametric approach as the basis for the BRPs.

The F_{MSY} proxy ($F_{40\%MSP}$) of 0.25 was derived using the partial recruitment and weights at age from the most recent five years of the VPA. As observed in other GARM III stocks, observed weights at age have declined recently which will impact the partial recruitment. Using a non-parametric approach, recruitment estimates from the full time series of the VPA were used in a stochastic projection (AGEPRO) to provide a B_{MSY} proxy of 15,500 t and an MSY of 3400 t.

Gulf of Maine (GOM) Winter Flounder

The Gulf of Maine winter flounder stock is the smallest of the three GARM stocks of this species. Current BRPs for this stock are based upon a VPA using 1982 – 2002 data. The revised BRPs presented here are based on a VPA with survey series split between 1993 and 1994.

Splitting the survey series served to diminish the severe retrospective pattern seen in an unsplit VPA, although some bias remains in the recruitment estimates (less so in the most recent years). The VPA was applied to re-estimated catch-at-age data for 1982-2006.

A non-parametric approach was adopted for deriving revised BRPs. The B_{MSY} proxy (3557 t) was chosen as the median of stochastic projected (AGEPRO) SSB values after 50 years of fishing at $F_{40\%MSP}$ (0.27). Recruitment from the full time-series of estimates from VPA was used in the projections. The associated MSY is 854 t.

There is considerable uncertainty associated with this assessment and the resulting BRP estimates. Conflicting trends between relatively stable recruitment indices and declining catches and the failure to track year-classes in the catch and survey age compositions lead to a lack of confidence in the results. In particular, the appropriate level for the biomass reference point is doubtful because of uncertainty about the level of average recruitment. The VPA indicated a steeper decline in recruitment than indicated by alternative models (i.e. SCALE), although there was broad congruence between the different assessments in the upper limits of recruitment. Based on the VPA and SCALE models, it is possible to state that B_{MSY} should be at least 3,000 t, but it is unclear how much larger than this would be appropriate. The assessment difficulties were not resolved by attempting SCALE assessments which incorporated differences in growth and natural mortality between males and females. The Panel recommends further exploration of the SCALE assessment approach as time permits.

Notwithstanding the problems encountered, the updated VPA was considered to be the best available basis for developing BRPs. An important outcome is that the new assessment indicates a stock that is less resilient to exploitation than appeared from the previous assessment.

Southern New England – Mid Atlantic (SNE/MA) Winter Flounder

The current BRPs for this stock are based upon a 1982 – 1998 VPA which provided recruitment and spawning stock biomass for an externally estimated Beverton and Holt stock – recruitment relationship. The GARM III ‘models’ review, while noting that an age-structured model was appropriate as a basis for determination of stock status and derivation of BRPs, could not assess the overall utility of which modeling approach to use and encouraged model explorations to address the severe retrospective pattern that has been observed.

The VPA formulation presented at this meeting used a split survey time series (pre and post 1994), which appears to have reduced the retrospective problem. It is emphasized that while this modification to the VPA addresses the retrospective pattern, the underlying causes are still unknown. This split VPA was thus accepted as the basis of BRP calculations.

After examination of the stock – recruitment relationship using data from the VPA, the Panel determined that a non-parametric approach should be used to estimate BRPs. Thus, the F_{MSY} proxy of 0.26 was determined using 40% MSP considerations, with B_{MSY} (37608 t) then derived using a stochastic projection (AGEPRO) with recruitment estimates of all year-classes produced at spawning stock biomasses of 6000t (breakpoint) or greater. This sub-set of the recruitments was chosen to reflect the higher productivity apparent at larger stock sizes observed earlier in the time series. The break point identified as that which minimized the residual

variance after taking mean values either side of the break point (the “razor” analysis). The associated MSY with these BRPs is 9658 t.

It is notable that the recruitment time series for this stock shows similarities with other flatfish stocks in the area, for example in relation to the period of high recruitment in the early 1980s. While recent productivity appears to have been much lower, it should not be overlooked that the stock is apparently being subjected to fully recruited fishing mortalities between 0.8 and 1.

Redfish

Current BRPs for the redfish stock are based upon a statistical catch at age model specifically developed for this resource (‘RED’). The review of GARM III assessment models (NEFSC, 2008) supported use of an age-structured approach to modeling, particularly given the strong evidence for infrequent large pulses of recruitment which persist in the stock over decadal time periods.

The model adopted for the estimation of BRPs for the redfish stock was based on a new age-structured approach (ASAP), using a longer time series of landings data (1913 - 2006), and revised weights and maturities at age. In relation to the former, weights at age now are considerably larger than estimated previously.

Panel discussion focused on the choice of natural mortality (M) and the selection of recruitments to be used to determine B_{MSY} . With regard to the former, there were some concerns that the assumed M of 0.05 was low compared to estimates used for other redfish stocks. This value should be corroborated with supporting data if possible for the August 2008 review. With regards to recruitment, the model was apparently able to explain the high catches early in the time series; however the estimates prior to 1969 were largely determined by the Beverton and Holt stock – recruitment relationship assumed in the model. For the stochastic projections, the Panel chose to use recruitment estimates from the model for 1969 onwards (period for which age composition data of landings and / or survey data are available) in a non-parametric determination of BRPs.

This stock exhibits low productivity, which is reflected in the F_{MSY} (0.04 based on the F producing 50% of unfished SPR as opposed to the 40% used on other GARM III stocks). The B_{MSY} from the stochastic projections (AGEPRO) is 239,309 t while the associated MSY is 8951 t.

Georges Bank – Gulf of Maine (GB/GOM) White Hake

Current BRPs for this stock were derived upon an index-based analysis (AIM) of catch and survey data from 1964 – 2000.

Stock reconstructions using ASAP were conducted using both a short (1963 - 2005) and a long (1893 - 2005) catch time series. Tight priors were placed on the survey catchability (q) parameter to resolve issues with a historical retrospective pattern; however this created unreasonable patterns in the survey residuals. Suggestions for developing the model further for future assessments include: initialize the population (ie. 1893) assuming fishing mortality has been constant, and explore sensitivity to the assumed value; fix recruitment residuals for cohorts which are not represented in the age-composition data at zero (but, bias-corrected) unless doing a Bayesian analysis; no prior on the survey q , unless doing a Bayesian analysis; fit the catch data exactly (either a high weighting on catch fits or explicit solution of the catch equations); and examine uncertainty in the catch due to red / white hake misidentification through sensitivity

analysis. Development of the long-term statistical catch age analysis is encouraged; resulting estimates of R_0 (virgin recruitment) should allow estimation of parametric stock-recruitment relationships. These explorations should be undertaken as time permits.

Notwithstanding concerns with the q prior, survey residual patterns, and the use of a pooled age-length key for estimating 2001-2006 age compositions, the short time-series ASAP analysis was considered appropriate for calculating BRPs. Certainly, the use of an analytical assessment model for estimating BRPs is considered an important step forward for this stock. A relatively strong and systematic retrospective pattern, particularly in SSB estimates, should have minimal impact on BRP estimates although it could result in appreciable bias in stock projections. A model formulation assuming different pre- and post-1994 survey catchabilities should be investigated for the August GARM review in relation to resolving the retrospective pattern.

The revised BRPs are based on a non-parametric approach using $F_{40\%MSP}$ with recruitment estimates from a statistical catch-age analysis (ASAP) of 1963-2005 catch, survey, and age-composition data. All recruitment estimates produced by SSB greater than or equal to 10,000 t (breakpoint) were included in the BRP calculations. The F_{MSY} and B_{MSY} proxies were 0.21 and 56,500 t respectively with an associated MSY of 7,000 t.

Georges Bank – Gulf of Maine (GB/GOM) Pollock

The current BRPs for Pollock are based upon an index-based (AIM) analysis of the 1963 – 2000 dataset. NESFC (2008) considered that this ‘relative trend’ class of models is likely informative given the strong relationship between the relative fishing mortality and replacement yield for this resource and thus could be the basis of the 2008 assessment and revised BRPs. Thus, new BRPs for the stock are based on an updated AIM analysis. The main change from the previous analysis is the inclusion of recreational landings in the catch time-series. NEFSC fall survey data for 1963-2007 were included in the analysis.

The F_{MSY} proxy (5.76 catch / fall survey index) was derived as the Relative F corresponding to a Replacement Ratio of 1, estimated from the Replacement R - Relative F relationship. The B_{MSY} proxy (2.0 kg / tow in the fall survey) was selected by visual interpretation of the survey time-series in comparison with relative F estimates. This resulted in a decreased value compared with the current proxy in order to resolve a mis-match between the landings data and the relative F estimates. During the 1980s and early 1990s, landings close to the old MSY were associated with relative F values in excess of the F_{MSY} proxy. This mis-match was resolved by adjustment of the B_{MSY} proxy downward to ensure that landings below the new (lower) MSY (11, 516 t estimated as product of F_{MSY} and B_{MSY} proxies) coincided with Relative F estimates below the F_{MSY} proxy.

One inconsistency in the survey data remains. Biomass indices have generally increased since the early 1990s but this coincides with a period when fish older than age 8 were generally absent from the survey catches. This raises questions about the availability to the survey gear of this highly mobile species. Concerns were also raised about the high Replacement Ratios at low relative F values implied by the Relative F – Replacement Ratio model for deriving the F_{MSY} proxy. Suggestions were made for alternative model formulations (e.g. log-linear with priors on a or logistic). However, AIM is used to deduce when Relative F is too high, not for establishing B_{MSY} , and a and b can be viewed as nuisance parameters in this context. As time permits, if the alternative formulations can be fit, the parameter estimates might be useful for validating the

chosen value of B_{MSY} and put the biomass reference points in the same context from which the F index reference points were derived.

Georges Bank – Gulf of Maine (GB/GOM) Windowpane Flounder

The current BRPs for this stock are based upon an index-based (AIM) analysis conducted in 2005 (NEFSC, 2005). The GARM III ‘models’ review (NEFSC, 2008) considered that this approach would be adequate for assessment and BRP derivation. An age-based assessment for this stock is not possible as there is no age composition data available from either the research surveys or fishery samples.

Commercial landings data are available for 1975 – 2006. Catches ranged between about 3700 and 2000 t during 1985 – 1991 but since 1994, catch has been primarily bycatch in other targeted fisheries. Since 2000, most of the catch has been comprised of discards, these being about 10 - 20 times the landings.

The 2005 AIM analysis was updated with the most recent survey information. Biomass indices from the 1975 – 2006 NMFS fall survey were used due to the lack of significant relationships between Relative F and Replacement Ratios for the other surveys considered. The Relative F (catch / fall survey biomass index) increased during 1977 – 1991, then declined through 2002 but then increased during 2002 – 2006. Replacement Ratios were near to or greater than 1.0 during 1995 – 2001 then declined to below one thereafter. A marginally significant Relative F – Replacement Ratio relationship indicated that the stock can replace itself at a Relative F of 0.62 which was thus chosen as the F_{MSY} proxy.

To determine the biomass BRPs, the trends in catch and fall survey biomass indices were examined during the period when the discards were most precisely estimated (1989 – 2006). The stock appeared to be able to sustain a median catch of 700t during 1995 – 2001 as Replacement Ratios were near or above 1.0 during this period and thus this was chosen as the MSY proxy. Division of the MSY proxy by the F_{MSY} proxy of 0.62 provided a B_{MSY} proxy of 1.14 kg / tow in the NMFS fall survey.

It is important to note that whereas the current BRPs were stated in terms of landings, the updated BRPs are stated in terms of landings plus discards.

Southern New England – Mid Atlantic (SNE/MA) Windowpane Flounder

The current BRPs for this stock are based upon a surplus production model (ASPIC). The GARM III ‘models’ review (NEFSC, 2008) considered that there were benefits to using a common approach for both windowpane stocks and that an index – based method (AIM) would be adequate for assessment and BRP derivation. An age-based assessment for this stock is not possible as there is no age composition data available from either the research surveys or fishery samples.

Commercial landings data are available for 1975 – 2006. Catches have been primarily discards, which were highest during 1982 – 1991, ranging between 3600 – 5400 t annually, and then declining to a time series low in 2001 before gradually increasing thereafter. In recent years, discards have been about 7 – 8 times the landings.

The AIM analysis used biomass indices from the 1975 – 2006 NMFS fall survey. Survey indices from previous assessments were computed based upon data from only the offshore sampling strata. As the inshore strata comprise a substantial portion of the total windowpane habitat, these were included in the current analysis.

The Relative F (catch / fall survey biomass index) increased during 1980 – 1990, then declined through 2001 with a slight increase thereafter. Replacement Ratios were near to or greater than 1.0 during 1995 – 2001 then rapidly declined and have been below 1.0 since 2004. Replacement Ratios suggest that the stock was able to replace itself during 1980 – 82 but has not been able to replace itself for extended periods since then. A significant Relative F – Replacement Ratio relationship indicated that the stock can replace itself at a Relative F of 1.53 which was thus chosen as the F_{MSY} proxy.

To determine the biomass BRPs, the trends in catch and fall survey biomass indices were examined during the period when the discards were most precisely estimated (1989 – 2006). The stock appeared to be able to sustain a median catch of 500t during 1995 – 2001 as Replacement Ratios were near or above 1.0 during this period and thus this was chosen as the MSY proxy. Division of the MSY proxy by the F_{MSY} proxy provided a B_{MSY} proxy of 0.33 kg / tow in the NMFS fall survey.

It is important to note that whereas the current BRPs were stated in terms of landings, the updated BRPs are stated in terms of landings plus discards. Also, the previous BRPs were estimated using fall survey data from only the offshore sampling strata. The updated BRPs are more reflective of the stock as they are based upon an analysis using survey indices from the entire habitat of windowpane flounder.

Ocean pout

Existing BPRs, based on the AIM method, were updated using a new catch time series that now includes discard estimates.

An AIM analysis was conducted using 1968-2006 catch and survey data, however the relationship between Relative F and Replacement Ratio was not significant thereby invalidating the assumptions underlying the use of AIM for calculating BRPs. The lack of a significant relationship between Relative F and Replacement Ratio is largely attributed to the four most recent Relative F estimates, which are among the lowest in the time series, yet the trend in the survey abundance index (used for the Replacement Ratio) continues downward. For this reason the AIM analysis was not updated, however previous BRPs were adjusted to account for discards as well as the landings estimates.

The Ocean pout fishery is essentially a discard fishery and catches are at historical low levels. The survey abundance index declined dramatically in 2004 and is currently at a historical low level. This suggests that Ocean pout may be in a depensatory state where the stock cannot rebuild to BRPs even in the absence of removals.

Thus the revised F_{MSY} and B_{MSY} proxies are 0.76 (catch / survey index) and 4.94 kg / tow respectively while the MSY is 3754 t.

Atlantic Halibut

As was pointed out at the GARM III ‘models’ review, the tagging data for this stock showed a relatively high proportion of recoveries from Canadian waters, suggesting that the stock boundaries should be reviewed and that this might be better treated as a trans-boundary issue.

The current BRPs for this stock are based upon an index-based approach. NEFSC (2008) suggested attempting a one parameter depletion analysis for the determination of stock status and revision of the BRPs. A replacement yield model (which is a form of surplus production model) was developed and reviewed at this meeting and while it had issues to be resolved (e.g. how high

catches are dealt with early in the time series and with the estimation of catches during 1800-1900), it was considered informative for BRP determination.

A yield per recruit analysis using updated biological information was used to estimate $F_{0.1} = 0.04$ as a proxy for F_{MSY} . B_{MSY} (70,000 t) was then derived using the replacement yield model assuming $r = 2 * F_{MSY}$ (as implied by the Schaefer production model) and $M = 0.06$. The associated MSY is 2800 t. The Panel considered that the estimate of natural mortality (0.06), while consistent with the maximum age observed in the data, is low compared to other halibut stocks (e.g. typically in the order of 0.14 – 0.15), and should be reviewed in time for the August 2008 review in the light of information from Pacific Halibut and Atlantic Halibut stocks in, for instance, West Greenland and Canadian Atlantic waters. Consideration of the estimate of natural mortality and revisions to the replacement yield model will have implications for the BPRs which will need to be considered at the August GARM III review.

ToR 5. Appropriate models for forecasting and for evaluating rebuilding scenarios

Other than comment in working paper 4.2 on the need to consider using different recruitment scenarios for short and long-term projections, no analyses were tabled that explicitly addressed ToR 5. There was also some limited discussion about the need to consider different weights at age and fishery selectivity to be used in short term versus medium to longer term projections. The Panel suggests that in developing rebuilding scenarios, careful consideration be given to consistent use of the stream of recruitments used in those scenarios with those used in this review to derive the BRPs. There is limited experience with potential difficulties that may be encountered when imputing a 'sharp breakpoint' between two recruitment stanzas rather than a 'smooth' transition of recruitment from low biomass to higher biomass, and warrants some caution when interpreting rebuilding projections.

CONCLUDING REMARKS

The meeting required an extensive suite of working papers prepared by scientists at the NEFSC and substantial and in-depth discussions at the meeting itself. This was a very substantial workload for the Center, which the Panel acknowledges being of very high quality. The Panel would also like to acknowledge the valuable contributions at the meeting made by all participants, particularly that of Doug Butterworth, who attended on behalf of the fishing industry. Finally, the Panel would like to again thank Andrea Strout of the NEFSC who assisted the chair in preparing this report. All these contributions made it possible for the GARM III 'BRPs' review to generally meet its terms of reference.

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APPENDICES

Appendix 1. Terms of Reference

1. For relevant stocks, determine the influence of retrospective patterns in parameter estimates (e.g., fishing mortality, biomass, and/or recruitment) from assessment models on the computation of BRPs and on specification of initial conditions for forecasting.
2. Trends in Stock Productivity:
 - a.) For relevant stocks, identify trends in biological parameters (i.e., life history and/or recruitment) and assess their importance for the computation of BRPs and for specification of rebuilding scenarios;
 - b.) If possible, summarize trends in pertinent environmental variables that might be related to the trends in those biological parameters relevant to BRPs.
3. Ecosystem approaches to Gulf of Maine/Georges Bank fisheries:
 - a.) Determine the production potential of the fishery based on food chain processes and estimate the aggregate yield from the ecosystem;
 - b.) Comment on aggregate single stock yield projections in relation to overall ecosystem production, identifying potential inconsistencies between the two approaches.
4. Biological Reference Points (B_{target} , $B_{\text{threshold}}$, F_{target} , $F_{\text{threshold}}$):
 - a.) For each stock, list what the current BRPs and/or BRP Proxies are (e.g., B_{MSY} , B_{MAX} , F_{MSY} , $F_{40\% \text{MSP}}$, historical survey catch per tow, etc.), and give their values (i.e., typically from GARM II);
 - b.) For each stock, update or redefine BRPs or BRP proxies that will be used for stock status determination, and compute their expected values and precision. Note: These BRPs and their proxies must be comparable and consistent with outputs from the recommended assessment models from the GARM III “Modeling” Meeting.
5. For each stock, identify appropriate models for forecasting and for evaluating rebuilding scenarios.

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Appendix 3. Agenda

<i>Date /Day</i>	<i>Start</i>	<i>End</i>	<i>Duration (min)</i>	<i>Topic</i>	<i>Presenter</i>
28-Apr	9:00	9:10	10	Introduction	
1	9:10	9:30	20	Overview of GARM and objectives of this meeting	Chair
				TOR #4 Biological Reference Points: a. Current values and proxies	
1	9:30	9:45	15	<i>Working Paper 4.1</i> Overview of current BRPs methods and estimates	Rago
1	9:45	10:00	15	Discussion	
1	10:00	10:30	30	<i>Working Paper 4.2</i> Setting SSBmsy via Stochastic Simulation Ensures Consistency with Rebuilding Projections. Chris Legault	Legault
1	10:30	10:45	15	Break	
1	10:45	11:00	15	Discussion	
				TOR #2: Trends in Stock Productivity	
1	11:00	11:45	45	WP 2.1 Trends in Average length, weight and maturity at age for relevant stocks and trends in environmental variables.	O'Brien
1	11:45	12:00	15	Discussion	
1	12:00	12:15	15	WP 2.2 Implications of biological trends for estimation of biological reference points and rebuilding schedules.	Rago et al
1	12:15	12:30	15	Discussion	
1	12:30	13:30	60	Lunch	

<i>Date /Day</i>	<i>Start</i>	<i>End</i>	<i>Duration (min)</i>	<i>Topic</i>	<i>Presenter</i>
				TOR #3 Ecosystem Approaches to Gulf of Maine/Georges Bank Fisheries	
1	13:30	13:50	20	WP 3.1 US Northeast Shelf LME Biomass, target biological reference points for fish and worldwide cross-system comparisons. Overholtz, Link, Fogarty, Col, Legault.	Overholtz
1	13:50	14:00	10	Discussion	
1	14:00	14:20	20	WP 3.2 Energy Budget contextualization of fish biomasses at B _{MSY}	Link
1	14:20	14:30	10	Discussion	

1	14:30	14:50	20	WP 3.3 Estimates of aggregate surplus production for the GARM and other stock groups for the US Northeast Shelf LME. Overholtz, Fogarty, Link, Legault, Col.	Overholtz
1	14:50	15:00	10	Discussion	
1	15:00	15:15	15	Break	
1	15:15	15:35	20	WP 3.4 An Aggregate and MS Production Model: A Simulator Tool	Link
1	15:35	15:45	10	Discussion	
1	15:45	16:10	25	WP 3.5 Fishery Production Potential	Fogarty
1	16:10	17:00	50	Discussion—WP 3.6 Synthesis: Implications for single species reference points	Link/Fogarty
				TOR #4 Biological Reference Points:	
1	17:00	17:15	15	WP 4.3. Sensitivity of the Long-term Observation-error Survey Series (LOSS) model to variable stock-recruit steepness and stock depletion inputs: A test case using Gulf of Maine haddock (Palmer and Legault).	Palmer/Legault
1	17:15	17:25	10	Discussion	
1	17:25	17:40	15	Supplementary Paper WP 4.7 Size-specific tag recovery rates of cod and implications for estimation of fishing mortality in analytical models. Miller and Hart	Miller/Hart
1	17:40	17:50	10	Discussion	
1	17:50	18:00	10	Summary/Followup (Chair)	

<i>Date /Day</i>	<i>Start</i>	<i>End</i>	<i>Duration (min)</i>	<i>Topic</i>	<i>Presenter</i>
29-Apr	9:00	9:15	15	Progress review and Order of the Day (Chair)	Chair
				TOR #1 Influence of retrospective patterns on parameter estimates and specification of initial conditions for forecasting.	
2	9:15	9:35	20	WP 1.1 Specifying Initial Conditions for Forecasting When Retrospective Pattern is Present.	Legault/Terceiro
2	9:35	9:50	15	Discussion	
2	9:50	10:10	20	WP 1.2. A simulation study to evaluate estimation of biological reference points from VPA and ASAP.	Brooks/Legault/Seaver

2	10:10	10:25	15	Discussion	
2	10:25	10:40	15	Break	
				TOR #4 Biological Reference Points: b. Update by stock	
2	10:40	11:25	45	WP 4.A Georges Bank Cod	O'Brien
2	11:25	11:55	30	Discussion	
2	11:55	12:55	60	Lunch	
2	12:55	13:40	45	WP 4.F Gulf of Maine Cod	Mayo
2	13:40	14:05	25	Discussion	
2	14:05	14:30	25	WP 4.F.1 Gulf of Maine Cod	Butterworth
	14:30	14:40	10	Discussion	
2	14:40	15:30	50	WP4.B. Georges Bank Haddock	Brooks
2	15:30	15:55	25	Discussion	
2	15:55	16:10	15	Break	
2	16:10	17:05	55	WPs 4.C. Georges Bank + 4.D. Southern New England + 4.E Cape Cod-Gulf of Maine yellowtail flounder	Legault
2	17:05	17:50	45	Discussion	
2	17:50	18:00	10	Summary/Followup	Chair
Date /Day	Start	End	Duration (min)	Topic	Presenter
30-Apr	9:00	9:15	15	Progress review and Order of the Day (Chair)	Chair
3	9:15	10:00	45	WP 4.N. Gulf of Maine/ Georges Bank Acadian Redfish	Miller
3	10:00	10:15	15	Discussion	
3	10:15	11:00	45	4.K. Georges Bank winter flounder	Hendrickson
3	11:00	11:15	15	Break	
3	11:15	11:30	15	Discussion	
3	11:30	12:30	60	WP 4.I. Gulf of Maine Winter Flounder	Nitschke
3	12:30	12:45	15	Discussion	
3	12:45	13:45	60	Lunch	
3	13:45	14:30	45	WP 4.J. Southern New England Winter flounder	Terceiro
3	14:30	14:45	15	Discussion	
3	14:45	15:30	45	WP 4.G. Witch Flounder	Wigley
3	15:30	15:45	15	Discussion	
3	15:45	16:00	15	Break	
3	16:00	16:45	45	4.H. Gulf of Maine/Georges Bank American Plaice	O'Brien
3	16:45	17:00	15	Discussion	
3	17:00	17:30	30	WP 4.M. Georges Bank/Gulf of Maine Pollock	Mayo

3	17:30	17:45	15	Discussion	
3	17:45	18:00	15	Summary/Followup	Chair
	19:30	22:30		Social/Dinner --British Beer Company, Falmouth Heights	
Date /Day	Start	End	Duration (min)	Topic	Presenter
1-May	9:00	9:15	15	Progress review and Order of the Day	Chair
4	9:15	10:05	50	WP 4.L. White Hake	Sosebee
4	10:05	10:20	15	Discussion	
4	10:20	10:35	15	Break	
	10:35	10:55	20	WP.4.L.1 White Hake alt	Butterworth
	10:55	11:05	10	Discussion	
4	11:05	12:00	55	WP 4.R. Gulf of Maine Haddock	Palmer
4	12:00	12:15	15	Discussion	
4	12:15	13:15	60	Lunch	
4	13:15	13:35	20	WP 4.O. Ocean pout	Wigley
4	13:35	13:45	10	Discussion	
4	13:45	14:05	20	WP 4.P. Gulf of Maine/Georges Bank Windowpane Flounder	Hendrickson
4	14:05	14:15	10	Discussion	
4	14:15	14:35	20	WP 4.Q. Southern New England – Mid-Atlantic Windowpane	Hendrickson
4	14:35	14:45	10	Discussion	
4	14:45	15:05	20	WP 4.S. Atlantic Halibut	Col
4	15:05	15:15	10	Discussion	
4	15:15	15:30	15	Break	
4	15:30	17:50	140	Review/Revisions/Follow-up	TBD
4	17:50	18:00	10	Summary/Followup (Chair)	Chair
2-May	9:00	9:30	30	Progress review and Order of the Day	Chair
5	9:30	10:30	60	Review of Outstanding Issues as necessary	TBD
5	10:30	10:45	15	Break	
5	10:45	12:00	75	Report Development [CLOSED]	
5	12:00	13:00	60	Lunch	
5	13:00	16:00	180	Report Development, Summary and Assignments [CLOSED]	
5	16:00	16:00	0	Adjourn	

Appendix 4. Statement of Work of CIE Reviewers

General

The Groundfish Assessment Review Meeting (GARM) brings together stock assessment experts to peer review work on the status of 19 important fish stocks that are managed by the New England Fishery Management Council. GARM-III takes place in 2007-2008, and it will consist of four meetings that are cumulative in nature (i.e., successive meetings incorporate methods and results that were accepted at previous GARM-III meetings). Each meeting will have a chair as well as external panelists. A brief description and dates of the four GARM-III meetings are given below:

4. “Data Methods” Meeting (October 29 – November 2, 2007)

Review the commercial and survey data that will be used in the stock assessments. Identify appropriate statistical methods for analyzing those data (including bycatch and discard issues, changes in growth rates and other life history traits, issues related to merging databases, etc.). Other sources of data to be considered are tagging programs for cod and yellowtail flounder, and Industry-Based Surveys. Candidate sources of data relevant to ecological and ecosystem considerations will also be described.

5. “Modeling” Meeting (February 25 – 29, 2008)

Determine the most appropriate stock assessment methods and models for each of the 19 stocks. Perform runs of those models to obtain results (historical and current estimates of F and B) based on commercial and survey data, probably through calendar year (CY) 2006. The runs of the models will be used to evaluate diagnostics of model fit and appropriateness, including retrospective analyses.

6. “Biological Reference Point (BRP)” Meeting (April 28 – May 2, 2008)

Update or redefine BRPs for each of the 19 stocks. Use data available through CY2006. Consider whether the BRPs are reasonable in light of results from the “Modeling” Meeting. Define the appropriate initial conditions for forecasting and rebuilding strategies, particularly with respect to trends in biological attributes, recruitment and survival rates. Comment on relevant ecosystem considerations as they relate to rebuilding strategies.

4. GARM-III “Final” Meeting (August 4 - 8, 2008)

Use all of the methods proposed from the previous three meetings, along with survey and catch information through CY2007, to estimate historical and current fishing mortality rates and biomass for each stock. Based on procedures from the BRP Meeting, finalize the BRPs, appropriate initial conditions, and biological assumptions related to forecasts. Determine the status of each stock.

This SOW applies specifically to the GARM-III “Biological Reference Point (BRP)” Meeting, which will take place at the Woods Hole Laboratory of the Northeast Fisheries Science Center (NEFSC) in Woods Hole, Massachusetts, from April 28 – May 2, 2008. The meeting will have a

chairman (non-CIE) as well as external panelists, three of whom will be from the Center of Independent Experts (CIE).

Overview of CIE Peer Review Process

The Office of Science and Technology implements measures to strengthen the National Marine Fisheries Service's (NMFS) Science Quality Assurance Program (SQAP) to ensure the best available high quality science for fisheries management. For this reason, the NMFS Office of Science and Technology coordinates and manages a contract for obtaining external expertise through the Center for Independent Experts (CIE) to conduct independent peer reviews of stock assessments and various scientific research projects. The primary objective of the CIE peer review is to provide an impartial review, evaluation, and recommendations in accordance to the Statement of Work (SoW), including the Terms of Reference (ToR) herein, to ensure the best available science is utilized for the National Marine Fisheries Service management decisions.

The NMFS Office of Science and Technology serves as the liaison with the NMFS Project Contact to establish the SoW which includes the expertise requirements, ToR, statement of tasks for the CIE reviewers, and description of deliverable milestones with dates. The CIE, comprised of a Coordination Team and Steering Committee, reviews the SoW to ensure it meets the CIE standards and selects the most qualified CIE reviewers according to the expertise requirements in the SoW. The CIE selection process also requires that CIE reviewers can conduct an impartial and unbiased peer review without the influence from government managers, the fishing industry, or any other interest group resulting in conflict of interest concerns. Each CIE reviewer is required by the CIE selection process to complete a Lack of Conflict of Interest Statement ensuring no advocacy or funding concerns exist that may adversely affect the perception of impartiality of the CIE peer review. The CIE reviewers conduct the peer review, often participating as a member in a panel review or as a desk review, in accordance with the ToR producing a CIE independent peer review report as a deliverable. The Office of Science and Technology serves as the COTR for the CIE contract with the responsibilities to review and approve the deliverables for compliance with the SoW and ToR. When the deliverables are approved by the COTR, the Office of Science and Technology has the responsibility for the distribution of the CIE reports to the Project Contact.

Requirements for CIE Reviewers

Three CIE reviewers are requested to conduct an impartial and independent peer review in accordance with the Terms of Reference (ToR) herein. Each CIE reviewer's duties shall not exceed a maximum of 14 days conducting pre-review preparations with document review, participation on the GARM panel review meeting, editorial assistance to the GARM Chair, and completion of the CIE independent peer review report in accordance with the ToR and Schedule of Milestones and Deliverables. CIE reviewers shall have working knowledge and recent experience in the application of modern fishery stock assessment models. Reviewers should have experience in development of biological reference points that includes an appreciation for the varying quality and quantity of data available to support estimation for individual fish species living within the ecosystem. Expertise should include statistical catch-at-age, traditional VPA approaches, and index-based methods. Desirable background includes life-history theory, risk

analyses, stock-forecasting methodology, and ecosystem fisheries ecology. Some experience with groundfish (such as cod, haddock, flounder) population dynamics would be useful.

Specific Activities and Responsibilities

The CIE's deliverables shall be provided according to the schedule of milestones listed on page 6. The GARM Chair will use contributions from the CIE panelists as well as from other external panelists, to produce the GARM Panel Summary Report. In addition, each CIE panelist will write an individual independent report. These reports will provide peer-review information for a presentation to be made by NOAA Fisheries at meetings of the New England and Mid-Atlantic Fishery Management Councils in 2008. The GARM Panel Summary Report shall be an accurate and fair representation of the GARM panel viewpoint on the quality and soundness of the science, methods and results with regard to each Term of Reference (see Annex 1). The report shall also contain recommendations for improvement that might be implemented in a future GARM meeting.

Charge to GARM panel

The panel is to determine and write down its viewpoint on the quality and soundness of the science, methods and results with regard to each Term of Reference (see Annex 1). Criteria to consider include whether: (1) the data are adequate and were used properly; (2) the analyses and models were appropriate and correctly accomplished; and (3) the conclusions are correct/reasonable. Where possible, the chair shall identify or facilitate agreement among the panelists regarding each Term of Reference.

During the course of the review, the panel is allowed limited flexibility to deviate from the results and recommendations of earlier GARM-III meetings. This flexibility may include only minor alterations in procedures previously established at the peer review of the "Data Methods" Meeting in October 2007 and the "Modeling" Meeting in February 2008. Large scale changes, such as changing a stock definition would not be possible in view of the difficulties of implementing these changes in time available before the final GARM meeting in August 2008.

Furthermore, if the panel rejects certain assessment models or Biological Reference Points (BRP), the panel should explain why they are not suitable, and the panel should recommend suitable alternatives. If such alternatives cannot be identified, then the panel should indicate that the existing (status quo) models and/or BRPs are the best available at this time.

Roles and responsibilities

(1) Prior to the meeting

(GARM Chair and CIE panelists)

Review the reports produced by the Working Groups, and read background reports.

(2) During the Open meeting

(GARM Chair)

Act as chairperson, where duties include control of the meeting, coordination, facilitation of the presentations and discussions, and ensuring that all Terms of Reference of the GARM are reviewed and completely addressed.

During the question and answer periods, provide appropriate feedback to the assessment scientists on the sufficiency of the analyses and when possible, suggest improved approaches. It is permissible to discuss the working papers, and to request additional information to clarify or revise existing analyses, if that information can be produced rather quickly.

(CIE panelists)

Participate in panel discussions on the quality and soundness of the science, methods and results with regard to each Term of Reference (see Annex 1).

During the question and answer periods, provide appropriate feedback to the assessment scientists on the sufficiency of the analyses. It is permissible to request additional information if it is needed to clarify or revise existing analyses, if that information can be produced rather quickly.

(3) After the Open meeting

(GARM Chair, CIE and non-CIE panelists)

The GARM Chair will lead preparing, editing, and completing the GARM Panel Summary Report, based on contributions from the panelists (CIE and non-CIE). This report (see Annex 3 for information on contents) is to comment on the quality and soundness of the science, methods, and results with regard to each Term of Reference. If any modeling approaches and/or BRPs are considered inappropriate, the GARM Panel Summary Report should include recommendations and justification for suitable alternatives. If such alternatives cannot be identified, then the report should indicate that the existing modeling approaches and/or BRPs are the best available at this time.

The panelists and the chair will discuss whether their views on each Term of Reference can be summarized into a consensus conclusion. In cases where multiple, differing views exist on a given Term of Reference, the GARM Panel Summary Report will note that there was no consensus and will summarize the various opinions and the reason(s) for these.

(GARM Chair)

The Chair's role during GARM Panel Summary Report development will be to facilitate rather than to force consensus from the panel.

The GARM Chair shall prepare the introduction to the GARM Panel Summary Report, summarizing the background of the work to be conducted as part of the review process, and whether the process was adequate to successfully address the Terms of Reference.

As appropriate, the chair will include suggestions (in an Appendix) on how to improve the process.

The GARM chair will finalize all editorial and formatting changes of the draft GARM Panel Summary Report prior to its final approval by all panelists. The GARM chair will then submit the approved GARM Panel Summary Report to the NEFSC contact (i.e., SAW Chair).

(GARM CIE panelists)

Each CIE panelist shall prepare a CIE independent peer review report (see Annex 2). This report should comment on the quality and soundness of the science, methods, and results with regard to each Term of Reference.

If any modeling approaches and/or BRPs are considered inappropriate, the CIE independent peer review report should include recommendations and justification for suitable alternatives. If such alternatives cannot be identified, then the report should indicate that the existing modeling approaches and/or BRPs are the best available at this time.

During the meeting, questions which are not in the Terms of Reference but are directly related to the meeting may have been raised. Questions not explicitly referenced in the TOR but relevant to its intent can be documented and addressed.

Schedule of Milestones and Deliverables

The milestones and schedule are summarized in the table below. No later than May 16, 2008, the CIE panelists should submit their CIE independent peer review reports to the CIE for review⁴. The CIE reports shall be sent to “University of Miami Independent System for Peer Review,” and sent to Dr. David Sampson, via e-mail to David.Sampson@oregonstate.edu and to Mr. Manoj Shivilani via e-mail to mshivilani@ntvifederal.com

Milestone	Date
Open workshop at Northeast Fisheries Science Center (NEFSC) (report writing begins as soon as open Workshop ends)	April 28 – May 2, 2008
GARM Chair and CIE panelists work at the NEFSC drafting reports. Report writing starts during the meeting. Panelists leave meeting with at least the summary bullets.	May 1 - 2
Draft of GARM Panel Summary Report, reviewed by all panelists, due to the GARM Chair **	May 16
CIE panelists submit CIE independent peer review reports to CIE for approval	May 16
GARM Chair sends Final GARM Panel Summary Report, approved by CIE panelists, to NEFSC contact (i.e., SAW Chairman)	May 23

⁴ All reports will undergo an internal CIE review before they are considered final.

CIE provides reviewed CIE independent peer review reports to NMFS COTR for approval	May 30
COTR notifies CIE of approval of CIE independent peer review reports	June 6 *
COTR provides final CIE independent peer review reports to NEFSC contact	June 6

* Assuming no revisions are required of the reports.

** The GARM Panel Summary Report will not be submitted, reviewed, or approved by the CIE.

The SAW Chairman will assist the GARM chairman prior to, during, and after the meeting in ensuring that documents are distributed in a timely fashion. NEFSC staff and the SAW Chairman will make the final GARM Panel Summary Report and CIE independent peer review reports available to the public. Staff and the SAW Chairman will also be responsible for production and dissemination of the collective Working Group papers.

Acceptance of Deliverables

Upon review and acceptance of the CIE reports by the CIE Coordination and Steering Committees, CIE shall send via e-mail the CIE reports to the COTRs (William Michaels William.Michaels@noaa.gov and Stephen K. Brown Stephen.K.Brown@noaa.gov) at the NMFS Office of Science and Technology by the date in the Schedule of Milestones and Deliverables. The COTRs will review the CIE reports to ensure compliance with the SoW and ToR herein, and have the responsibility of approval and acceptance of the deliverables. Upon notification of acceptance, CIE shall send via e-mail the final CIE report in *.PDF format to the COTRs. The COTRs at the Office of Science and Technology have the responsibility for the distribution of the final CIE reports to the Project Contacts.

Key Personnel

Contracting Officer's Technical Representative (COTR):

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Request for Changes

Requests for changes shall be submitted to the Contracting Officer at least 15 working days prior to making any permanent substitutions. The Contracting Officer will notify the Contractor within 10 working days after receipt of all required information of the decision on substitutions. The contract will be modified to reflect any approved changes. The Terms of Reference (ToR) and list of pre-review documents herein may be updated without contract modification as long as the role and ability of the CIE reviewers to complete the SoW deliverable in accordance with the ToR are not adversely impacted.

ANNEX 1: Draft Terms of Reference for the GARM-III “Biological Reference Point (BRP)” Meeting (Last Revised: 1/11/08; A final draft will be distributed to the Panel prior to the meeting.)

1. For relevant stocks, determine the influence of retrospective patterns in parameter estimates (e.g., fishing mortality, biomass, and/or recruitment) from assessment models on the computation of BRPs and on specification of initial conditions for forecasting.
2. Trends in Stock Productivity:
 - a.) For relevant stocks, identify trends in biological parameters (i.e., life history and/or recruitment) and assess their importance for the computation of BRPs and for specification of rebuilding scenarios;
 - b.) If possible, summarize trends in pertinent environmental variables that might be related to the trends in those biological parameters relevant to BRPs.
3. Ecosystem approaches to Gulf of Maine/Georges Bank fisheries:
 - a.) Determine the production potential of the fishery based on food chain processes and estimate the aggregate yield from the ecosystem;
 - b.) Comment on aggregate single stock yield projections in relation to overall ecosystem production, identifying potential inconsistencies between the two approaches.
4. Biological Reference Points (B_{target} , $B_{\text{threshold}}$, F_{target} , $F_{\text{threshold}}$):
 - a.) For each stock, list what the current BRPs and/or BRP Proxies are (e.g., B_{MSY} , B_{MAX} , F_{MSY} , $F_{40\% \text{MSP}}$, historical survey catch per tow, etc.), and give their values (i.e., typically from GARM II);
 - b.) For each stock, update or redefine BRPs or BRP proxies that will be used for stock status determination, and compute their expected values and precision. Note: These BRPs and their proxies must be comparable and consistent with outputs from the recommended assessment models from the GARM III “Modeling” Meeting.
5. For each stock, identify appropriate models for forecasting and for evaluating rebuilding scenarios.

ANNEX 2: Contents of GARM-III CIE independent peer review report

1. The Independent CIE Report should comment on the quality and soundness of the science, methods and results with regard to each Term of Reference. CIE panelists should consider whether the work provides a scientifically credible basis for developing fishery management advice. Scientific criteria to consider include: whether the data were adequate and used properly, the analyses and models were carried out correctly, and the conclusions are correct/reasonable.
2. If any modeling approaches and/or BRPs are considered inappropriate, the Independent CIE Report should include recommendations and justification for suitable alternatives. If such

alternatives cannot be identified, then the report should indicate that the existing modeling approaches and/or BRPs are the best available at this time.

3. Any independent analyses conducted by the CIE panelists as part of their responsibilities under this agreement should be incorporated into their Independent CIE Reports. It would also be helpful if the details of those analyses (e.g., computer programs, spreadsheets etc.) were made available to the respective assessment scientists.

4. Additional questions that were not in the Terms of Reference but that are directly related to the meeting can be addressed. This section need only be included if additional questions were raised during the GARM meeting.

ANNEX 3: Contents of GARM-III Panel Summary Report

1. The first section the report shall consist of an introduction prepared by the GARM chair that will include the background, a review of activities and comments on the appropriateness of the process in reaching the goals of the GARM. The next section will contain comments on the quality and soundness of the science, methods and results with regard to each Term of Reference. The GARM Panel should consider whether the work provides a scientifically credible basis for developing fishery management advice. Scientific criteria to consider include: whether the data were adequate and used properly, the analyses and models were carried out correctly, and the conclusions are correct/reasonable.

If the CIE panelists, the non-CIE panelists and GARM chair do not reach an agreement on a Term of Reference, the report should explain why. It is permissible to express majority as well as minority opinions.

2. If any modeling approaches and/or BRPs are considered inappropriate, the GARM Panel Summary Report should include recommendations and justification for suitable alternatives. If such alternatives cannot be identified, then the report should indicate that the existing modeling approaches and/or BRPs are the best available at this time.

3. The report shall also include: a.) the bibliography of all materials provided during the meeting and any papers cited in the GARM Panel Summary Report; and separate appendices with b.) a copy of the CIE Statement of Work; c.) the assessment with the Terms of Reference used for the GARM BRP Meeting, including any changes to the Terms of Reference or specific topics/issues directly related to the assessments and requiring Panel advice; d.) a list of participants; e.) the meeting agenda, f.) a list of working papers; and g.) Presentation Highlights and Meeting Discussion Summary for each working paper. The Highlights and Discussion Summary are to be written by the assessment scientists and rapporteurs, respectively, with editing and oversight by the GARM Chairman.

Appendix 5. List of Working Papers

- 1.1 Legault C, Terceiro M. Specifying Initial Conditions for Forecasting When Retrospective Pattern is Present.
- 1.2 Legault C, Seaver A, Brooks L. A Simulation Study to Evaluate Estimation of Biological Reference Points from VPA and ASAP.
- 2.1 O'Brien L. Trends in Average Length, Weight and Maturity at Age for Relevant Stocks.
- 2.2 Rago et al. Implications of Biological Trends for Estimation of Biological Reference Points and Rebuilding Schedules.
- 3.1 Overholtz W, Link J, Fogarty M, Col L, Legault C. US Northeast Shelf LME Biomass, Target Biological Reference Points for Fish and Worldwide Cross-System Comparisons.
- 3.2 Link J, Overholtz W, Legault C, Col L, Fogarty M. Energy Budget Contextualization of Fish Biomasses at B_{MSY}
- 3.3 Overholtz W, Fogarty M, Link J, Legault, Col L. Estimates of Aggregate Surplus Production for the GARM and Other Stock Groups for the US Northeast Shelf LME.
- 3.4 Link J, Gamble R, Overholtz W, Legault C, Col L, Fogarty M. An Aggregate and MS Production Model: A Simulator Tool
- 3.5 . Fogarty M, Overholtz WJ, Link J. Fishery Production Potential of the Northeast Continental Shelf of the United States.
- 3.6 Link et al. Synthesis of Ecosystem Considerations.
- 4.1 Rago et al. Overview of Current BRPs Methods and Estimates.
- 4.2 Legault C. Setting SSB_{msy} via Stochastic Simulation Ensures Consistency with Rebuilding Projections.
- 4.3 Palmer M, Legault C. Sensitivity of the Long-term Observation-error Survey Series (LOSS) Model to Variable Stock-Recruit Steepness and Stock Depletion Inputs: A Test Case using Gulf of Maine haddock
- 4.4. Palmer M. (Supplementary Paper): A Method to Apportion Landings with Unknown Area, Month and Unspecified Market Categories Among Landings with Similar Region and Fleet Characteristics
- 4.5. Palmer M, Wigley S, O'Brien L, Mayo R, Rago P. (Supplementary Paper): A Description of Discard Estimation Methods Where Observer Coverage is Unavailable

- 4.6 Legault C, Palmer M, Wigley S (Supplementary Paper): Uncertainty in Landings Allocation Algorithm at Stock Level is Insignificant.
- 4.7 Miller T, Hart D. (Supplementary Paper): Analysis of Tagging Data for Evidence of Decreased Fishing Mortality for Large Gulf of Maine Cod.
- 4.8 Butterworth D, Rademeyer R. (Supplementary Paper): Implications of Tagging Analyses for the Shape of Selectivity at Age of GoM cod.
- 4.8a Butterworth D. (Supplementary Paper). Further Runs of ASPM/SCAA for GoM cod
- 4.A. Georges Bank Cod . O'Brien L.
- 4.B. Georges Bank Haddock. Brooks L.
- 4.C Georges Bank yellowtail flounder. Legault C
- 4.D Southern New England-Mid Atlantic yellowtail flounder. Legault C, Cadrin S.
- 4.E Cape Cod-Gulf of Maine yellowtail flounder. Legault C, Cadrin S, King J, Sherman S.
- 4.F. Gulf of Maine Cod. Mayo R
- 4.F.1 Gulf of Maine Cod, Butterworth D
- 4.F.1a Gulf of Maine Cod Addendum, Butterworth D, Rademeyer R
- 4.G. Witch Flounder. Wigley S
- 4.H. Gulf of Maine/Georges Bank American Plaice. O'Brien L
- 4.I. Gulf of Maine Winter Flounder. Nitschke P
- 4.J. Southern New England Winter flounder. Terceiro M
- 4.K. Georges Bank winter flounder. Hendrickson L
- 4.L. White Hake. Sosebee K
- 4.L.1 White Hake, Butterworth D
- 4.M. Georges Bank/Gulf of Maine Pollock. Mayo R
- 4.N. Gulf of Maine/ Georges Bank Acadian Redfish. Miller T
- 4.O. Ocean pout . Wigley S
- 4.P. Gulf of Maine/Georges Bank Windowpane Flounder. Hendrickson L
- 4.Q. Southern New England – Mid-Atlantic Windowpane Flounder . Hendrickson L
- 4.R. Gulf of Maine Haddock. Palmer M
- 4.S. Atlantic Halibut. Col L

WP 5.1. Rago P, Brodziak R. (Supplementary Paper): Overview of age-based projection model (AgePro) for reference point estimation and scenario analyses.

Appendix 6. Presentation Highlights and Discussion

This appendix includes the presentation highlights provided by the senior author of each working paper along the rapporteur's notes of the ensuing discussion. In regard to the latter, the emphasis was to capture the main points made. There was only modest editing of these during preparation of this report. Notwithstanding this, the text gives a sense of the main topics discussed, areas of agreement, and areas of future work. While these were referred to by the Panel, statements in this Appendix should not be considered the final conclusions of the Panel, which are stated in the body of this report.

ToR 1. Influence of Retrospective Patterns

Working Paper 1.1: Legault, C. and M. Terceiro. Specifying Initial Conditions for Forecasting when Retrospective Pattern Present

Rapporteur: Tim Miller

Presentation Highlights

There is currently no generally agreed methodological approach to adjusting projections to account for retrospective patterns in the stock assessment. This paper presents three alternative approaches and compares the resulting time series of spawning stock biomass, landings, and fishing mortality rate based on a summer flounder-like stock assessment. The three adjustments for retrospective patterns all reduce landings in the quota setting year, but the magnitude of the reduction is quite variable and the implications for future years in the projections are quite different. Adjusting the fishing mortality rate in the quota setting year is not recommended in the context of rebuilding programs because the future catches are greater than the unadjusted projections. Adjusting all ages in the starting population creates the largest decrease in projected catch, but typically cannot be justified based on the patterns observed at age. Making adjustments to the starting population based on the age specific retrospective patterns produces the most consistent approach, although the overall impact is relatively minor. A number of technical questions remain regarding exactly how to compute the retrospective adjustments at age. Management strategy evaluation work is required in the future to determine if any adjustment method performs better than the others.

Discussion

The chair and the presenter agreed that the methodology is not yet ready for the formal assessment process. A reviewer noted that perhaps retrospective patterns could be obtained when model misspecification is consistent over time, but it was not the case in the scenarios explored here. The presenter suggested that age-specific adjustments to initial population numbers at age is the best approach for dealing with retrospective patterns when they exist, but it may not always help and the question of what magnitude of a retrospective pattern warrants adjustment still remains. There was a proposal to assess the aggregate biomass for retrospective patterns and if one was suspected, look at age-specific patterns. Determining a default adjustment procedure was proposed as an important first step in using the methodology for formal stock assessment. In the near term, while the best adjustment procedure is still being determined, the chair thought (and others agreed) that it important to caution the Council that the results of any adjustment procedure are not robust and use the results with that in mind. Further

work that will help determine best adjustment methodology includes simulation. However, it will be important to constrain the set of scenarios for simulation to include the only the most problematic GARM stocks.

Working Paper 1.2: Liz Brooks, C. Legault, A. Seaver. A simulation study to evaluate estimation of BRPs from VPA & ASAP

Rapporteur: Tim Miller

Presentation Highlights

A simulation study was performed to evaluate two NOAA Fisheries Toolbox assessment models (VPA and ASAP) with respect to their ability to estimate biological reference points (BRPs) and the parameters of a stock recruit function. Data sets with different lengths of time, three different levels of recruitment variability (0%, 20%, and 80% CV), and two levels of steepness ($h=0.60, 0.88$) were simulated with PopSim, a simulation program in the Toolbox. Each simulated dataset was fit in the VPA and in ASAP. The estimated time series of spawning biomass and recruits from each model were passed to SRFIT, another Toolbox program, to estimate the stock recruit function and the corresponding BRPs. These externally estimated reference point values were compared to the true values to determine bias and precision. In addition, the internally estimated BRPs from ASAP were compared to the true values.

Between externally estimated BRPs from VPA and ASAP runs on the same data sets, the bias in estimates of the stock-recruit parameters was similar, but slightly less for ASAP, which carried through to less bias in the BRPs. Comparing internally versus externally estimated stock-recruit parameters for ASAP, the external estimates of R_0 were generally less precise, but slightly less biased for CV=0% and CV=20%. However, the bias in external estimates was quite severe when CV=80%. This may relate to misspecification in the default level of recruitment variability assumed in ASAP and SRFIT; it would require further detailed tuning to evaluate the impact of that model setting. When the ASAP model was applied to data from three different time periods with different amounts of data in each period, we found that the model performance was improved by extending the series as far back as there were indices (1963), but extending back to 1935 when only total catch was available produced no gain and oftentimes exacerbated the bias. For the VPA model runs using catch at age data that started in 1977 or in 1995, the shorter time series (only 12 years of data) did a very poor job of estimating unexploited levels of recruitment. This could be due to the length of the time series, or to the limited amount of contrast in stock size (the depletion level in SSB was pretty flat over that time period, ranging from 6% to 16%). Although there is not time to fully evaluate these hypotheses, based on the cases explored in this simulation, we conclude that short time series from an overfished stock are likely to produce informative time series of SSB and recruitment from which to estimate BRPs.

In all comparisons, the pattern of bias and precision in steepness carried through to the bias and precision of F_{MSY} while unexploited recruitment (R_0) largely determined the bias and precision in MSY and SSB_{MSY} .

Discussion

The inability to better estimate reference points with longer time series in some cases was unexpected by several people. The chair raised a concern that there was a stock-recruit curve assumed for the simulations, but that VPA does not assume one. Some simulations where a

“random” stock-recruit relationship is assumed would provide interesting results. However, the expected fact that short time series did not provide reliable estimation of reference points was thought to be an important result of this study and the chair thought that, in these cases, incorporating other information from related stocks in a statistically rigorous way would be a good option.

ToR 2. Trends in Stock Productivity

Working Paper 2.1 Part II. O’ Loretta O’Brien, Michele Traver, Jessica Blaylock, Betty Holmes, Jiashen Tang, Liz Brooks, Laurel Col, Mike Fogarty, Kevin Friedland, Larry Jacobson, Joe Kane, Jason Link, and Paul Rago. Trends in Average Length and Weight, and Proportion Mature at Age for Relevant Stocks and Trends in Environmental Variables

Rapporteur: Jessica Blaylock

Presentation Highlights

This paper presents the results of several approaches aimed at detecting trends in length, weight, and maturity for twenty groundfish stocks.

Z-score analyses combined with a Loess smooth fit of the NEFSC Survey stratified mean lengths and mean weights at age indicate that six stocks show no particular trend in either mean length or mean weight in more recent years, while two stocks show an increasing trend, and the remaining twelve stocks show a decline in length and mean weight at age in recent years. Female maturity ogives estimated with data smoothed with 3- or 5-year moving average show no trend for 8 stocks, an increasing trend for 11 stocks, and decreasing trends for 2 stocks.

Quintile Plots (Visual Report) show three different patterns across the stocks: 1) faster growth during periods of low density and slower growth during periods of high density, suggesting density dependence in some stocks such as GB Haddock; 2) reverse non-density dependent growth, as in GB Cod; and 3) a mix of patterns 1 & 2, as in GB Yellowtail. A reordering of these plots showed that juveniles and adults are trending together, and that mean weight seems to be declining more in Gadids than in Flatfish in recent years.

Analysis of environmental data, such as the Northwest Atlantic Oscillation (NAO), sea surface temperature, and primary productivity, shows an earlier period of low anomalies, low temperatures and low productivity, followed by a more recent trend to positive anomalies, higher temperatures, and high productivity.

Finally, copepod and zooplankton abundance data exhibit a distinct pattern of negative anomalies prior to 1989, and generally positive values in the following years. Food habits data showed no strong trends.

Discussion

Panelists questioned the implications of these trends for the determination and use of Biological Reference Points (BRPs). This brought the use of a three to five year average for mean weights for BRP determination back into question. This issue had been widely discussed during the GARM III ‘Data Inputs’ review, but the results of WP 2.1 might influence the decision to use a short-term versus a long-term approach concerning BRPs. In other words, should one incorporate recent trends in long-term projections using a three to five year average or use the time series average instead? There was also some concern about potentially

incorporating trends for which the exact cause is unknown. This discussion is continued in the review of Working Paper 2.2.

It was observed that most trends seem to be year effects rather than cohort effects. This is expected since these trends are assumed to be linked to environmental patterns affecting all ages, so we would not expect to see cohort effects.

In response to the suggestion to look at other sources of data in addition to the survey data, the presenter reminded the Panel that it was the observation of decreased catch weights that was the initial reason for undertaking this analysis. Survey data was therefore analyzed to determine if the trends also occurred at the population level.

Finally, there was some concern about the significance of changes in the parameters, given that no error bars were presented. There is some question about whether conclusion on trends would be different if we had error bars, and whether recent values are truly significantly different than previous ones. The presenter asserted that the time-series trend was shown to be significant for ten of the stocks in a previous analysis using randomization tests, and that the calculation of confidence intervals cannot be easily incorporated into computations at this time.

Working Paper 2.2: Rago et al. Implications of biological trends for estimation of biological reference points and rebuilding schedules

Rapporteur: Jessica Blaylock

Presentation Highlights

This paper evaluates the potential effects changes in life history parameters can have on Biological Reference Point (BRP) estimation and rebuilding strategies. Determination of size at age, maturity and survival has a direct influence on fisheries management since these measures reflect stock productivity and are used to determine BRPs, which are the basis for defining rebuilding plans. Changes in life history parameters have been observed for numerous stocks in the region (Working Paper 2.1), but the exact cause of these changes is not always clear. Mis-estimation of these parameters can have serious consequences, as illustrated by the Pacific Halibut and GB Haddock stocks.

It is thus critical to estimate correct values for life history parameters, both for long-term goals such as efficient management and successful rebuilding, but also in relation to the more immediate decisions that have to be made concerning BRP estimation.

Discussion

Much of the discussion reconsidered the decision to use the 5-year moving average for weight, length and maturity in relation to Biological Reference Point (BRP) estimation. When this decision was made at the GARM III 'Data Inputs' review, it was agreed that this approach would be suitable for most stocks. In the current meeting, Working Paper 2.1 showed trends in life history that differed across stocks, suggesting a different approach to each stock might be preferable. Despite this, and because it is not clear how sensitive the BRPs are to the observed trends, the Panel cautioned that the 5-year average approach should still be used unless analysts have compelling reasons not to do so. Consensus was reached to use the 5-year moving window approach as a default for BRP estimation, while staying open to specific case-by-case deviations from this method. This is especially valid because some stocks do not seem to be recovering (i.e. Cod), and many of the stocks are on the southern edge of their distribution, where they are

expected to be most influenced by changes such as climactic and environmental variations. Whatever the final decision is concerning BRP estimation, the chosen approach will have to be clearly explained to management bodies.

These conclusions led to questions about implications for forecasting as mentioned in Term of Reference 1, especially relative to 'specification of initial conditions'. While using a 5-year period average seemed acceptable for SSB, there was agreement that TACs would need a different forecasting approach that would take any trend into account.

A few other topics also required brief clarification: 1) density dependence is currently not built into any of the forecasting tools, and 2) the number of years to be used for recruitment is determined on a case-by-case basis.

ToR 3. Ecosystem Approaches to Gulf of Maine / Georges Bank Fisheries

Working Paper 3.1: W.J. Overholtz, J.S. Link, M. Fogarty, L. Col, and C. Legault. US Northeast Shelf LME Total Fish Biomass, Target Biological Reference Points for Fish and Worldwide Cross System Comparisons.

Rapporteur: Tony Chute

Presentation Highlights

The total target biomass for the US Northeast Shelf ecosystem is 6.1 million mt, 67% demersal species and 33% pelagic species. The GARM stocks, commercial pelagic fishes, and elasmobranchs have similar B_{MSY} biomass targets at 5.78, 5.24, and 4.69 t/km², respectively. The LME biomass targets for pelagic and demersal fishes are similar in scale to biomass estimates from previous studies of the region. The total B_{MSY} target biomasses for the Northeast LME for demersal and pelagic fish resources are similar to the current Northeast LME biomass and similar to the average biomass of many other temperate marine systems. The target biomass for the Northeast LME is below the average for the nine other temperate marine systems (24.485 versus 32.763 t/km²). The target biomass for the demersal component is moderately higher than the average for the demersal group from nine other systems, while the target pelagic biomass is well below the average for pelagic fish from these systems.

Conclusions

On an ecosystem basis, current biomass management targets (B_{msys}) for GARM, pelagic, and elasmobranch fishes are reasonable. The current targets compare favorably with the results of current and historical studies in the region and are also in general agreement with results of many studies for other worldwide ecosystems.

Discussion

The carrying capacity of the system is supposedly only 70% of the summed B_{MSY} of all the species (GARM spp, pelagics, elasmobranchs). A 2-tier system where the individual MSYs as well as the carrying capacity of the system should be adopted. The fish don't need to just feed each other; their populations need to be able to withstand human removals. We will look at the whole Northeast shelf ecosystem and the MSYs of managed species based on single species models, an energy budget, and surplus production models.

One of the presenters noted that they looked at the current biomass and target BRPs for individual fish species from the Northeast shelf ecosystem, summed them up and converted to

biomass per unit area for comparison with other systems around the world. They collected all the B_{MSY} and current biomass information available for the 19 GARM species, pelagics and some elasmobranchs. Species which had a kg/tow proxy for a BRP used that information and swept area biomass to calculate current biomass and a B_{MSY} . The ratio of current biomass to B_{MSY} was then calculated. Biomass of squid, sand lance, mesopelagics, anadromous fish etc was also added. It was estimated using ECOPATH that 12 tons per km² of demersals were currently in the system, and the target biomass is 16 tons. For pelagics, the current biomass is 11.4 tons and the target biomass is 8.4. When compared to other LMEs, the biomass per unit area fell within reasonable bounds.

It was acknowledged that the entire shelf ecosystem was used for analysis when some fish species inhabited only part of it. Sub-areas were considered too small for comparison with other ecosystems. Migration out of the system was accounted for. The ratio of pelagics to demersals was similar to that found in other systems. When biomass and kg/tow of some species were known, they were used to estimate a catchability value which was useful for the species that only had kg/tow information. The Northeast shelf system was not obviously similar to any of the other systems used for comparison.

Working Paper 3.2: J.S. Link, W.J. Overholtz, C. Legault, L. Col, M.J. Fogarty. Energy budget contextualization for fish biomasses at B_{msy} .

Rapporteur: Tony Chute

Presentation Highlights (from slides presented to meeting)

Model Structure

- EMAX for four NEUS regions combined into one total
- Areal weighted for B, P/B and C/B
- Common diet with all nodes (group of species) from SNE
- Summed for fisheries and bycatch
- Used mass-balance equations
 - $C = P + R + E$

Model applications

- Current biomass combined for all four NEUS regions
- Then balanced: used as baseline
- Main objective was to ascertain effects of having fish nodes at B_{msy}

Model scenarios

- B_{MSY} for eight fish groups
- All pelagics B doubled from B_{MSY} values
- All pelagics B halved from B_{MSY} values
- All demersals B halved from B_{MSY} values
- Rebalanced each scenario
 - Compared difference from input & difference from current baseline
 - Locked P/B, C/B ratios
 - Changes demersals: perturbed & rebalanced
 - Compared rebalanced scenarios to current baseline

Results

- Bmsy: had to up small pelagics & down demersals to make model work
- Double pelagics
- Half pelagics
- Half demersals
- Flow to detritus tracked
- Cybernetic metrics summarized

Summary

- Overall, results inconclusive given multiple caveats of network model
- Recall, just equilibrium rebalancing; doesn't account for responses in F
- Fish components of the system could be increased relative to current biomass levels
- Overall, scenarios had minimal change relative to balanced baseline
- Unclear if BMSY for all species is energy limited from a systemic perspective
- However, rebalancing relative to input levels suggests may not be able to have all fish spp at BMSY due to flow constraints
- All scenarios were balanced largely predicated upon a higher small pelagic-comm biomass and a lower demersal-omniv. and pisc. Biomass

Discussion

The presenters used the EMAX model to make an energy budget for the Northeast shelf ecosystem. The system was four sub-regions, and nodes within each sub-region. For the diet portion of the model, the Southern New England diet web was used, because it contained the most nodes. The model is an equilibrium model and accounted for fish entering and leaving nodes, and used biomass, consumption per unit biomass and production per unit biomass. Model runs were started with target biomass of each species in the nodes, then the model ran with double the pelagics, half the pelagics, and half the demersals (perturbing the system). C/B and P/B were fixed but diets could change. Results were shown as percentage or number increase or decrease in various species groups. At target biomasses, the model reduced demersal benthivores and increased small pelagics; at double the pelagics, the model increases the demersals, but halve the pelagics and the model wants to increase them and reduce the demersals, and if the demersals are halved, the pelagics increase by a large amount. The different scenarios delivered similar results with the exception of the double pelagics. A large proportion of pelagics increases the “flow to detritus” in the model. No fishing mortality was included in the model. It was not clear whether the system itself put any constraints in the Bmsys.

“Pedigrees” were given to each node depending on the confidence level they inspired before the model was run, and some parameters were more flexible, like diets and species composition. Life history parameters can be added into the model, such as larger fish becoming more prevalent as species recover. Small pelagics were always increased in each run of the model, but they are currently over Bmsy. They may have an impact on the recovery of the GARM species and that point needs to be raised.

Working Paper 3.3: W.J. Overholtz, M. Fogarty, J.S. Link, C. Legault, and L. Col. Estimates of aggregate surplus production for the GARM and other stocks groups for the US Northeast Shelf LME.

Rapporteur: Tony Chute

Presentation Highlights

Overall, the results from both surplus production modeling approaches suggest that the expected aggregate yield is lower, the Bmsy biomass is lower and the overall fishing mortality rate should be lower for the GARM III stocks as a whole than is suggested from the single species results. The expected yield for the pelagic complex is similar or slightly higher, the Bmsy biomass is higher, and the overall fishing mortality rate is lower than suggested from the single species target results. This suggests the need for an overall 2nd layer of consideration for the GARM III stocks as a whole, and managing the pelagic stocks at a higher level of biomass than suggested by the single species results.

Discussion

Aggregate (summed) surplus production was estimated for all stock groups using the ASPIC model which uses landings and survey indices as input data. Methods like this have also been used in the Gulf of Alaska and the Bering Sea ecosystems. Each group, GARM spp, pelagics and elasmobranchs, had its own parameters developed initially by using sensitivity analysis. Sometimes survey data was lacking, but again those species with a kg/tow proxy were given a q based on swept area biomass. Final ASPIC results indicated a fairly low aggregate Fmsy of 0.11, and a high Bmsy for the group. It looked like a better recovery for all species with the addition of the pelagic group. The results of a 1998 study which calculated individual species MSY and Bmsy were summed and compared to the ASPIC results and were found to be different.

To attempt to take into account environmental variables, another model was used with SST, SST range, CO₂ and bottom temperature as input (positive, negative or neutral). CO₂ showed a significant result indicating a higher F and lower MSY, but most did not seem to affect the model appreciably. A higher Bmsy for pelagics and a lower F for all spp was shown to be best for recovery.

It might be possible to come up with a value for natural mortality (M) using this type of model. It is important to look at the residual patterns before bootstrapping. The aggregate Fmsy takes the different species in different nodes into account, sometimes it is easier to think of it as “fishing effort”. The output changes when the $B1/K$ goes from 0.5 to 0.6 in table 7, and that may be evidence of some sort of “wall” in the model. All zooplankton and phytoplankton is being eaten in the model. Some models make the plankton more dynamic. There are many analyses that can be done with this model, including adding up “known” MSYs from an age-structured models and seeing how ASPIC output compares. For the purpose of this analysis, the species needed to be summed for comparison with other studies.

Working Paper 3.4: J.S. Link, R. Gamble, W.J. Overholtz, C. Legault, L. Col, M.J. Fogarty. An Aggregate and MS Production Model: A Simulator Tool

Rapporteur: Larry Jacobson

Presentation Highlights

A logistic model was augmented to include ecosystem effects on a fish organized into three guilds (GARM species, small pelagic species and elasmobranch guilds). The model included fishing, predation, inter- and intra-guild competition. Model parameters were from single species stock assessments (e.g. Fmsy and Bmsy), food habits data and other sources. The

model was used to simulate biomass dynamics of guilds and individual species under various assumptions under various levels of fishing, competition and predation. The main purpose was to examine how fishing, predation and competition affect carrying capacity and stock rebuilding plans for simulated GARM stocks individually, as guilds and in aggregate.

Long term projections for aggregate biomass showed four main patterns. First, all groups had approximately equal carrying capacity with GARM species dominating slightly in simulations with no fishing and no species interactions. Second, harvesting impacted the pelagics and elasmobranchs more than GARM species guild. Third, species interactions impacted pelagics the most (as would be expected due to predation). Finally, with no harvest or interactions, the system produced a total biomass close to system carrying capacity. As either interactions or harvest intensified, aggregate carrying capacity was reduced. With both factors occurring, carrying capacity was reduced by approximately one-half.

There were five main patterns in multispecies simulation results. First, with no harvest or interactions, most species achieved the carrying capacity levels expected based on assumed parameter estimates and carrying capacity for the entire system was high. Second when species interactions are turned on, not all species reached their expected carrying capacities and many species approached carrying capacity much more slowly than expected. Third, reductions in carrying capacity due to harvesting were smaller than reductions due to species interactions. Fourth, with harvest and species interactions, carrying capacity and stock biomass was substantially lower for all species, guilds and the ecosystem as a whole than in the absence of these factors.

Discussion

Discussants generally agreed with the overall results indicating reduction in carrying capacity due to species interactions and their potential importance. However, no procedures for adjusting actual reference points used by managers were presented.

Several members of the audience pointed out that production parameter estimates from single species assessments implicitly include “average” predation and species interaction effects during years included in the model. It was argued that model presented as parameterized had heuristic value but should not be used for management purposes as parameterized because species interaction effects were “double counted”. The authors agreed with the point but indicated that the intent was heuristic, the model was preliminary and similar overall results would be obtained using adjusted parameters.

Working Paper 3.5: Fogarty, M., W. Overholtz and J. Link. Fishery Production Potential on the Northeast Continental Shelf of the United States

Rapporteur: Larry Jacobson

Presentation Highlights

The Northeast Continental Shelf of the United States has undergone dramatic shifts in species composition of harvested fish populations over the last five decades. We have documented a steady decline in the mean trophic level of the catch since 1960 with a current dominance by low trophic level invertebrates and small pelagic fishes. At the height of the distant water fleet fishery, an estimated 35% of the primary productivity was required to account for the observed commercial landings. Currently, approximately 10% of the primary production

is appropriated to account for the observed catch (landings plus discards). Under our best current estimates of primary production, mean trophic level of the catch, transfer efficiencies, consideration of total removals (landings and discard) from the system at MSY levels, it appears that important constraints on available energy must be considered in setting harvest policies at an ecosystem level. Further consideration of food requirements for threatened species and apex predators under rebuilding strategies highlights the potential constraints on available energy to meet overall ecosystem management objectives. This perspective of necessarily involves consideration of possible tradeoffs among harvesting of GARM species and other system components. Application of an ecosystem overfishing criterion based on the primary production required to account for observed catch levels and the mean trophic level of the catch, the Northeast Continental Shelf is classified as overfished at the ecosystem level. If changes in system productivity states resulting in lower growth rates for GARM and other species are confirmed, the ecological transfer efficiencies for these components will shift to lower levels and the estimated fishery production potential will be correspondingly lower, exacerbating the constraints on the system removals.

Discussion

This working paper compared preliminary estimates of total MSY for GARM species from preliminary stock assessments to updated estimates of potential production based on primary production and trophic structure assumptions. Trends in relative amounts of primary production associated with catches of various species were calculated also. Consumptive demands of fish (including GARM species), marine mammals, turtles, birds and protected species were included in calculations.

Results indicate that 7.2% of total primary production was required to support the commercial fishery during 2005. Including discard estimates and recreational catch, 9.55% of total primary production was required. In contrast, almost 35% of total primary production was required during peak years of exploitation by the distant water fleets. The estimated mean trophic level at MSY for all species represented by stock assessments during 2005 was 3.1. Based on a recently published classification system that uses percent of total primary production and mean trophic level, ecosystem overfishing occurred on the northeast shelf during 2005.

Results were sensitive to relatively uncertain assumptions about mean trophic levels. Based on one plausible estimate of mean trophic level, MSY for finfish and invertebrates is 1.29 million t or about 83% of the estimated primary production potential. If discards and incidental losses were included, then primary production required to support the fishery might be near or exceed 100% of the total available. Thus, results suggest that production potential may be a limiting factor in achieving MSY biomass levels for all fisheries simultaneously. It may be important to considering this possibility in formulating harvest policies for GARM and other northeast stocks.

Members of the audience seemed to recognize potential limits on stock biomass and fishery productivity due to limits on available primary production. After discussion, however, the Panel decided that the paper did not propose any particular immediate adjustment to harvest recommendations for GARM species during the current management cycle.

Working Paper 3.6: Link JS et al: Implications for Single Species Reference Points

Rapporteur: Larry Jacobson

Presentation Highlights

Proposed Ecosystem Terms of Reference Updates

- 1) Simulation studies to examine the performance of the aggregate model when applied to data generated using full age-structured models for an assemblage of species.
- 2) If the simulations in (a) confirm the utility of the aggregate model, we will compare our final results with results of single species production model analyses using the same estimation methods.
- 3) We will compare results from production models (both aggregate and single species) with the final results from GARM analyses of BRPs to determine overall applicability of the production models.
- 4) If we find convincing evidence that the aggregate case remains appreciably lower than the sum of the single species levels, we will examine possible ways of integrating the multispecies perspective with the individual species reference points in a simulation exercise.
- 5) We will update and refine the broader ecosystem analyses to provide an overall context for the GARM analyses. These will be used in a qualitative way.

Discussion

No working paper was presented under this agenda item. Instead, the previous working papers were discussed.

Several lines of evidence in WP3.5 and WP3.6 indicate that the ecosystem may not be able to support Bmsy levels for all managed stocks simultaneously, particularly if consumption by large marine mammals increases and considering discard.

ToR 4. Biological Reference Points by Stock

Working Paper 4.1. Rago, P. Overview of Current Biological Reference Point Methods and Estimates for Multispecies Groundfish in the Northeast US

Rapporteur: Elizabeth Brooks

Presentation Highlights

This report provides a summary of current Biological Reference Points (BRP) for the 19 GARM III stocks and background on their methods of estimation. The definition of BRPs is an essential component of stock assessment. Measures of abundance and harvest rates derived from assessment models are compared to standards that constitute desirable states for each stock. These states are based on the concept of maximum sustainable yield. When sufficient information is available, BRPs can be based on fishing mortality and biomass values that produce maximum sustainable yield. In other instances, the BRPs are based on a proxy value that should approximate the fishing mortality rates and biomass levels associated with maximum sustainable yield. The range of approaches reflects the range of available data types and quantity, and historical exploitation patterns.

Biological reference points for the GARM III stocks can be classified into three groups: “parametric”, “nonparametric”, and “index”. Parametric BRPs are derived from specification of an explicit functional relationship between recruitment and stock size. “Internal” parametric estimates are derived as part of the model identification and estimation process (GB winter flounder (fl.), surplus production model). “External” parametric estimators of BRPs use model outputs of abundance, SSB, recruits and fishing mortality as inputs to stand alone models such as SRFIT (GB cod, GOM cod, GOM winter fl., and SNE winter fl.). If parametric models (internal or external) are not acceptable, a “nonparametric” method is used to derive proxy values for Fmsy and Bmsy (GB haddock, GB yellowtail fl., SNE yellowtail fl., CC/GOM yellowtail fl., Amer. Plaice, witch fl., and redfish). These proxies are derived by combining standard yield per recruit (YPR) and SSB per recruit (SSB/R) methods with model-based estimates of absolute recruitment. Model parameters can be used to define appropriate partial recruitment vectors for YPR analyses leading to estimates of proxy estimates of Fmsy. SSB/R estimates for proxy Fmsy values can be multiplied by some function of the recruitment time series to obtain an estimate of SSBmsy or Bmsy.

Index methods for the GARM III stocks this approach is formalized as the AIM model in the NOAA Fisheries Toolbox. This empirical approach finds a reference point for relative F where the population replaces itself (Pollock, northern windowpane fl., southern windowpane fl., Ocean pout, GOM haddock, and white hake). A major limitation of the AIM model is that the relative biomass target must be externally supplied. For a number of stocks even the index methods fail to provide precise quantitative guidance. For these stocks proxy reference points were deduced by examining historical landings, relevant aspects of the fisheries, and behavior of surveys (halibut).

Discussion

Clarification was requested as to whether rebuilding requirements were separate or distinct from specifying BRPs. It was noted that care is needed in how one re-samples recruitment into the future. Clarification was also requested as to what determines the decision for when to reject the fit of a stock-recruit model. The approach was outlined in Brodziak and Legault (2005). Typically, it takes into account multiple models, looking at the degree of fit for all models, variances, etc. The rules within parametric world look at AIC, but making the jump from saying “no parametric model fits are acceptable” to move to a non-parametric approach is not well-defined. One typically looks at diagnostics such as patterns in residuals. A panelist noted that one might also want to look at the level of SSB contrast (observations between SSB_{MSY} and SSB_0). This was acknowledged by the presenter, but emphasized that one doesn’t always have (rarely has) that type of contrast.

The meaning of $B_{threshold}$ was unfamiliar to some of the panelists, who questioned what happened when a resource goes to that threshold. It was clarified that $B_{threshold}$ is the point below which management action is triggered and a rebuilding plan is established. The equivalent threshold for fishing mortality is $F_{threshold} = F_{MSY}$.

A panelist suggested that it would be good to get clarity on terminology, targets, threshold, limits, F_{max} , $F_{40\%MSP}$, etc. We need to think about the different types of proxies, justification and implication of when a proxy is chosen.

Working Paper 4.2. Legault, C. Setting SSBmsy via Stochastic Simulation Ensures Consistency with Rebuilding Projections

Rapporteur: Elizabeth Brooks

Presentation Highlights

Current approaches to setting biological reference points and conducting projections contain an inconsistency. Specifically, fishing at the Fmsy rate for many generations does not produce the SSBmsy with 50% probability. This inconsistency arises whether a parametric or empirical approach is used due to the variance in projected recruitment causing the stock to be more or less productive than assumed in the deterministic calculations of the reference points. The proposed solution is to utilize the available projection software to make the SSBmsy value an emergent property of fishing at Fmsy for many generations. This approach ensures consistency between the reference points and the projections used to determine fishing levels necessary to rebuild overfished stocks to the SSBmsy level. This paper provides a demonstration of large the inconsistency can be in a typical situation and discusses a number of related issues including an extension of this approach to solve for Fmsy, the standard approach to deal with lognormal error distributions, historical significance of this inconsistency, biologic and fishery vectors used in the calculations, and Fmsy relative to its proxies.

Discussion

A panelist was concerned that you end up having a different definition for Bmsy if your rebuilding target were 50% or 75%. Bmsy should be independent of your rebuilding target. The speaker clarified that 50% would still be the Bmsy target, but management could shoot for a different rebuilding target. The speaker was not proposing that we change the 50% target; the management choice of a rebuilding percentile is an independent choice.

Regarding projecting to get the median, a panelist asked if this is a switch to use the median vs. the mean. If you are happy to go with the average F, then you can use bias correction, so it seems the difference is whether we accept median or mean. The panelists' inclination is to stick with the mean, only because you don't have to do the simulations and therefore your results would be invariant to simulation trials. It is quicker and easier. The speaker responded that the issue is that in the deterministic calculation, you can solve for the values, but the implied precision is unreal. For mean vs. median, because we are working in a probabilistic situation, and because there is talk of moving to alternative percentiles, we need a method that is consistent with that. It works in the parametric case, but not so easy for the empirical approach. The projections accept two parameters for the stock recruitment function, and you assume (fix) some level of variability about that. This approach takes into account whatever level of uncertainty is specified.

A panelist questioned the decision to not do same thing for Fmsy as is being proposed for Bmsy. The speaker responded that when we do the empirical approach, we have a different model to derive Fmsy. The panelist rejoined that it seems like you have an F that you would get for a different model. The speaker responded that the tradeoff is you have to look at variability in yield from year to year.

There was a fair amount of discussion regarding the mean versus the median for reference points. The main point of debate was that the median is a management decision, whereas the mean is an expectation or maximum likelihood result. Choosing the median is just

another way of defining an SSB reference point, but it doesn't correspond to the population dynamics implied SSBmsy. The speaker responded that this is a proposed proxy. It is an easy fix to ensure that you meet your rebuilding target.

A member of the audience strongly supported the proposed projection approach. He pointed out that you have a process that has an inconsistency, and this method solves the inconsistency. A nightmare of added complexity could ensue if one were to carry this any further; what is needed is a robust proxy rather than something perfect. One shouldn't get carried away with the mass at age, and say you'll work with it over the short term horizon. It is not worth nitpicking every year. The proposed approach is viable and consistent. It was pointed out, however, that there are two things to take care of in this proposed approach. 1) the issue of what is in and what is not in when you consider recruitments (ex: for haddock, is it a mixture distribution or a single distribution; considering a single distribution you get an unbelievable distribution); 2) given the different results for fitted S-R vs. proxy, you've got to look at some measure of precision of that estimate (the proxy); you will likely see that there is a wide range that may be in a more reasonable range. The speaker responded to the first point by saying that with the exceptionally large year-classes for haddock, even if one sets the bar high by including them, you still have consistency—even if it is unrealistic.

A panelist asked if, when going through stocks later, would the expected value for SSBmsy from deterministic as well as AGEPRO estimates be presented, just so that the Panel understands the magnitude of the adjustment. The speaker replied that for some that would be the case, but probably not for all. The SRFit values probably exist for most, so it is a matter of compiling those. The panelist followed up, saying that it is important for the Panel to see the estimates so that they can understand the adjustment, and to understand what is causing the size of the adjustment; it becomes a point of whether you believe the estimate of sigma for recruitment deviations.

The Panel decided to accept the approach in principle, but to look at results on a case by case basis to see if it makes sense.

Working Paper 4.3: Michael Palmer and Chris Legault. Sensitivity of the Long-term Observation-error Survey Series (LOSS) model to variable stock-recruit steepness and stock depletion inputs: A test case using Gulf of Maine haddock

Rapporteur: Gary Shephard

Presentation Highlights

The GARM III 'models' review Panel recommended that for stocks currently using the Relative Trend class of models "alternative models should be explored that both have a stronger basis in biology and more explicitly address uncertainty". Specifically, age-structured models were recommended that incorporate life history parameters and which allowed direct estimates of biological reference points; e.g., age-structured production model. Biological reference points for the Gulf of Maine haddock stock have been determined using An Index Method (AIM) since 2002. This model is assumed to be informative given the strong relationship between the relative fishing mortality and replacement yield for this resource. Because of this strong relationship, the Gulf of Maine haddock stock is good candidate to assess the performance of age-structured production models on northeast United States groundfish stocks.

The application of a specific age-structured production model, the Long-term Observation-error Survey Series (LOSS), to the Gulf of Maine haddock stock is examined. Despite a clear minimum value of the objective function, none of the LOSS model runs are statistically different from one another with values of the objective function ranging from 21.795 to 22.517. However, there are large differences in the implications between the runs for stock status determination. Given the inability to determine a “best” model formulation and the wide ranging implications on stock status, the LOSS model is not a good candidate with which to determine biological reference points for Gulf of Maine haddock.

Discussion

The intent was to examine the use of an alternative model for Gulf of Maine haddock assessment. It was concluded that there was no clear best model based on the objective function and there were implications in the biological reference point in choosing the wrong model.

The Panel suggested the development of a model incorporating process error. In addition, a follow-up model was suggested using an informed prior such as the use of age one estimates. However, since the log-likelihood did not provide adequate contrast, incorporation of process error could have a big influence on the outcome. Use of some catch at age information would constrain the process error. The approach has worked for some species but inevitably poor data creates poor results without any information as a prior. A more extensive modeling exercise has been undertaken in the GoM haddock assessment.

Working Paper 4.7: D. Hart and T. Miller. Analyses of tagging data for evidence of decreased fishing mortality for large Gulf of Maine Cod, *Gadus morhua*

Rapporteur: Gary Shephard

Presentation Highlights

Two complimentary analyses of Atlantic cod tagging data from a tagging study carried out by the Gulf of Maine Research Institute were performed using the methodology we employed previously for yellowtail flounder at the previous Groundfish Assessment Review Data Meeting. The first compares expected probability of recovery by age class for tagged fish based on estimates of age-specific fishing mortality by Butterworth and Rademeyer (2008) and a standard VPA with the observed proportions of recoveries for different length classes (and approximate corresponding ages) in the Atlantic cod tagging data. The second analysis fits a finite-state continuous-time model to the Atlantic cod tagging data to estimate different fishing mortality parameters within the Gulf of Maine, Georges Bank and Canadian 4X stock areas for fish in three size classes (≤ 60 , > 60 and ≤ 85 , > 85) at release. Maximum likelihood estimates of instantaneous migration, natural mortality and tag-shedding rates, tag reporting probability and a non-mixing scalar to adjust fishing mortality in the first month after release are also provided by the second analysis. Although the latter parameters are not the focus here, it is desirable to “control” for different migration between and mortality rates within regions when estimating these size-specific fishing mortality rates. Neither of the analyses we undertook showed evidence (statistical or otherwise) that larger (older) Atlantic cod are subjected to lower fishing mortality in the Gulf of Maine than smaller (younger) Atlantic cod. Ideally, we would like to consider a model for the tagging data that allows fishing mortality to change over the life history of a given fish as it grows larger and older, because fish that are small at release will experience different

fishing intensities as it grows. However, the use of size at release should provide results that are a good approximation.

Discussion

Tag results from a cod tagging program in the Gulf of Maine were presented. The Panel questioned if the high reward tags were randomly assigned among all sizes. The model produced variable M by size and it was suggested a constant M model may influence the results as the higher M may confound the dome question. However in the largest size class the M was fairly uniform compared to the next smaller size category and was unlikely creating any undue influence. The high reward reporting rate remained an issue in that a higher reporting rate by size could camouflage any dome selectivity pattern. Perhaps further examination of high reward reporting rates would be helpful. Some modifications to the Miller model were suggested, such as constant M , but time constraints did not permit new runs.

Working Paper 4.8 (Supplementary Paper): Butterworth, D. Implications of Tagging Analyses for the Shape of Selectivity at Age for Gulf of Maine cod

Rapporteur: Gary Shephard

Presentation Highlights

WP 4.8 (Supplementary) discussed alternative possible interpretations of the results of the tag-recapture data for cod provided in Hart and Miller (GARM-III BRP TOR 4.7). Building on the basic framework underlying estimation from such data previously presented in Butterworth and Rademeyer (Supplement 2 to GARM-III TOR 2), it was shown that the high estimates of M in the Hart and Miller analyses could reflect either higher natural mortality than 0.2, or permanent emigration of portions of the population, given that the other interpretation of a tag-induced additional mortality rate of 0.8 for older animals seemed unrealistically large. Thus the tag-recapture results were open to interpretation as a validation of permanent emigration (which would be reflected as an apparent decline in selectivity at large ages), or of higher natural mortality. A further possibility was that there is either large immediate mortality of tagged cod, or under-reporting of high reward tags, which would lead to increased estimates of F and decreased ones of M . Specifications for a suggested further run of the Hart and Miller analysis were put forward, anticipating that the results would show whether the requisite decrease in M could be obtained without increasing F to an extent that would render it incompatible with the assessment. Suggestions were made of approaches to independently test hypotheses that would lead to domed shaped selectivity. Specifically the possibility of older stronger swimming cod being able to escape capture by trawl nets could be examined by mounting cameras on nets, and of older cod preferentially inhabiting untrawlable rocky ground by placement of longlines in such areas.

WP 4.8a presented the results of runs of the ASPM (SCAA) assessments for Gulf of Maine cod presented in WP 4.F.1 adjusted to commence in 1964 as requested during discussions, and covering values of $M=0.3$ as well as the conventional $M=0.2$ for both Ricker and Beverton-Holt stock recruitment relationships, and for both estimated and flat selectivity at large ages. Notable results were clear preferences in likelihood terms of Ricker over Beverton-Holt relationships, and of $M=0.3$ over $M=0.2$. For $M=0.3$ and the Ricker relationship, extension from flat to dome shaped survey selectivity was not justified in terms of AIC. Thus a change from

M=0.2 to M=0.3 would seem to provide a way forward towards satisfying the requirement for assessment models to fit proportion at age data at large ages without at the same time having to postulate decreasing selectivity at these ages. However there remained a number of aspects of these analyses that needed to be investigated further, including alternative formulations of the stock-recruitment relationship which might have implications for values estimated for the spawning stock biomass at MSY.

Discussion

The discussion turned to an alternative interpretation of the tagging model results. The suggestion was made that a permanent emigration to parts unknown would account for a dome shaped selectivity pattern in GoM cod. The chair remarked that the saturation of the area with fishing effort made it improbable that a refuge for large fish existed within the confines of the Gulf of Maine. Also a high reward reporting rate less than 100% was suggested as a factor influencing M and consequently the selectivity pattern in the Miller model. The alternative Butterworth model implied that the Miller model had likely over estimated M. It was noted that M in the Miller model is actually a combination of all factors that could result in tag not being recovered.

The issue of dome shaped selectivity was further discussed. Gear avoidance was proposed as a possible mechanism. However the mixture of gear types in the fishery would make that mechanism less likely. The survey gear could have a dome if fish were concentrated in unfishable habitat or the survey changed over time. It was pointed out that the change in age distribution over the survey time series suggested that excessive fishing mortality on large cod was a more plausible explanation. The issue of dome shaped selectivity was not resolved and participants waited the next iteration of this discussion.

Working Paper 4.A: O'Brien L. Georges Bank Cod

Rapporteur: Sue Wigley

Presentation Highlights

Georges Bank Atlantic cod is a transboundary stock that is harvested by both US and Canadian fishing fleets. The stock includes landings from statistical areas 521-522, 525-526, 561-562, 551-552, 537-539 and south. GB cod range in depth from 32 m to 226 m, occupying cool, shallow water in the spring and warmer, deep water in the autumn.

A VPA model formulation was accepted as the final assessment for GB cod (O'Brien et al., 2006) at the GARM-II meeting (NEFSC, 2005). The biological reference points (BRPs) were developed based on landings only from the 2001 assessment (O'Brien and Munroe, 2001), using a Beverton-Holt stock-recruit relationship with an assumed prior for the unfished recruitment as (NEFSC, 2002):

$$\begin{aligned}F_{MSY} &= 0.175, \\MSY &= 35,200 \text{ t and} \\SSB_{MSY} &= 217,000 \text{ t.}\end{aligned}$$

At the GARM III BRP meeting, a VPA formulation was accepted as a preliminary assessment model and a non-parametric YPR analysis was chosen for estimation of BRPs.

These estimates are provisional and may change after the GARM III Assessment Meeting in August 2008:

$$\begin{aligned}F_{MSY} &= 0.25, \\MSY &= 30,220 \text{ t and} \\SSB_{MSY} &= 143,343 \text{ t.}\end{aligned}$$

The current April 2008 VPA formulation includes landings, commercial discards, and recreational catch in the catch at age as recommended by the GARM II Panel (NEFSC, 2005) for the period 1978-2006. The NEFSC spring and autumn, and DFO spring survey abundance indices are used to calibrate the VPA. A three-year moving average was used to estimate the proportion mature at age. An ASAP model formulation was also run but not used for estimation of BRPs. In the YPR analysis, VPA results were used to derive a five year average, 2002-2006, for the PR, stock weights, catch weights, and proportion mature at age.

The provisional BRPs from the current YPR are higher for F_{MSY} , slightly lower for MSY , and lower for SSB_{MSY} compared to the previous BRPs. This is due in part to a change from a parametric to a non-parametric model for estimation of the BRPs. The lower values are also due to a change in the partial recruitment vector with GB cod becoming fully recruited at age 5 instead of age 4 as seen in previous assessments. In addition, the mean weights at age have declined in recent years, and there is an updated maturity ogive.

Discussion

An updated assessment that included landings, commercial discards, and recreational catch through 2006 was presented. Based on GARM 'models' review advice, two models (VPA and ASAP) were used to assess this stock. Results from the two models were similar with relatively small percent differences in F and SSB between the VPA and ASAP formulations. ASAP estimates of Age 1 recruitment of the 2003 and 2005 year classes are about 35% less than VPA estimates. Regarding the ASAP model, a point of clarification was made; the ASAP formulation did account for changes in mean weights at age, however it did not account for changes in selectivity. Given a more pronounced retrospective pattern in the ASAP, the VPA (with split in all survey tuning indices) was selected as the most appropriate model for biological reference point estimation and that best model for stock status determination would occur at a later meeting.

There has been a shift in fully recruited fishing mortality from age 4 to age 5. The Panel noted that the revised biological reference points (BRPs) are not comparable to current BRPs due to this shift in selectivity as well as the addition of discards in the catch-at-age and the declining trends in mean weights that have occurred in age 5-8 yr old fish in recent years.

The Panel commented that recruitment has been low for the past 15 years, biomass has been low, and fishing mortality has been high for this stock. SSB_{msy} estimates for all models are outside the range of the time series observations. The BRPs may not be met given current conditions.

The Panel discussed the large differences between the parametric (Beverton-Holt S-Rfit) and the non-parametric (YPR) approach to derive SSB_{msy} (274,211 t and 93,995 t, respectively). The Panel suggested a closer examination of the stock-recruit relationship, specifically: 1) examine recruitment when SSB is greater than 40,000 t; 2) compare the stock spawning biomass and recruitment derived from the ASAP and VPA models, 3) use ASAP

formulation with a selectivity block at 1999 to account for the change in mesh size regulations, and 4) examine the impact of trimming the recruitment series based on residual variances.

The requested analyses were conducted during the meeting. A non-parametric approach using values of recruitment (14 values) when SSB was greater than 50,000 t was presented. Recruitment from SSB greater than 50,000 t was determined to be the best cut-point based on a 'razor' analysis, i.e. total variance of recruitment is estimated as a function of cut points on SSB where the preferred SSB cut point corresponds to the lowest variance in recruitment.

It was noted that the current BRP established in 2002 used a prior on recruitment of 23 million fish. The first B-H model BRPs presented was based on the upper 90% of recruitment (29 million fish) whereas the revised recruitment prior of 21 million fish is based on the 50,000 t SSB cut-point. The use of hindcasted values would have resulted in higher values for the prior on recruitment. The Panel expressed concern regarding the use of the ASAP re-run to derive BRPs due to the wide range of SSB_{msy} and MSY that results between the deterministic and the stochastic analyses. Because the results depended upon the prior and sigma used, the issue could not be resolved.

For this stock, the Panel agreed that the revised BRPs should be based on the projection results of the non-parametric approach (YPR) where $F_{40\%MSP} = F_{msy} = 0.25$, $SSB_{msy} = 143,343$ t, $MSY = 30,220$ t using an empirical cdf of recruitment associated with SSB greater than 50,000 t. These reference points are provisional and may change at the August 2008 GARM.

Working Paper 4.B: Brooks L. Georges Bank Haddock

Presentation Highlights

The Georges Bank stock of haddock (*Melanogrammus aeglefinus*) is found in the waters of Georges Bank at depths of 40 to 150 m. The stock spans NEFSC statistical areas 521, 522, 525, 526, 537, 538, 539, 551, 552, 561, 562. The stock was last assessed at GARM-II in 2004 using an ADAPT VPA model. The reference points were derived from the working group on biological reference points (NEFSC 2002), where $F_{40\%MSP}$ served as a proxy for F_{MSY} , and SSB/R and YPR were scaled by the average recruitment level for years where $SSB > 75,000$ t, excluding the 1963 year class. The GARM-III agreed that an ADAPT VPA (v2.7.7) was the preferred assessment model. Model inputs included new estimates of discard at age for years 1989-2006, following the method of observed ratio of discarded haddock to kept of all species (approved method from GARM III 'models' review). Landings at age were re-estimated for years 1989-2006 using the landings allocation methodology agreed to at the GARM III 'data input' review. One further difference between the GARM-III and GARM-II formulation is that the GARM-III VPA used a single maturity ogive for all years, whereas the GARM-II assessment used time-varying stanzas of maturity. The reference points for GARM-III were calculated according to the AGEPRO projection methodology accepted at the GARM-III reference point meeting. Bootstrapped numbers at age for the terminal year were projected for 100 years at $F_{40\%MSP}$ (a proxy for F_{MSY}) using AGEPRO and taking the median value of SSB and yield at equilibrium. An average of the last five years of selectivity and weight at age were used, and the selectivity was forced to be flat topped by scaling such that the fully selected age and all older ages had a selectivity value of 1.0. Projected recruitment was resampled from the cdf of recruitment values that corresponded to years where SSB greater than 75,000 t, excluding the 1963 and 2003 year classes. The recruitment values came from applying the accepted VPA framework to data that extended back to 1931. The BRPs for GARM-III were:

$F_{MSY}=F_{40\%MSP}=0.34$, $SSB_{MSY}=164,300$ t, and $MSY=35,000$ t. The rate for F_{MSY} is higher than that from GARM-II because the partial recruitment has shifted towards older ages, in part because of smaller fish length at age. The values for SSB_{MSY} and MSY are lower than values from GARM-II because fish weigh less at age now than in 2000 (the last year of data used to calculate existing reference points). These BRP values are provisional and may change at the final GARM-III meeting.

Discussion

It was noted that this assessment differs from previous analyses by the inclusion of revised discards, and maturity ogives. The addition of the revised discards back to 1989 resulted in a slight increase in the estimated stock sizes.

It was suggested that one should look for year effects and age effects in the bootstrapped survey indices. Because the parametric fit to the Beverton-Holt S/R function did not provide reasonable results, the AGEPRO approach was attempted, resampling the CDF of recruitment. This also produced an unreasonable outcome. The default was to use SSB/R multiplied by average recruitment. The average used excluded the large 1963 and 2003 year classes. This generated considerable discussion, with Panel members on both sides of the issue. It was seen to be acceptable if only one of these appeared. But now that the 2003 year class has appeared at the similar magnitude as 1963, it is possible that these may appear again. These year classes were included in the CDF used by AGEPRO, but not when calculating the average recruitment for the SSB/R analysis. There will be a lesser effect on the median compared to the mean.

The question of density-dependent effects on weights at age was raised. Are these effects transient meaning that the stock may return to earlier conditions and a longer period to average the mean weights at age may be more appropriate. For this meeting the “true” values were presumed to be bounded by those used in the 2002 BRP meeting and GARM III.

For the ASAP run, considerable effort was placed on matching the catch at age as closely as possible. This was achieved by inserting a series of selectivity blocks. Based on this, it appears that selectivity has changed over time, especially in recent years. This led to a question on the basis of using a 5 year recent average instead of the most recent few years. It was suggested that changes in the partial recruitment may occur as the 2003 year class passes through the fishery. In general, selection of a partial recruitment pattern should take into account the same considerations as changes in growth.

There were many reasons such as autocorrelation for rejecting the deterministic stock-recruit fit in addition to the residual pattern. It was noted that autocorrelation is present in many groundfish stocks.

The calculation of SSB_{msy} using the SSB/R approach is deterministic, and was used as a fallback approach. One of the consequences of lower partial recruitment and mean weights at age is higher $F_{40\%MSP}$ that says fish harder. Concern was raised that there will be an increase in exploitation as the change in partial recruitment will affect the TAC. Average recruitment was calculated using estimated recruits produced by SSB levels greater than the median SSB as was done by the 2002 BRP Working Group.

A discussion ensued on whether to use median SSB as the breakpoint at the present meeting, or whether the transition from the lower recruitment stanza to the higher one occurs at another SSB level. The s/r plot should be examined to look for the SSB breakpoint. It was concluded that 75,000 t of SSB may still be a valid value for use as the transition point.

A lengthy discussion took place regarding three assumptions related to this approach: 1) whether to remove the 2 largest year-classes (1963 and 2003), 2) whether to use an arbitrary eyeball approach to determine the transition point, and 3) how to incorporate stochasticity.

On point 1, the Panel agreed that it is appropriate to remove these 2 very large year classes. This is equivalent to managing for a lower distribution of recruitment and take advantage of a bonanza when it occurs. It may be possible to test to see when we are at the transition point.

On point 2, it was suggested that the 75,000 t breakpoint is arbitrary. There may be an objective way to find the breakpoint, such as the breakpoint that provides the best AIC. Use a 3 parameter step function, including the value to the left, the one to the right and the change point. Actually, choice of 75,000 t is not arbitrary as it was based on odds ratios.

On point 3, it was suggested that instead of taking the average, one can bootstrap the distribution of recruitment in calculating the median. Using this approach may not be consistent with the AGEPRO approach. AGEPRO allows for 2-stage re-sampling and can be tried here.

The Panel questioned the type of reference point that is required for this almost rebuilt stock. There is a need to capture stochasticity and maintain consistency and not alter the measure of central tendency. The median Bmsy is the median value of the biomass that provides MSY at Fmsy rather than the expected value (the mean). This does depend on the underlying distribution.

Finally the Panel concluded that The VPA model 3 is the most appropriate. The Panel also supported exclusion of the 2 very large year classes, and to use the 75,000 mt SSB breakpoint.

Working Papers 4.C, D & E: Legault C et al.: Georges Bank, Southern New England/Mid Atlantic, Cape Cod/Gulf of Maine Yellowtail Flounder

Rapporteur: Lisa Hendrickson

Presentation Highlights Georges Bank

Georges Bank yellowtail flounder are generally found in depths between 40 and 70 m. The biological reference points in GARM-II were derived from a VPA as $F_{msy} = 0.25$, $SSB_{msy} = 58,800$ t, and $MSY = 12,900$ t. The biological reference points in GARM-III were derived from a VPA as $F_{msy} = 0.25$, $SSB_{msy} = 46,000$ t, and $MSY = 10,000$ t. These updated values are provisional and may change at the final GARM-III meeting. The updated values assume $F_{40\%MSP}$ as a proxy for F_{msy} and recruitments associated with SSB values greater than 5,000 t including hindcast recruitments. The updated VPA has catch information for years 1973 to 2006 and the hindcast values are for years 1963-1972. All hindcast values are assumed to have SSB above 5,000 t. Changes to the data include revisions to the US commercial landings due to the new trip-based allocation scheme and revisions to the US commercial discards due to the application of the SBRM approach. The NEFSC Spring and Fall surveys along with the DFO survey were used as age-specific tuning indices and the NEFSC scallop survey provided an age-1 index of abundance as well. The changes in biological reference points are relatively minor and reflect mainly changes in estimated recruitments due to the change from the “Base Case” VPA to the “Major Change” VPA and the retrospective pattern observed in the “Base Case” VPA.

Discussion Georges Bank

Parametric (assumed Beverton-Holt S-R relationship) and empirical (YPR and SSB/R model) approaches were utilized to estimate biological reference points (BRPs) for the “base case” VPA run (strong retrospective pattern) versus the “major change” run (survey series split between 1994 and 1995 resulting in improved retrospective pattern, this is the model used for management purposes). The Panel noted that the BRPs were similar for input data from both the “major change” model and the “base case” model. The Panel discussed the Beverton-Holt (B-H) stock-recruitment model formulations at length and noted that the inclusion of an R_0 prior resulted in lower F_{MSY} and higher SSB_{MSY} estimates than those estimated without an R_0 prior and that the estimated steepness parameters were high (0.79-0.86). As a result, the Panel recommended acceptance of the empirical BRP estimate of $F_{40\%MSP}$ and SSB_{MSY} , but was concerned about the effects of the inclusion of the less-precise estimates of hindcast recruitment (1963-1972) and the inclusion of all of the SSB values. Consequently, the Panel requested and reviewed a per-recruit model run with an SSB cut point of 5,000 t and inclusion of all hindcast recruitment estimates (SSB values were assumed to be greater than 5,000 t), in order to increase the likelihood of high recruitment in the future. There was some concern about the fact that catches were high during the period for which recruitment was hindcast (1963-1972) and therefore the R and SSB_{msy} may be underestimated. Conversely, the large extrapolation in the hindcast calculations caused concern that these values may be too high. It was suggested that the hindcast recruitment values and associated catches during the period be used to solve for F for confirmation that the hindcast values are reasonable.

The Panel accepted the empirical reference point estimates that incorporated data from the “major change” VPA model ($F_{40\%MSP} = 0.25$, as an F_{MSY} proxy, and $SSB_{MSY} = 46,000$ t). The associated MSY value is 10,000 t.

Presentation Highlights SNEMA

Southern New England-Mid Atlantic yellowtail flounder are generally found in depths between 40 and 70 m. The biological reference points in GARM-II were derived from a VPA as $F_{msy} = 0.26$, $SSB_{msy} = 69,500$ t, and $MSY = 14,200$ t. The biological reference points in GARM III were derived from a VPA as $F_{msy} = 0.26$, $SSB_{msy} = 27,600$ t, and $MSY = 6,300$ t. These updated values are provisional and may change at the final GARM III meeting. The updated values assume $F_{40\%MSP}$ as a proxy for F_{msy} and recruitments associated with SSB values greater than 5,000 t but does not include hindcast recruitments. The updated VPA has catch information for years 1973 to 2006. The new VPA uses ages 1-6+ while the previous VPA used ages 1-7+. The new VPA does not exhibit a retrospective pattern while the previous one did. Changes to the data include revisions to the commercial landings due to the new trip-based allocation scheme and revisions to the commercial discards due to the application of the SBRM approach. The NEFSC Winter, Spring and Fall surveys were used as age-specific tuning indices. The changes in biological reference points are relatively large and reflect mainly changes in recruitments used in the calculations. Only VPA estimated recruitments are used in the updated biological reference points while the GARM II values used hindcast recruitments as well. This change is due to the continued low recruitment in recent years potentially indicating a change in stock productivity.

Discussion SNEMA

Similar to the GB stock, Panel members recommended acceptance of the empirical BRP estimates based on input data from the VPA model but were concerned about the effect of including the two largest hindcast recruitment values and all of the SSB values in the estimation. Survey indices suggest that the stock has been much less productive since the early 1990s, and because the stock is at the southern limit of its range, sustainability may be affected by changes in environmental conditions. As a result, the Panel reviewed two additional model runs that included an SSB cut point of 5,000 t and either the exclusion or inclusion of the hindcast recruitment values for 1963-1972.

The Panel accepted the empirical reference point estimates that incorporated data from the final VPA model run ($F_{40\%MSP} = 0.26$, as an F_{MSY} proxy, and an SSB_{MSY} estimate of 27,600 t). The associated MSY value is 6,300 t.

Presentation Highlights Cape Cod-Gulf of Maine

Cape Cod-Gulf of Maine yellowtail flounder are generally found in depths between 40 and 70 m. The biological reference points in GARM-II were derived from a VPA as $F_{msy} = 0.17$, $SSB_{msy} = 12,600$ t, and $MSY = 2,300$ t. The biological reference points in GARM-III were derived from a VPA as $F_{msy} = 0.24$, $SSB_{msy} = 8,300$ t, and $MSY = 1,800$ t. These updated values are provisional and may change at the final GARM-III meeting. The updated values assume $F_{40\%MSP}$ as a proxy for F_{msy} and both VPA and hindcast recruitments. The updated VPA has catch information for years 1985 to 2006 and the hindcast values are for years 1977-1984. The new VPA uses ages 1-6+ while the previous VPA used ages 1-5+. The new VPA does not exhibit a retrospective pattern while the previous one did. Changes to the data include revisions to the US commercial landings due to the new trip-based allocation scheme and revisions to the US commercial discards due to the application of the SBRM approach as well as the addition of two new survey series: the Maine-New Hampshire Inshore Trawl Survey Spring and Fall series. The NEFSC Spring and Fall surveys and Massachusetts Spring and Fall surveys, along with the ME-NH surveys, were used as age-specific tuning indices. The changes in biological reference points are relatively minor and reflect mainly changes in estimated partial recruitment (for F_{msy}) and recruitments (SSB_{msy} and MSY) due to the change from the age 5+ VPA to the age 6+ VPA using the new data.

Discussion Cape Cod-Gulf of Maine

A R_0 prior was required to estimate the steepness parameter for the B-H curve, otherwise steepness was estimated as 1.0 and very high estimates of F_{MSY} , equal to F_{max} , were obtained. However, even with the incorporation of a prior, high steepness estimates (0.949 and 0.954, respectively) were obtained for models that used VPA and ASAP input data. As a result, the Panel recommended acceptance of the empirical BRP estimates based on input data from the VPA model. However, the Panel had concerns about the effects of the inclusion of hindcast recruitment values and all of the SSB data on the BRP estimates. Therefore, the Panel requested and reviewed an additional model run that included hindcast recruitment estimates for 1977-1984. There was no obvious breakpoint present in the SSB data series, so the entire series was used in the final model run.

The Panel accepted the results of the empirical approach which resulted in an $F_{40\%MSP}$ estimate of 0.24 ($= F_{MSY}$ proxy) and SSB_{MSY} estimate of 8,300 t. The associated MSY value is 1,800 t.

Working Paper 4.F: Mayo R. Gulf of Maine Cod

Rapporteur: Sue Wigley

Presentation Highlights

Atlantic cod (*Gadus morhua*) inhabiting the waters of the Gulf of Maine are found at most depths ranging from the shallow parts of the western Gulf of Maine out to depths down to 300+ m. The stock comprises NEFSC statistical areas 511-515. The stock was last assessed at GARM II in 2004 using a VPA model. The existing reference points at that time were: $F_{msy} = 0.23$, $SSB_{msy} = 82,830$ t, and $MSY = 16,600$ t. The GARM III agreed assessment is a VPA model using the same formulation as at GARM II. The reference points based on results of this assessment are: $F_{40\%MSP}$ proxy $F_{msy} = 0.23$, $SSB_{msy} = 71,150$ t and $MSY = 14,936$ t. The GARM III assessment includes catch data through 2006 and survey data through spring 2007. The catch data have been revised since the GARM II assessment, including: revised catch by stock based on the allocation scheme agreed at the October 2007 GARM III Data Meeting, revised catch at age from 1994 forward, revised recreational estimates from 1982 forward, and revised Massachusetts DMF survey indices from 1982 forward. These data changes were minor and did not contribute to any substantial differences in the assessment. The biological reference points estimated at the GARM III Biological Reference Point Meeting are similar to those in place at GARM II. F_{msy} is the same, and SSB_{msy} is about 14% lower and MSY is about 10% lower than the existing reference points. The revised reference points were based on a period of lower partial recruitment and average weights at age than the existing reference points.

Discussion

VPA and ASAP models were presented with updated information through 2006 (WP 4.F). The VPA analyses included a BASE run that used the same formulation as in previous assessments and a SPLIT run that used survey tuning indices that were split between 1994 and 1995. Retrospective patterns were not present in either the BASE or the SPLIT VPA formulations. An alternative forward-projecting model (ASAP) was also performed to investigate the fishery selectivity pattern. A single logistic selectivity pattern and a double logistic pattern for two time periods were explored. Results indicated a similar fully recruited F in most years; however estimates of F from ASAP were lower than from the VPA. Retrospective patterns of F were considerably different between the two ASAP formulations. The Panel agreed with the conclusion of the GARM III 'models' Panel that the catch at age data are sufficient to employ an age – structured model assuming negligible errors in the catch-at-age, thus, the VPA base assessment was preferred model for estimation of biological reference points.

Discussion focused on the magnitude of the hindcast recruitment from the S-R model; the Panel noted that the mean of the hindcast recruitment was approximately twice the mean of the non-hindcast recruitment. The Panel noted that high recruitment occurred at high biomass. Given the low current biomass, the Panel commented that it appeared unlikely that stock rebuilding could be achieved by 2014.

Additional discussion focused on the flat-top partial recruitment vector used in the VPA, lack of older fish in the population and the previously high fishing mortality on this stock. This topic was also discussed during the cod tagging analysis (WP 4.7) that indicated no evidence of a decline in the return rates for older fish compared to younger fish in the population.

Working Paper 4.F.1: Butterworth D. Gulf of Maine Cod

Rapporteur: Sue Wigley

Presentation Highlights

WP 4.F.1 (plus Addendum) updated the ASPM (SCAA) assessments for Gulf of Maine cod presented in Butterworth and Rademeyer (GARM III Working paper 2.2a) through the addition of data for two more years, with the plus group extended from age 7 to age 8 on AIC grounds. Based largely on AIC considerations (though for technical reasons these are admittedly approximately calculated), the best assessment selected was that with a Ricker stock recruitment function and dome shaped selectivity. Amongst a number of sensitivity tests, an early gear change, use of the Baranov form rather than Pope's approximation, and commencing the assessment in different years (all prior to abundance index data becoming available) did not lead to any differences of note in estimates of key quantities. A simulation study showed the ASPM estimator to introduce only a slight bias towards a domed shape when the underlying reality exhibits asymptotically flat selectivities. Assessment variants which force flat selectivity in NEFSC surveys and the commercial fishery at large ages were not simply less preferred, but indeed strongly rejected under the AIC model selection criterion (e. g. relative AIC-weights of less than 10⁻¹³ for the standard $M=0.2$ specification). Such variants are not compatible with the low proportions of older cod in surveys and commercial catches – a feature for which cogent explanation needs to be offered before they might be accepted as providing a reliable basis for assessment. The greater rate of decline of commercial selectivity for old cod compared to that for the NEFSC surveys provides indirect confirmation of some dome effect, though further evidence from other sources would be desirable. The assessment could hardly distinguish different values of M , though increasing M above 0.2 suggested a lesser downward selectivity slope at large ages and a better resource status. Search over a range of stock recruitment relationships suggested the Ricker form to be preferred, though without completely eliminating the Beverton-Holt form in AIC terms. Reference point estimates for each of these forms were put forward. Under the best ASPM assessment, the stock was estimated to be at present at some 80% of its MSY level in terms of spawning biomass, with most assessment variants suggesting somewhat higher levels than this.

The Alt-VPA methodology of Butterworth and Rademeyer (GARM III Working paper 2.2a) was applied to these updated data for the period 1982-2006 for which catch-at-age data are available. The fits of the models showed a preference for domed over asymptotically flat selectivity. However, the narrow range of estimates of B_{sp} values virtually precludes fits of different stock-recruitment curves from being able to distinguish between options as different as Ricker and Beverton-Holt (from which also very different estimates of Reference Points follow). Because of the clearly high variance that would accompany Reference Points inferred from this VPA analysis, they were not advanced, with a preference for approaches that can accommodate a wider range of data and hence achieve reasonable precision being expressed.

Discussion

An alternative assessment (SCAA/ASPM; WP4.F.1) was also presented where sensitivity to natural mortality, stock-recruitment and selectivity was explored. From this study, change in survey gear, the starting year, and the catch equation used (Pope vs. Baranov) had little effect on biological reference points. However, natural mortality did have an impact on BRPs. It was

noted that there is a confounding relationship between M , selectivity, and the stock-recruitment relationship (either Ricker or Beverton-Holt). Additional analyses would be needed to isolate each of the three factors. Given the tagging (WP 4.7) result discussions, arguments were made (and counters to these also offered) that there is no evidence of older fish in the population as suggested by this alternative SCAA/ASPM assessment.

The discussion of the alternative SCAA/ASPM assessment focused on the years used in the assessment, the selectivity pattern, and natural mortality. It was pointed out that it is inappropriate to use landings data prior to 1963. While total species landings may be accurate prior to 1963, stock landings were derived via ad-hoc methods and thus the quality of the stock landings is different pre- and post-1963. The long history of cod fishing in New England indicates that 'pristine' conditions were not present in 1956 as suggested. Additionally, there is no survey data available to calibrate the model prior to 1963. WP 4.F.1 had shown that key results were not sensitive to whether the analysis commenced in 1960 rather than 1893. It was recommended that data from 1963 onward should be used.

The Panel pointed out that the alternative SCAA/ASPM analysis and the VPA analysis used a different time period as well as different age groups. The two assessments were not comparable due to the input differences.

Subsequent SCAA/ASPM analyses (WP4.8.a) were conducted during the meeting and presented where the time period of the alternative assessment was limited to 1964 onward and the implication of $M=0.2$ and $M=0.3$ were explored. Results indicated when $M=0.3$, statistical model selection criteria admitted the choice of a model with flat-topped survey selectivity, though for the case of a Ricker (and not a Beverton-Holt) stock recruitment relationship.

The Panel noted that the alternative SCAA/ASPM assessment is useful for exploring the interdependency of M , selectivity, and stock-recruitment; however, the unsolved issue of input data comparability remains. Without resolution of the above issue, there must be strong evidence to move away from the current approach (VPA analyses).

The Panel agreed that the choice of S-R model (Ricker or Beverton-Holt) could not be resolved at this meeting, and they recommended an empirical, non-parametric approach be used for biological reference points. The Panel suggested further examination of older age groups in the VPA assessment (beyond the current 7+ age groups); however the Panel recognized that there may be limitations in the survey data that may prevent extending to older age groups. The Panel also suggested extending the VPA time period back to 1963, if possible.

The Panel agreed that there was enough information to provide preliminary estimates of BPRs based on the VPA assessment. The Panel felt a flat-top partial recruitment assumption should be the default unless there is compelling evidence that older fish are not caught by the fishery. Further, a flat-top survey catchability at age is preferred unless there is a plausible explanation for older fish to avoid the survey gear or to have emigrated out of the survey area. The Panel also agreed that the all recruitment values from the time series (1982 -2006) should be used. The revised reference points are: $SSB_{msy} = 71,150$ t, $F_{40\%MSP}=F_{msy}=0.23$ and $MSY = 14,936$ t. These revised reference points are provisional and may change at the August 2008 GARM.

Presentation Highlights

Witch flounder are common throughout the Gulf of Maine and in deeper areas on and adjacent to Georges Bank and along the shelf edge as far south as Cape Hatteras; witch flounder are assessed as a unit stock. During the SAW/SARC 37 (NEFSC 2003), a VPA assessment was conducted. The current biological reference points were estimated for witch flounder using yield and spawning stock biomass per recruit analyses (Thompson and Bell 1934) and the arithmetic mean of the VPA Age 3 recruitment (NEFSC 2003). The current biological reference points from that analysis are: $SSB_{msy} = 25,248$ t; $F_{msy} = F_{40\%MSP} = 0.23$; and $MSY = 4,375$ t.

To update the biological reference points, two VPA formulations were performed for witch flounder: a BASE run and SPLIT run where survey tuning indices were split into two series between 1994 and 1995. The retrospective patterns observed in previous assessments persist in the BASE run while the retrospective patterns diminish in the SPLIT run. The VPA SPLIT run is selected as the preferred run for estimation of biological reference points.

Based on yield per recruit analyses using the 5-year (2002-2006) averages for partial recruitment, stock weights, catch weights and the 2005 maturity vector (2003-2007 pooled maturity data), the revised $F_{msy} = F_{40\%MSP} = 0.22$. Based on the long-term (100 year) stochastic projection, revised SSB_{msy} is 10,863 t and revised MSY is 2,195 t. The stochastic projection used the same partial recruitment vector, mean weight at age and maturity vectors used in the yield per recruit analysis. A constant F scenario was used ($F = F_{msy} = 0.22$). Estimates of age 3 recruitment used in the projection was derived by re-sampling the cumulative density function based on the empirical observations during 1982 to 2006 (1979 to 2003 year classes) from the VPA SPLIT RUN. Fishing mortality was apportioned among landings and discards based on the proportions observed during 2002 – 2006. The proportions of F and M which occurs before spawning equals 0.1667 (March 1); $M = 0.15$. The revised SSB_{msy} and MSY values are lower than the current reference point values; this is attributed to the lower estimates of recruitment from the VPA SPLIT run, as well as the lower yield and SSB per recruit estimates. The revised reference points are provisional and may change at the August 2008 GARM.

Discussion

The Panel recommended the non-parametric (empirical) approach to determine biological reference points given the negative the stock-recruitment relationship for this species. This method was consistent with the previous biological reference point evaluation in 2002. For this stock, the Panel agreed that the VPA split formulation was the preferred model to use for the estimation of biological reference points given the diminished retrospective pattern. The underlying mechanism for splitting the time series in 1994 was questioned and it was commented that this time period was concurrent with several major changes in management regulations. By splitting the time series to address the retrospective pattern, it was felt that biological reference point estimation and associated management advice would be sounder. The best model for stock status will be determined at a later meeting. For witch flounder, the Panel agreed that the revised BRPs should be based on a non-parametric approach where $F_{40\%MSP} = F_{msy} = 0.22$, $SSB_{msy} = 10,863$ t and $MSY = 2,195$ mt using all recruitment values.

Presentation Highlights

American plaice is distributed along the Northwest Atlantic continental shelf from southern Labrador to Rhode Island in relatively deep waters (Collette and Klein-MacPhee 2002). Off the U.S. coast, American plaice are managed as a single stock in the Gulf of Maine-Georges Bank region where the greatest commercial concentrations exist between 90 and 182 m (50 and 100 fathoms).

A VPA model formulation was accepted as the final assessment for American plaice at the GARM II meeting (O'Brien et al. 2005, NEFSC, 2005). The biological reference points (BRPs) were developed with a non-parametric YPR analysis (NEFSC 2002) using mean recruitment associated with all SSB estimates from the 2000 assessment (O'Brien and Esteves, 2000):

$$\begin{aligned}F_{MSY} &= 0.17, \\MSY &= 4,900 \text{ t and} \\SSB_{MSY} &= 28,600 \text{ t.}\end{aligned}$$

At the GARM III BRP meeting, an update VPA formulation was not presented, however, the YPR analysis was updated using a 3 year average (2002-2004) of partial recruitment, stock weights, catch weights, and maturity at age from the most recent assessment (O'Brien et al. 2005). The YPR was then updated further by using research survey mean weights at age averaged over 2003-2007 for stock weights, spawning stock weights, and proportion mature at age. This updated non-parametric YPR analysis was chosen for interim estimation of BRPs. The following estimates are provisional and will change once the final assessment is conducted and presented at the GARM III Assessment Meeting in August 2008:

$$\begin{aligned}F_{MSY} &= 0.18, \\MSY &= 4,317 \text{ t and} \\SSB_{MSY} &= 20,828 \text{ t.}\end{aligned}$$

The provisional BRPs from the above YPR analysis are higher for F_{MSY} , slightly lower for MSY , and lower for SSB_{MSY} compared to the previous BRPs. The lower SSB_{MSY} is due to a change in the partial recruitment vector and a decline in the population mean weights at age in recent years.

Discussion

The American Plaice assessment was not completely updated because the data were not available with sufficient time before this meeting; however, the partial update presented takes account of recent changes in mean weight at age which is a primary determinant for reference points. The results therefore indicate a likely direction for change in the BRPs, but there will be further changes in the estimated BRPs when the full assessment is completed for the August 2008 GARM meeting.

Rapporteur: Kathy Sosebee

Presentation Highlights

The Gulf of Maine winter flounder assessment suffers from poor sampling of the landings by market category. A substantial overlap in lengths among market categories did help justify the pooling used to estimate the catch at length and age. The VPA model exhibited a severe retrospective pattern in F , SSB , and recruitment. Splitting of the surveys did improve the retrospective pattern but a lack of fit to the age 1 and 2 recruitment indices was still present. A forward projecting model (SCALE) that tunes to indices at age for the younger ages and length data for the older/larger fish was also examined. Winter flounder exhibits sexually dimorphic growth and males appear to have higher natural mortality than females. Sex specific growth and natural mortality were modeled within the Scale model. The alternative forward projecting Scale model failed to reconcile the conflicting trends between the age 1 and 2 recruitment indices with the declining trend in catch and the adult indices. Lower weights on the recruitment indices and a low penalty on recruitment variation allowed the Scale model to produce a declining trend in recruitment in order for the model to fit to the catch. The scale model has a retrospective pattern similar to the VPA and the splitting of the surveys also improved the retrospective pattern. Parametric stock recruit reference points were not used for either model due to the uncertainty in the estimated recruitment. The entire time series of recruitment (1982-2006) was used to estimate empirical biological reference points. The Scale model estimated a higher F_{msy} proxy ($F_{40\%MSP} = 0.44$) than the VPA ($F_{40\%MSP} = 0.27$) due to the difference in the estimated selectivity. However the estimated SSB_{msy} values were similar between the two models (VPA = 3,557 t, Scale = 3,138 t).

Discussion

Several models were attempted for this stock. The VPA which did not have a strong retrospective pattern in 2002 now has a severe pattern. Recruitment and adult biomass trends are not the same. Both the VPA and Scale models have poor fits to the age 1 and 2 recruitment indices. The proposed model is SCALE with split survey series and with recruitment not emphasized. Diagnostics may not indicate SCALE to be a better model.

SCALE captures more biologically (sexually dimorphic growth and differential M) than does the VPA. A model which assumes error in the catch may be more appropriate for this stock which has limited sampling of the landings. SCALE is sensitive to weighting on recruits and the current model has low weight on recruits. The Panel felt that a stock-recruitment curve may not be applicable for this stock even though the SR points appear to be similar between models. The Panel discussed examining catchability from the other stocks of winter flounder but it was noted that growth rates and mesh sizes are different between areas which would make selectivity different. The Panel did not feel confident in the recruitment values. At this time, it is recommended to use the value of $F_{40\%MSP}=0.27$ from the VPA run for the fishing mortality reference point and that the B_{msy} proxy is unlikely to be lower than 3000 t. A preliminary SSB_{msy} reference point could be set at 3557 t with and MSY of 854 t.

Rapporteur: Larry Alade

Presentation Highlights

The GARM III ‘models’ Panel reviewed the 2005 GARM3 VPA and a version of the assessment implemented in ASAP v2.0.9, which both exhibited a strong retrospective pattern in the late 1990s and into 2001. The Panel advised that model results should be checked for the retrospective pattern when the 2005-2006 catch data were added and that if pattern reappeared, then “consideration should be given to splitting the survey time series pre and post 1994.” Splitting the survey series used in calibration acts as a proxy for fishery and biological factors that could have changed in the mid-1990s, resulting in the observed retrospective pattern. Fishery catches were updated through 2006 and survey indices through 2007 to create the GARM III BASE case VPA. The BASE run continued to exhibit a strong retrospective pattern, although it was less severe in recent years than in the 2005 GARM II assessment. Given the persistence of the retrospective pattern in the BASE configuration, survey series were split as per the GARM III ‘models’ Panel recommendation. Under this SPLIT run configuration, the retrospective pattern was significantly reduced, no appreciable problems in residual patterns developed as a result of splitting the survey series, and the precision of the terminal year estimates was comparable to the BASE run estimates. The SPLIT configuration was selected as the preferred run for the basis of reference point calculations and stock status determination. The Southern New England/Mid-Atlantic (SNE/MA) winter flounder stock complex is overfished and overfishing is occurring. Fishing mortality (F) in 2006 was estimated to be 1.02 (exploitation rate = 59%), about three times $F_{MSY} = 0.34$. There is an 80% chance that the F in 2006 was between 0.87 and 1.20. SSB in 2006 was estimated to be 2,544 t, about 7% of $SSB_{MSY} = 35,240$ t. There is an 80% probability that SSB in 2006 was between 2,306 t and 2,860 t. The 2005 year class is estimated to be among the smallest on record, at only 5.6 million fish.

Discussion

The report summarizes a proposed revision of the reference points for the Southern New England Winter flounder assessment based on an ADAPT VPA (TOR 4). The Panel points out that the retrospective pattern continues to be problematic and agree that the split series configuration appears to address the retrospective problem, but the underlying causes are still unknown. The Panel also identifies that the weight at age and maturity at age have been relatively stable as this implies that biological conditions have not changed much. However, the Panel raises concerns about the recruitment time series as they believe that that the R_0 may not be characteristic of the virgin recruitment and may only correspond to the time periods when the stock was exploited. This also led to discussions about the use of priors in the S-R fit as to whether it is informative or not in determining the reference points. The Panel came to consensus with the following recommendations: (a) Move forward with the VPA split series configuration as the basis of the assessment, (b) adopt the non-parametric empirical approach using $F_{40\%MSP}$ as a proxy for F_{MSY} as the basis for the BRPs (c) Calculate the deterministic equivalent of the AGEPRO stochastic projections in determining SSB_{MSY} (d) Coupled with recommendation (b), use a “breakpoint” approach to determine average recruitment above 6000 for SSB in the non-parametric empirical approach (i.e., the top eight estimated recruitments).

Working Paper 4.K: Hendrickson L. Georges Bank winter flounder

Rapporteur: Kathy Sosebee

Presentation Highlights

Winter flounder is a shallow-water species. The Georges Bank stock was assessed at GARM II using a surplus production model (ASPIC) for the period 1963-2004. The current biological reference points were estimated internally from the same model and are: $F_{MSY} = 0.32$ and $B_{MSY} = 9,400$ t. The GARM III assessment was conducted utilizing an age-based Virtual Population Analysis (VPA) for the period 1982-2006. The provisional reference point estimates from the VPA model are: F_{MSY} proxy ($F_{40\%MSP}$) = 0.25 and $SSB_{MSY} = 15,500$ t. The VPA model included: an initial estimate of discards-at-age; landings-at-age for U.S. and Canadian landings; and all ages from the NEFSC spring (1982-2006), and fall surveys (1981-2005, lagged forward one year and age), and the Canada spring surveys (1987-2006). The difference between the current reference point estimates and the provisional estimates are, in part, due to the two different types of models. In addition, different data sets were utilized in each model.

Discussion

It was noted that the projected non-parametric gave a lower value for SSB_{MSY} and MSY although others were higher. The Panel questioned the use of a tight prior on R_0 suggesting that using a different prior may give a different answer. An alternative would be to use a prior on steepness obtained from the literature for similar stocks. For SNE-MA winter flounder the BRP Working Group tested all options and models and decided to use the prior on R_0 instead of steepness. It may be useful to check if past survey and recruitment were not higher. The Panel recommended using the empirical approach with recruitment values sampled from 1982-2005.

Working Paper 4.L: Sosebee K. Georges Bank/Gulf of Maine White Hake

Rapporteur: Michael Palmer

Presentation Highlights

An assessment was conducted for Gulf of Maine-Georges Bank white hake using ASAP, a forward projecting age-structured model. Two variations of the model were explored, one with a long (1893-2006) time series of catch data and the other with a shorter (1963-2006) time series. Both models showed the same trend in spawning stock biomass, fishing mortality, and recruitment over the similar time frame. The reference points were derived using both Beverton-Holt stock-recruit curve fits and empirical yield-per-recruit estimation. The value for SSB_{msy} ranged from 35,900 t to 83,800 t depending on the assumptions. A value of 56,500 t was chosen for the reference point with a value of 0.21 for F_{msy} proxy and 7,000 t for MSY .

Working Paper 4.L.1: Butterworth D. Georges Bank/Gulf of Maine White Hake

Rapporteur: Michael Palmer

Presentation Highlights

WP 4.L.1 applied the ASPM (SCAA) methodology presented in Butterworth and Rademeyer (GARM III Working paper 2.2a), with an adjustment to be able to incorporate data on proportions at length, to white hake. In a preliminary and (for reasons of time) restricted analysis, four scenarios were considered for the period from 1963 when abundance indices first become available. These reflected the assumptions that spawning biomass in 1963 was at 25% and 50% of its pristine level, and that the catch of hake of length less than 60 cm was either all white hake or all red hake, with the latter assumption leading to somewhat more optimistic appraisals of the current status of white hake. Model fits to survey index trends were broadly reasonable; though there were some difficulties with proportions at length data which would likely be better addressed in future analyses by adopting a length-specific rather than an age-specific selectivity framework. All four scenarios considered suggested an increase in spawning biomass over the last decade, and that the current fishing mortality is less than FMSY. Nevertheless the preliminary nature of all results was stressed, particularly as time had thus far allowed for only a very limited number of variants of the assessment to be investigated. A set of reference point values ranges across the four scenarios considered was presented on an indicative rather than a definitive basis.

Discussion on working papers 4.L and 4.L.1

The Panel expressed concern with the ASAP fits of the survey indices and the use of prior distributions for the survey catchabilities (q). In general the Panel commended the ASAP attempt, but suggested additional formulations be investigated as time permits to include splitting the survey time series and removal of the prior distributions for q 's. The Panel expressed concerns with calculating biological reference points (BRP) using the long time series of recruitment (pre-1963). Their concern was based on the uncertainty of these data. The uncertainty was related to the fact that historical recruitment was estimated internally within the ASAP model based on historical landings which may suffer from the same speciation problems that plague the current landings time series. It was clarified that since the historical fishery was a hook and line fishery it is unlikely that an appreciable proportion of the landings comprised red hake. The Panel recommended that BRPs be calculated using recruitment estimates from 1963 and onward, but felt that these BRPs should include a disclaimer that BRPs may change if historical productivity is later determined to have been higher than observed during the time series from 1963. The Panel supported empirical estimates of BRPs (including use of $F_{40\%MSP}$) due to concern with the reliability of stock recruit fits. It was recommended that recruitment resulting from SSB greater than 10,000 t be used to derive B_{MSY} and MSY . If time permitted use of a variance minimizer approach ('razor' analysis) was suggested to provide a more objective measure of the SSB threshold.

Rapporteur: Anne Richards

Presentation Highlights

Pollock (*Pollachius virens*) in habiting the waters of the Gulf of Maine and Georges Bank are found at most depths ranging from the shallow parts of the western Gulf of Maine out to depths down to 300+ m. The stock comprises NEFSC statistical areas 511-616, although most of the fishery occurs in the Gulf of Maine. The stock was last assessed at GARM II in 2004 using an AIM model. The existing reference points at that time were: Fmsy proxy (Relative F) = 5.88, Bmsy proxy = 3.00 kg/tow (NEFSC autumn RV survey, and MSY = 17,640 t. The GARM III agreed assessment is an AIM model using a similar formulation as at GARM II. The reference points based on results of this assessment are: Fmsy proxy = 0.5.758 (Relative F), Bmsy proxy = 2.00 kg/tow (NEFSC autumn RV survey) and MSY = 11,516 t. The GARM III assessment includes commercial and recreational landings data and autumn RV survey data through 2006. The recreational landings data have been revised since the GARM II assessment. These data changes were minor and did not contribute to any substantial differences in the assessment. The biomass reference points estimated at the GARM III Biological Reference Point Meeting are substantially different from those in place at GARM II. The Fmsy proxy is almost the same, but the Bmsy proxy is about 33% lower than the existing Bmsy reference points. Because the Fmsy proxy has not changed appreciably, this results in a similar reduction in the MSY proxy.

Discussion

BRPs were estimated using the status quo method and with two changes: (1) inclusion of recreational landings in the catch time series, and (2) using an assumed Bmsy proxy of 2 kg/tow (vs. 3 kg/tow in the status quo method).

The Panel had no objections to adding recreational landings to the catch series.

The choice of Bmsy proxy is subjective and the revision was based on examination of trends in replacement ratios and survey biomass. When replacement ratios were below 1 (stock not replacing itself), survey biomass indices were generally below 2 kg/tow. The Panel agreed that Bmsy proxy=2 kg/tow is more internally consistent, and approved using this in place of the status quo Bmsy proxy (=3 kg/tow).

The survey shows strong year effects and cohorts can not be tracked, probably because of variability in migratory patterns and thus availability to the survey. However, a clear pattern is the lack of fish older than age 8 since the early 1990s, similar to many other GARM species; this information does not enter into evaluation of stock status with the present method.

Concerns were raised over the high implied population growth rate from the AIM model and suggestions made for alternative formulations for the relationship between replacement ratio and relative F (e.g. log-linear with priors on a or logistic). However, AIM is used to deduce when relative F is too high, not for establishing Bmsy, and a and b can be viewed as nuisance parameters in this context. A suggestion was made that if the alternative formulations can be fit, the parameter estimates might be useful for defending the chosen value of Bmsy and would put the biomass reference points in the same context from which the F index reference points were derived.

Rapporteur: Elizabeth Brooks

Presentation Highlights

The Panel at the GARM III ‘models’ review was concerned with the problematic estimation of biomass levels prior to the substantial landings starting 1936 using RED and STATCAM. The reviewers suggested implementing a Beverton-Holt stock-recruitment relationship with a steepness as estimated for Pacific Ocean Perch and assume low coefficient of variation (CV, approximately 0.2) of log recruitment residuals in years where age samples is not available and high CV (approximately 0.4) of log recruitment residuals where age samples are available. The reviewers were also interested in relaxing the constant selectivity assumption (i.e., the separability assumption).

In the revised assessment, we have used ASAP (ASAP 2008) as the assessment model because it is also a statistical catch-at-age model and it has options for assuming a Beverton-Holt stock-recruitment relationship. We fit three ASAP models assuming the suggested CVs for log recruitment residuals (0.2 and 0.4, alternative 1) assuming more drastic differences in the CVs for periods with and without age sampling (0.1 without age samples and 0.8 with age samples, alternative 2) and assuming the same CVs as alternative 2 except with a 5 year linear ramp from 0.1 in 1964 to 0.8 in 1969 (alternative 3). In addition, we revised the maturity at age, weight at age and assumed CVs for survey biomass indices and we included discards with landings for total catch estimates between 1989 and 2006 with corresponding CVs provided by variance estimates for the annual discards. The CVs for the biomass indices were estimates provided by the sampling design used in the fall and spring bottom trawl surveys when available. In years where design-based CV estimates were not possible, we assumed $CV = 0.3$. Further assumptions in the ASAP models were intended to mimic those used previously in STATCAM and RED models where possible. However, we have not attempted to relax the constant selectivity assumption in this assessment because the time span over which age composition data are available from landings (1969-1985) is short relative to the entire time span of landings (1913-2006) and as such there is no ability to estimate different selectivity patterns in the periods prior to and after age observations from landings.

The spawning biomass estimates in the initial period (1913 to 1934) provided by the ASAP alternatives are all greater than those provided by the STATCAM alternatives. Furthermore, the magnitude of the infrequent large recruitment estimates is generally less using the ASAP models. Overall, the diagnostics of the three ASAP alternatives were similar and estimation of initial stock biomass was better behaved than any of the STATCAM alternatives. However, we propose ASAP alternative 3 as the best of the alternative assessment models at this time because the standardized recruitment residuals were best behaved.

We used AGEPRO (AGEPRO 2005) to determine median SB_{MSY} under two alternative scenarios. In the first scenario, we assumed recruitment events are related to spawning biomass in the same manner as the ASAP alternative 3 with 0.8 CV for the residuals (Beverton-Holt spawner-recruit relationship) and the stock is fished at F_{MSY} with fishery age-specific selectivity as estimated from that model. In the second scenario, we assumed recruitment is a random draw from the 94 recruitment estimates provided by ASAP alternative 3 and the stock is fished at $F_{50\%MSP}$ (0.03780) as determined from the revised weight at age and maturity at age and fishery age-specific selectivity as estimated from ASAP alternative 3. For both projection scenarios, we

used 100 draws of numbers at age vectors in 2007 from the posterior distribution provided by ASAP alternative 3 and we projected 300 years forward with 100 simulations per numbers at age vector.

The median SB_{MSY} as estimated using AGEPRO, using the first scenario with a Beverton-Holt spawner-recruit function is approximately 353,040mt and the MSY estimate is approximately 13,660 t whereas the median spawning biomass using the 94 estimated recruitments from ASAP and $F_{50\%MSP}$ is approximately 261,280 t ($Yield_{50\%MSP}$ estimate is 9,780mt). Both of these SB_{MSY} estimates are greater than the NEFSC (2002) estimate.

Discussion

A panelist asked about the stock recruit plots for the different CV cases, because he thought he'd see red points above and below the predicted line for $CV=20\%$, but they were all above the line. Another panelist said that the problem with those points is that because there is no age information for those points, they go to the curve. The way you fit the model, prior to data kicking in your estimates are lower. The expected value during that period is lower during that period than after, because of the lognormal distribution. But this influences the shape of the S-R curve and estimates of B_0 . In a Bayesian analysis, you'd want the CV constant over time.

A panelist suggested that he thought the point was to find the recruitment that explains the amount of catch removed during that early period. Given that selectivity is constant, ASAP is filling in the recruitment to generate the observed catch.

A member of the audience pointed out that there is a self-consistency problem, but in a frequentist framework, you'd want to make it the S-R curve deterministic prior to some period, then add the bias correction to it. What has happened is the model has had difficulty at the transition point between the CV periods. But, the other question is how strictly you want to interpret them.

The panelists had trouble reading and interpreting the plots of fits to age composition. One panelist thought they were residuals, rather than observed versus predicted. One panelist voiced a preference for bubble plots of observed and another bubble plot of residuals. It was also noted that strong year classes appeared on the diagonal of the age composition plots.

A panelist asked what was the effect of changing the weights at age on the model results. Another panelist asked for clarification, regarding MSP relative to SSB/R and SPR? It was clarified by a NEFSC employee that MSP is % of spawning potential relative to $F=0$.

A panelist asked what is the F reference. It was noted that the S-R curve was not believed, so an SPR was defaulted to, and because redfish was long lived, they use 50% instead of 40% SPR.

A panelist suggested that he was not sure this model will work for assessing status, but that it may be ok to average over it in a YPR calculation. The value added to what is shown here is that we've shown that catches prior to age composition data have come from average recruitment rather than earlier models that suggested one strong 'bonanza' year-class. It was noted that the previous STATCAM applications to this stock used a single selectivity.

A member of the audience questioned why $M=0.05$? He suspected that the results will be highly dependent on that assumption (this is whale like). For the distribution of ages, he would not have thought that M was as low as .05. He pointed out that in Figure N20, bottom right, there is a clear temporal pattern in residuals, and that you can reduce that autocorrelation in recruitment residuals with a higher M.

A NEFSC employee pointed out that the value of M is consistent to redfish stocks around the world.

Both an audience member and a Panel member pointed out that weight at age plot shows older fish. One way to support the use of $M=0.05$ would be to show the age or length data that has been collected to help corroborate that you have such a low M .

A member of the audience asked if he heard correctly that the model didn't show any evidence of a change in selectivity. It was clarified that what he heard was that the residual fits were not bad. The same individual asked if that weren't troubling given the management history. It was clarified by a NEFSC employee that the fishery always used a small mesh; when the mesh changed in 1994, the fishery effectively closed. Therefore, the single selectivity assumption is probably justified.

A panelist commented on the modeling approach, and referenced Fig N10, which shows the pattern of residuals in fit to total catch. The panelists comment is that you should try to fit total catch quite exactly, even when there is uncertainty. The rationale is that you can't expect a model like this to pick up where in catch series the errors should be. It is disturbing to see this residual pattern. This suggestion is just a general approach to modeling. Another panelist asked what this general approach was based on. The first panelist responded, again, that it is unlikely that the data can inform where the errors in catch are or aren't. In the face of uncertain removals, you're better off running models with different assumed levels of removals (as sensitivity cases), and in each of those runs, fit to those removals exactly.

The meeting chair asked if there was sufficient support for the BRPs. A panelist questioned the middle one case (with $CV=0.8$ fixed) given that in the model fitting exercise the analyst had split the CV . Another panelist was comfortable with the model fit and internally estimated S-R function, because it doesn't require very different recruitment levels than what we've observed. But this is not to say that the panelist was comfortable with the exact S-R function, because the form is largely influenced on predicted recruitments which are based on data from where we have no age comp.

A discussion ensued as to whether predicted recruitment for years where there was no age composition should be included in the projections that sample from the recruitment cdf. Many panelists agreed that it did not make sense to sample from those years without age composition data, and that they should be dropped in making projections to get the reference points. Because those points are basically on the predicted S-R function, which was rejected as a basis for deriving reference points, then those points shouldn't be included; including them is giving an artificially tight central tendency.

Further discussion centered on trying to reconcile the difference in the BRP table of results between the far left and the far right columns. Several assignments were requested of the analyst.

1. take arithmetic average of top of recruitments associated with the top 25% of SSB values, and scale reference points by this.
2. use this same series of recruitments in the AGEPRO approach
3. bring info forward to corroborate lower M .

Working Paper 4.O: Wigley S. Ocean pout

Rapporteur: Laurel Col

Presentation Highlights

Ocean pout is assessed as a unit stock from Gulf of Maine/Cape Cod Bay south to Delaware. An index assessment was presented. Landings, survey indices and exploitation ratios remain at, or near, record low levels and the annual estimates of discards exceeds the landings. Although exploitation has been low, stock size has not increased. The stock appears to be in a depensatory state. Discards are estimated to be an important component of catch and may be sufficiently high to hinder recovery of the stock.

For Ocean pout, the replacement ratio and relative F analyses, as well as age-structured biomass dynamics model analyses, were not informative upon which to base Bmsy, Fmsy, and MSY. Thus, biological reference point proxies for Ocean pout remain based upon research vessel survey biomass trends and exploitation.

The current biological reference points were determined by the Overfishing Definition Panel in 1998. The Bmsy proxy is the median NEFSC spring survey biomass (4.9 kg/tow) during 1980-1991. The MSY is 1,500 t, chosen by visual inspection of landings. The Fmsy proxy is 0.31 (4.9/1.500).

The revised biological reference points are updated using total catch (landings and discards). The Bmsy proxy is the median NEFSC spring survey biomass (4.94 kg/tow) during 1977-1985; the Fmsy proxy is the median exploitation ratio (0.76) during 1977-1985. The 1977-1985 time period corresponds to the time when the replacement ratio was above 1 and biomass increased. Based on these revised proxies, MSY is estimated to be 3,754 t ($4.94 * 0.76 * 1000$). Differences between current and revised reference points are due to the inclusion of discards in the total catch. The revised biological reference points are provisional and may change at the August 2008 GARM.

Discussion

The Panel expressed concern with the method for determining the biological reference points since AIM showed that the relationship between relative F and the replacement ratio was uninformative. The Panel commented that the time period used to determine MSY, the time when replacement ratio greater than 1, could have encompassed a strong year class.

It was discussed that when the current reference points were determined in 1998, there appeared to be a relationship between biomass and relative F. The 2002 re-evaluation of the reference points defaulted to the 1998 values since the recent data were not informative to update the biological reference points. The Panel discussed that the available data remains generally uninformative for providing updated reference points; however, defaulting to the 1998 reference points is not advisable since discards are important and were not included in 1998 reference point determinations. The Panel therefore concluded that using the method of estimating MSY based on a stable period where replacement ratio was greater than 1 should be applied to the new catch data, since this method is consistent with 1998 reference point determinations. The revised reference points are $MSY = 3,754$ t, SSB_{MSY} proxy = 4.94 kg/tow, and $F_{MSY} = 0.76$. The Panel further stated that caution should be taken in interpreting the reference points since the recent depensation would likely inhibit rebuilding. It was commented that the stock may not be able to increase even in the absence of fishing.

Presentation Highlights

Windowpane flounder is a shallow-water species. The Gulf of Maine-Georges Bank stock was assessed at GARM II using an index-based method for the period 1963-2004. The current biological reference points are: F_{MSY} proxy = 1.11 and B_{MSY} = 0.94 kg per tow. The F_{MSY} proxy was based on an assumed MSY proxy of 1,000 t and the median of the fall survey biomass index during 1975-1987. The GARM III assessment was conducted utilizing an index-based model called AIM for the period 1975-2006. The provisional reference point estimates are: F_{MSY} proxy (relative F) = 0.62 and B_{MSY} proxy = 1.14 kg per tow. Input data to the AIM model consisted of: initial estimates of discards; landings; and the NEFSC fall survey biomass indices. The provisional F_{MSY} proxy was estimated from the AIM model and represents the relative fishing mortality rate (catch / fall survey biomass index) at which the stock can replace itself. The MSY proxy (= 700 t), assumed as the median catch during a period of time when the stock was replacing itself (1995-2001), was divided by the F_{MSY} proxy to compute the B_{MSY} proxy. The current reference point estimates cannot be compared with the provisional estimates because different survey strata sets were used and the provisional reference point estimates include discards.

Discussion

The population is assessed as two different stocks, northern (GOM/GB) and southern (SNE/MAB). The AIM model was used to estimate the relative F (catch/survey biomass index) at which the population would be stable. Inputs to the AIM model are catch and survey biomass indices.

GOM-GB

For the northern stock, catches and NEFSC fall survey biomass indices were used in the final AIM model run. Biomass indices from the spring NEFSC, Canadian, MA, NJ, and Long Island Sound surveys and the fall MA, NJ, and Long Island Sound surveys were not included in the final model run because the regression of relative Fs against stock replacement ratios was not significant at the $p = 0.1$ level. Since 1994, catches have been mostly bycatch, and since 2000, consisted of 10-20 times the landings. It is important to note that the previous reference point estimates included only landings and that the revised estimates include discards as well as landings. Since 2004, there has been an increase in pre-recruit abundance in the NEFSC fall surveys.

AIM results indicate the stock can replace itself at a relative F of 0.62. This was considered an F_{msy} proxy. During 1995 and 2001, the replacement ratio was greater than or near one which infers that the catch was sustainable during that time period. Therefore, the median catch during 1995-2001 (700 t) was considered as MSY and a B_{MSY} proxy was computed as 1.14 kg per tow. These reference points were selected by the Panel over the B_{MSY} proxy estimate representing the median biomass index because of the greater precision of the discard estimates after 1988. It was also noted that replacement ratios suggest that the stock could not replace itself when a directed fishery occurred during the early part of the time series. The extent of discarding indicates that there is currently no market for GOM-GB windowpane flounder. It was speculated that the AIM regression may have been determined as significant as a result of a few data points.

Rapporteur: Toni Chute

Presentation Highlights

Windowpane flounder is a shallow-water species. The Southern New England-Middle Atlantic Bight stock was assessed at GARM II using an index-based model (AIM) for the period 1963-2004. The current biological reference points are: F_{MSY} proxy = 0.98 and B_{MSY} = 0.92 kg per tow. The F_{MSY} proxy was based on an MSY estimate of 900 t from an ASPIC surplus production model for the period 1963-1996. The GARM III assessment was conducted utilizing an index-based model called AIM for the period 1975-2006. The provisional reference point estimates are: F_{MSY} proxy (relative F) = 1.53 and B_{MSY} proxy = 0.33 kg per tow. Input data to the AIM model consisted of: initial estimates of discards; landings; and the NEFSC fall survey biomass indices. The provisional F_{MSY} proxy was estimated from the AIM model and represents the relative fishing mortality rate (catch / fall survey biomass index) at which the stock can replace itself. The MSY proxy (= 500 t), assumed as the median catch during a period of time when the stock was replacing itself (1995-2001), was divided by the F_{MSY} proxy to compute the B_{MSY} proxy. The current reference point estimates cannot be compared with the provisional estimates because different survey strata sets were used and the provisional reference point estimates include discards.

Discussion

Catches for the southern stock are driven by discards and the survey indices have been at very low levels for the past two decades. The same methods and the same time period of sustainable fishing (1995-2001) used for the northern stock, based on stock-specific trends in replacement ratios, were used to estimate BRPs. It was noted that the southern stock has not shown a positive response to management actions in the past two decades and that replacement ratios suggest that the stock could not sustain itself when the directed fishery occurred. The revised BRP estimates are substantially different from the current BRPs but the two sets are not comparable because of differences in the methods and data used to compute each set of BRPs. The revised BRPs include initial discard estimates and discards are the predominant catch component. Also, the previous BRPs were based on an ASPIC surplus production model which did not contain survey indices covering the entire habitat of windowpane flounder (inshore strata were not included). As a result, the two sets of BRPs are not comparable. It was noted that recent fishing in sea scallop closed areas may also be impacting the stock. The question was asked about what would happen if the stock, at this point mostly discards, crept back above B_{msy} and this was interpreted as a signal that a directed fishery would be sustainable? The Panel noted that caution must be taken here because the market for windowpane flounder may change in the future.

Rapporteur: Ralph Mayo

Presentation Highlights

The Gulf of Maine haddock stock is defined by the United States statistical areas 511 through 515, corresponding to the Northwest Atlantic Fisheries Organization area 5Y. Haddock in this region range in depth from 20 m to 380 m, but are more common at depths ranging from 45 m to 135 m. This stock was last assessed in 2005 at the Groundfish Assessment Review Meeting (GARM) II using biological reference points determined using the method, An Index Method (AIM). The corresponding biological reference points were $F_{MSY[proxy]} = 0.23$, $B_{MSY[proxy]} = 11.09$ kg/tow, and $MSY_{[proxy]} = 5,100$ t. These biological reference points (BRPs) and the associated assessment included only commercial landings in the estimates of fishery removals.

Reference points have been recalculated for GARM III using the results from an ADAPT virtual population analysis (VPA) run for the years 1977 to 2006. The VPA included commercial landings at age, commercial discards at age and recreational landings at age and was tuned to both the spring and autumn Northeast Fisheries Science Center bottom trawl survey indices of abundance. Both empirical and deterministic BRPs were calculated, however the deterministic estimates were determined to be unreliable because of the poor fit of the stock-recruit function. AgePro projections were used to determine the BRPs associated with a constant harvest of $F_{40\%MSP} = 0.454$ using the cumulative distribution function (CDF) of age-1 recruitment from 1963 to 2006. The 1962 “bonanza” year class was removed from the recruitment time series as well as those year classes corresponding to spawning stock biomass less than 3,000 t (1986 to 1996). The five year averages (2002 to 2006) of partial recruitment, stock weights, catch weights and spawning stock weights, the 1977 to 2006 average female maturity at age and an assumed constant natural mortality of 0.2 were used as input vectors in the AgePro projections. The resultant BRPs were $SSB_{MSY} = 5,995$ t and $MSY = 1,360$ t; however, these are considered provisional and subject to change at the final GARM III meeting.

The updated BRPs for this stock were appreciably different from those previously calculated using the AIM method. This is not unexpected given that these updates were determined using the results from an age-based model. The estimated $F_{40\%MSP}$ was higher than that estimated for Georges Bank haddock. This difference is likely due to the lower partial recruitment at age relative to the Georges Bank stock resulting from a higher proportion of the fishery removals made up of the recreational hook and line fishery and larger trawl mesh sizes used in the Gulf of Maine commercial fishery.

Discussion

The VPA exhibits a weak retrospective pattern, but was considered to be a reliable basis for calculating biological reference points. The Panel focused first on the estimate of the F_{msy} proxy ($F_{40\%MSP}$). The estimate was considerably higher than the estimate for Georges Bank haddock.

Several factors were discussed as possible reasons for this difference. Fishery selectivity is delayed on this stock compared to the Georges Bank stock. This is due to lower mean weights at age and the larger mesh used by fishermen in the Gulf of Maine. Since 2002, these fishermen use 6.5 inch square mesh to target flatfish, resulting in greater escapement of roundfish compared to the 6 inch diamond mesh used on Georges Bank.

This supports the observation that larger haddock are taken in the Gulf of Maine compared to Georges Bank. The recreational fishery accounts for a large proportion of the landings in recent years and these fish are also relatively large. There was an abrupt drop in F in 2002, especially at age 2 when the mesh went to 6.5 inch square. The VPA appears to be picking this up. It was also noted that the $F_{40\%MSP}$ is contingent on continued use of the 6.5 inch square mesh. The delayed partial recruitment also indicates that stock is able to spawn at least once before they are selected.

A multiplicative model was used to explain age and year effects on the partial recruitment matrix. Younger ages in recent years show lower partial recruitment compared to earlier years. Largest differences occur in the most recent years.

Spring survey weights at age are similar to the RIVARD stock weights used in the SSB/R. There was a very large decline in survey weights at age in recent yrs, about $\frac{1}{2}$ of earlier weights. This argues for a lower B_{msy} than the existing value from the AIM analysis. The B_{msy} from the AIM model was based on an average from a period of heavy exploitation during the 1950s and 1960s when landings were very high.

Replacement ratios were never above 1.0 when the catch was above 2,000 t.

There was consensus that there is a need to explain the factors that account for the lower partial recruitment and mean weights resulting in the higher $F_{40\%MSP}$.

Four recruitment options were reviewed, including hindcasting to 1963, and dropping 3 large year classes. The SSB $_{msy}$ estimates show that the stock is rebuilt and F is low, a reversal from the last assessment. The Panel felt that it is difficult to accept that stock is above SSB $_{msy}$ compared to 1970s. A larger SSB $_{msy}$ estimate is more appropriate because the recent biomass increase is based on 1 year class (1998), not a rebuilt stock.

The Panel focused on current stock productivity. High historical landings imply that the stock was more productive during the 1950s. Is productivity lower now? SSB in the 1970s is a product of good recruitment of 1975 year class and recent SSB is a product of the 1998 year class. It was felt that the fishery is not maximizing yield per recruit with the use of the larger mesh. We may be underestimating the overall productivity by focusing on recent recruitment. Since recruitment dynamics in the Gulf of Maine is similar to Georges Bank, it could be that current productivity is underestimated by half if productivity is similar to what we saw for Georges Bank during the 1930-1950s.

The Panel ultimately agreed to accept $F_{40\%MSP}$ as the F_{msy} proxy and to use the recruitment option, hindcast back to 1963, and remove just the highest year class (1962) and other recruitment data when SSB was less than 3000 t. The Panel also recommended that recruitment patterns on Georges Bank be compared to Gulf of Maine to see if Gulf of Maine recruitment can be hindcast back to the 1930s.

Should a F_{msy} proxy higher than $F_{40\%MSP}$ be used because of reduced productivity? This issue should be examined in the future.

Rapporteur: Larry Alade

Presentation Highlights

Previously an index-based method was used to assess Atlantic halibut, where the 5-year moving average of the swept-area biomass was compared to biomass reference points ($B_{\text{threshold}} = 2,700$ t and $B_{\text{MSY}} = 5,400$ t). The previous reference points were determined based on a MSY of 300 t, estimated from the landings time series, and yield per recruit and biomass per recruit analyses using growth curve and length-weight equations from published literature. Although reliable fishing mortality estimates were not available using the index-based method, previous reference points were given as $F_{0.1} = 0.06$ and $F_{\text{target}} = 0.04$. Index-based reference points were updated using a length-weight relationship from NEFSC spring and autumn surveys, and von Bertalanffy growth parameters and maturity at age estimates from recent studies in the Gulf of Maine region. Revised biomass reference points were slightly higher, with $B_{\text{threshold}} = 3,200$ t and $B_{\text{MSY}} = 6,400$ t, and revised overfishing reference points were slightly lower, with $F_{0.1} = 0.04$ and $F_{\text{target}} = 0.02$.

An alternative replacement yield model was performed for Atlantic halibut, incorporating the time series of commercial catch. US discards were estimated using the Standardized Bycatch Reporting Methodology combined ration estimation. Due to low observed encounter rates of halibut and the implementation of the Atlantic halibut regulations in 1999, an average discard ratio from 1989 to 1998 was applied to the 1893-1998 landings and an average discard ratio from 1999-2006 was applied to the landings in those years. The resulting average US discards were added to the total landings, and a linear increase in catch was assumed from 1800-1892 to approximate the entire time series of Atlantic halibut catch in the Gulf of Maine-Georges Bank region. Simulations of varying carrying capacities and intrinsic growth rates were performed, and the model with the best fit was determined using a negative log-likelihood function. The resulting biomass in 2006 was estimated to be 21,000 t, well below the model estimated biomass reference points of $B_{\text{threshold}} = 75,000$ t and $B_{\text{MSY}} = 150,000$ t. Unlike the index-based method, current fishing mortality is estimable using the replacement yield model, and the 2006 estimated F of 0.0022 was below the F_{MSY} estimate of 0.003.

Discussion

This paper summarizes a proposed revision of the references points for the Atlantic Halibut assessment based on an Index based approach (old and revised approach) and an alternative replacement yield model for TOR 4. The Panel initially expressed concern with moving forward using the replacement yield model because the model was highly sensitive to priors on K and r . The Panel recommends using the updated life history parameters for the Gulf of Maine region for the YPR model, and that M should be consistent with published estimates from other halibut stocks. The Panel also recommended fixing r in the replacement yield model as two times the $F_{0.1}$ (proxy for F_{MSY}) from the YPR model. The Panel recommended using a parabolic function as basis for landings from 1800-1893, and using the replacement yield model to estimate B_{MSY} , $B_{\text{threshold}}$, current biomass and current F . A partial re-run of the replacement yield model was conducted by the analyst based on some of the recommendations made by the Panel to provide a tentative place-holder for BRP estimates. The current parameterization of the re-run included a new intrinsic growth rate value, twice the $F_{0.1}$ as a proxy for F_{MSY} ($r = 0.08$)

which yielded a $B_{MSY} = 70,000$ t, an $F_{MSY} = 0.04$ and $MSY = 2800$ t. The analyst noted that further analyses that will include a change in M for the YPR analyses and the incorporation of a parabolic function for the Pre-1893 landings will have implications on these BRP estimates and therefore subjected to revisions before the August meeting.

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