2013 Annual Report to the
Western and Central Pacific Fisheries Commission

United States of America

PART I. INFORMATION ON FISHERIES, RESEARCH, AND STATISTICS [1]
(For 2012)

National Oceanic and Atmospheric Administration
National Marine Fisheries Service

Scientific data was provided to the Commission in accordance with the decision relating to the provision of scientific data to the Commission by 30 April 2013	**YES**
If no, please indicate the reason(s) and intended actions:	

1. Summary

Large-scale fisheries of the United States and its Participating Territories for highly migratory species (HMS) in the Pacific Ocean include purse-seine fisheries for skipjack tuna (*Katsuwonus pelamis*) and yellowfin tuna (*Thunnus albacares*); longline fisheries for bigeye tuna (*Thunnus obesus*), swordfish (*Xiphias gladius*), albacore (*Thunnus alalunga*), and associated pelagic fish species; and a troll fishery for albacore. Small-scale fisheries include troll fisheries for a wide variety of tropical tunas and associated pelagic species, handline fisheries for yellowfin and bigeye tuna, a pole-and-line fishery for skipjack tuna, and miscellaneous-gear fisheries. Associated pelagic species include other tunas and billfishes, mahimahi (*Coryphaena hippurus*), wahoo (*Acanthocybium solandri*), moonfish (*Lampris* spp.), oilfish (*Ruvettus pretiosus*), and pomfrets (Bramidae). The large-scale fisheries operate on the high seas, within the U.S. exclusive economic zone (EEZ), and within the EEZs of other nations. The small-scale fisheries operate in nearshore waters off Hawaii and the U.S. Territories of American Samoa and Guam, and the Commonwealth of the Northern Mariana Islands (CNMI).

Overall trends in total landings by U.S. and U.S. associated-Participating Territory fisheries in the Western and Central Pacific Fisheries Commission (WCPFC) Statistical Area in 2012 are dominated by the catch of the purse-seine fishery. Preliminary 2012 purse seine landings estimates total 223,575 t of skipjack, 30,721 t of yellowfin, and 5,464 t of bigeye tuna. Total U.S. purse-seine landings in 2011 have been revised to 203,746 t from last year's preliminary estimate. Longline landings increased in 2012 to a level near the landings recorded in 2008. Bigeye tuna landings by U.S. longliners

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increased to 5,160 t, the highest level recorded during the 2008-2012 period. Albacore landings increased to 3,749 t in 2012. Excluding landings by the U.S. Participating Territories (i.e., American Samoa), longline landings of bigeye tuna increased slightly to 3,654 t in 2012 from a five-year low of 3,565 t in 2011 (Table 1f). These bigeye tuna landings by the U.S. longline fishery were below the limit of 3,763 t established in U.S. fishery regulations (50 CFR Part 300, 2009) pursuant to the provisions of WCPFC Conservation and Management Measure (CMM) 2008-01 for bigeye and yellowfin tuna during 2009 through 2011 and CMM 2011-01 in 2012. Longline landings of swordfish in the North Pacific Ocean (NPO) increased to 897 t in 2012, up from a five-year low of 859 t in 2011. Small-scale (tropical) troll and handline vessels operating in nearshore waters represented the largest number of U.S.-flagged vessels but contributed only a small fraction of the landings. The longline fleet was the next largest fleet, numbering 153 in 2012, while there were 39 purse-seine vessels in 2012.

The National Oceanic and Atmospheric Administration (NOAA) National Marine Fisheries Service (NOAA Fisheries Service) conducted a wide range of research on Pacific tuna and associated species at its Southwest and Pacific Islands Fisheries Science Centers and in collaboration with scientists from other organizations. NOAA Fisheries conducts fishery monitoring and research, including biological and oceanographic research, fish stock assessment research, and socio-cultural studies on fisheries for tunas and billfishes. The monitoring and research also address animals caught as bycatch in those fisheries. In 2012, socio-economic studies addressed market impacts of longline fishery regulations, retail pricing in the Hawaii seafood market, and cost-earnings analyses for Hawaii longline and small boat pelagic fisheries in Hawaii, Guam, and CNMI. Stock assessment research was conducted almost entirely in collaboration with members of the WCPFC, the International Scientific Committee for Tuna and Tuna-like Species in the North Pacific Ocean (ISC), and other Regional Fisheries Management Organizations (RFMOs). The stock assessment work is not described in this report but is detailed in other publications (Brodziak et al., 2012; Lee et al., 2012; Link et al., 2012; Mac Call and Teo, 2013; Piner et al., 2013; Simon et al., 2012).

NOAA Fisheries biological and oceanographic research on tunas, billfishes, and sharks addressed fish movements, habitat preferences, post-release survival, feeding habits, abundance, sexual maturity, and age and growth. Research on North Pacific albacore focused on otolith microchemistry and stock structure. Swordfish research included vertical habitat and foraging depth studies. Tagging projects continued for pelagic sharks, as did studies on oxytetracycline age validation. Bycatch mitigation studies in the longline and gillnet fisheries focused on sea turtles and pelagic sharks. Recent opah (*Lampris* spp.) research included studies on foraging ecology, gill morphology and regional heterothermy.

2. Tabular Annual Fisheries Information

This report presents estimates of annual catches of tuna, billfish, and other highly migratory species (HMS), and vessel participation during 2008-2012 for fisheries of the

United States and its Participating Territories operating in the western and central Pacific Ocean (WCPO). All statistics for 2012 are provisional. For the purposes of this report, the WCPO is defined as the Western and Central Pacific Fisheries Commission (WCPFC) Statistical Area.

The purse-seine fishery remains the largest U.S. fishery in terms of total catch. It accounts for about 94% of the total catch of HMS by the U.S. and its Participating Territories in the WCPO. The longline, tropical troll, handline and albacore troll fisheries account for about 5.0%, 0.8%, 0.4%, and 0.1% of the total catch, respectively.

Fisheries of the U.S. and its Participating Territories for tunas, billfishes and other pelagic species produced an estimated catch of 277,152 t in 2012 (Table 1a), up from 219,576 t in 2011 (Table 1b). The catch consisted primarily of skipjack tuna (81%), yellowfin tuna (12%), bigeye tuna (4%), and albacore (2%). Catches of skipjack and yellowfin tuna increased in 2012 due to higher purse-seine catches while albacore and bigeye tuna decreased from the previous year.

For the most part, U.S. estimates of catch by weight are estimates of retained catches due to lack of data on weights of discarded fish. With the exception of purse-seine and some small-scale fisheries, weight estimates are not available for at-sea discards or subsistence or recreational catches. In the future, the longline weight estimates may include at-sea discards.

Further discussion of the tabular fisheries information is provided in following section on flag state reporting.

Table 1a. Estimated weight (in metric tons) of landings by vessels of the United States and its Participating Territories (American Samoa, Guam, and Commonwealth of the Northern Mariana Islands) by species and fishing gear in the WCPFC Statistical Area, for 2012 (preliminary). Totals may not match sums of values due to rounding to the nearest metric ton (<0.5 t = 0).

Species and FAO code	Purse seine	Longline	Albacore troll	Tropical troll	Handline	Pole & line	TOTAL
Albacore (ALB), North Pacific	0	594	0	3	277	-	874
Albacore (ALB), South Pacific	0	3,155	198	0	0	-	3,353
Bigeye tuna (BET)	5,464	5,160	0	170	310	-	11,104
Pacific bluefin tuna (PBF)	0	7	0	0	0	-	7
Skipjack tuna (SKJ)	223,575	483	0	396	12	-	224,466
Yellowfin tuna (YFT)	30,721	1,184	0	702	405	-	33,012
Other tuna (TUN KAW FRI)	0	0	0	19	1	-	20
TOTAL TUNAS	259,760	10,583	198	1,289	1,005	-	272,836
Black marlin (BLM)	0	3	0	0	0	-	3
Blue marlin (BUM)	0	312	0	152	2	-	467
Sailfish (SFA)	0	9	0	0	0	-	9
Spearfish (SSP)	0	147	0	13	0	-	160
Striped marlin (MLS), North Pacific	0	262	0	12	0	-	274
Striped marlin (MLS), South Pacific	0	7	0	0	0	-	7
Other marlins (BIL)	0	1	0	4	0	-	5
Swordfish (SWO), North Pacific	0	897	0	1	7	-	905
Swordfish (SWO), South Pacific	0	14	0	0	0	-	14
TOTAL BILLFISHES		1,652		182	9	-	1,843
Blue shark (BSH)	0	18	0	0	0	-	18
Mako shark (MAK)	0	50	0	0	1	-	51
Thresher sharks (THR)	0	13	0	0	2	-	15
Other sharks (SKH OCS FAL SPN TIG CCL)	0	2	0	1	0	-	3
TOTAL SHARKS		83		1	3	-	87
Mahimahi (DOL)	0	351	0	549	36	-	936
Moonfish (LAP)	0	445	0	0	0	-	445
Oilfish (GEP)	0	228	0	0	0	-	228
Pomfrets (BRZ)	0	270	0	0	6	-	276
Wahoo (WAH)	0	239	0	240	8	-	487
Other fish (PEL PLS MOP TRX GBA ALX GES RRU DOT)	0	9	0	4	0	-	13
TOTAL OTHER		1,542		793	50	-	2,386
TOTAL	**259,760**	**13,861**	**198**	**2,266**	**1,067**	**0**	**277,152**

Table 1b. Estimated weight (in metric tons) of landings by vessels of the United States and its Participating Territories (American Samoa, Guam, and Commonwealth of the Northern Mariana Islands) by species and fishing gear in the WCPFC Statistical Area, for 2011 (updated). Totals may not match sums of values due to rounding to the nearest metric ton (<0.5 t = 0).

Species and FAO code	Purse seine	Longline	Albacore troll	Tropical troll	Handline	Pole & line	TOTAL
Albacore (ALB), North Pacific	0	610	69	4	84		767
Albacore (ALB), South Pacific	0.55	2,291	402	0	0		2,694
Bigeye tuna (BET)	7763.29	4,829		110	296		12,998
Pacific bluefin tuna (PBF)	0	2		0	0		2
Skipjack tuna (SKJ)	171242.04	300		394	9		171,945
Yellowfin tuna (YFT)	24008.53	1,437		501	357		26,304
Other tuna (TUN KAW FRI)	68.56	0		16	1		86
TOTAL TUNAS	203,083	9,469	471	1,026	747	-	214,796
Black marlin (BLM)	32	2		0	0		33
Blue marlin (BUM)	34	375		199	2		610
Sailfish (SFA)	2	15		2	0		19
Spearfish (SSP)	0	209		11	0		220
Striped marlin (MLS), North Pacific	0	331		16	0		347
Striped marlin (MLS), South Pacific	3	3		0	0		6
Other marlins (BIL)	163	1		5	0		169
Swordfish (SWO), North Pacific	0	859		0	5		864
Swordfish (SWO), South Pacific	0	12		0	0		12
TOTAL BILLFISHES	234.5	1,805		233	7	-	2,280
Blue shark (BSH)	0	14		0	0		14
Mako shark (MAK)	0	51		0	0		51
Thresher sharks (THR)	0	18		0	0		18
Other sharks (SKH OCS FAL SPN TIG CCL)	279	3		1	0		284
TOTAL SHARKS	279.24	87		1	0	-	367
Mahimahi (DOL)	3	353		364	17		737
Moonfish (LAP)	0	396		0	0		396
Oilfish (GEP)	0	233		0	0		233
Pomfrets (BRZ)	0	148		0	5		153
Wahoo (WAH)	7	270		162	4		443
Other fish (PEL PLS MOP TRX GBA ALX GES RRU DOT)	139	21		12	0		172
TOTAL OTHER	149	1,421		538	26	-	2,134
TOTAL	**203,746**	**12,782**	**471**	**1,798**	**780**	**-**	**219,576**

Table 1c. Estimated weight (in metric tons) of landings by vessels of the United States and its Participating Territories (American Samoa, Guam, and Commonwealth of the Northern Mariana Islands) by species and fishing gear in the WCPFC Statistical Area, for 2010. Totals may not match sums of values due to rounding to the nearest metric ton (<0.5 t = 0).

Species and FAO code	Purse seine	Longline	Albacore troll	Tropical troll	Handline	Pole & line	TOTAL
Albacore (ALB), North Pacific	0	356		2	53		411
Albacore (ALB), South Pacific	52	3,943	307	0	0		4,302
Bigeye tuna (BET)	4,878	4,064		118	340		9,400
Pacific bluefin tuna (PBF)	0	3		0	0		3
Skipjack tuna (SKJ)	207,074	235		398	7		207,714
Yellowfin tuna (YFT)	32,494	935		428	265		34,122
Other tuna (TUN KAW FRI)	280	0		26	4		310
TOTAL TUNAS	244,778	9,537	307	972	669	0	256,263
Black marlin (BLM)	21	1		0	0		22
Blue marlin (BUM)	28	293		144	2		467
Sailfish (SFA)	2	11		2	0		15
Spearfish (SSP)	0	86		0	0		86
Striped marlin (MLS), North Pacific	0	130		5	0		135
Striped marlin (MLS), South Pacific	14	2		0	0		16
Other marlins (BIL)	82	1		12	0		
Swordfish (SWO), North Pacific	0	1,024		0	3		1,028
Swordfish (SWO), South Pacific	0	11		0	0		11
TOTAL BILLFISHES	147	1,559	0	163	5	0	1,874
Blue shark (BSH)	0	7		0	0		7
Mako shark (MAK)	0	65		0	1		66
Thresher sharks (THR)	0	16		0	1		17
Other sharks (SKH OCS FAL SPN TIG CCL)	0	3		0	0		3
TOTAL SHARKS	0	92	0	0	2	0	94
Mahimahi (DOL)	29	251		451	25		756
Moonfish (LAP)	0	379		0	0		379
Oilfish (GEP)	0	176		0	0		176
Pomfrets (BRZ)	0	180		0	22		202
Wahoo (WAH)	25	238		232	5		500
Other fish (PEL PLS MOP TRX GBA ALX GES RRU DOT)	784	10		16	1		811
TOTAL OTHER	838	1,234	0	699	53	0	2,824
TOTAL	**245,763**	**12,422**	**307**	**1,834**	**729**	**0**	**261,055**

Table 1d. Estimated weight (in metric tons) of landings by vessels of the United States and its Participating Territories (American Samoa, Guam, and Commonwealth of the Northern Mariana Islands) by species and fishing gear in the WCPFC Statistical Area, for 2009. Totals may not match sums of values due to rounding to the nearest metric ton (<0.5 t = 0).

Species and FAO code	Purse seine	Longline	Albacore troll	Tropical troll	Handline	Pole & line	TOTAL
Albacore (ALB), North Pacific	0	171		3	97		271
Albacore (ALB), South Pacific	0	3,915	237 [1]	0	0		3,915
Bigeye tuna (BET)	6,561	4,029		59	136		10,786
Pacific bluefin tuna (PBF)	0	2		0	0		2
Skipjack tuna (SKJ)	253,783	266		399	11	214	254,673
Yellowfin tuna (YFT)	21,245	820		471	317	17	22,869
Other tuna (TUN KAW FRI)	1,260	0		12	3	1	1,275
TOTAL TUNAS	282,848	9,203	237	945	564	231	293,791
Black marlin (BLM)	0	1		0	0		1
Blue marlin (BUM)	0	389		180	1		570
Sailfish (SFA)	0	12		0	0		12
Spearfish (SSP)	0	103		0	0		103
Striped marlin (MLS), North Pacific	0	240		10	0		250
Striped marlin (MLS), South Pacific	0	4		0	0		4
Other marlins (BIL)	0	0		8	0		8
Swordfish (SWO), North Pacific	0	1,290		0	5		1,295
Swordfish (SWO), South Pacific	0	12		0	0		12
TOTAL BILLFISHES	0	2,051	0	198	6	0	2,255
Blue shark (BSH)	0	9		0	0		9
Mako shark (MAK)	0	104		0	0		104
Thresher sharks (THR)	0	29		0	0		29
Other sharks (SKH OCS FAL SPN TIG CCL)	0	6		0	0		6
TOTAL SHARKS	0	148	0	0	0	0	148
Mahimahi (DOL)	0	276		408	18	1	703
Moonfish (LAP)	0	512		0	0	0	512
Oilfish (GEP)	0	203		0	0	0	203
Pomfrets (BRZ)	0	218		0	16	0	234
Wahoo (WAH)	0	257		264	5	0	526
Other fish (PEL PLS MOP TRX GBA ALX GES RRU DOT)	371	8		13	3	0	395
TOTAL OTHER	371	1,474	0	684	42	1	2,572
TOTAL	**283,219**	**12,875**	**237**	**1,827**	**612**	**232**	**299,003**

Table 1e. Estimated weight in metric tons (t) of landings by vessels of the United States and its Participating Territories by species and fishing gear in the WCPFC Statistical Area, for 2008. Totals may not match sums of values due to rounding to the nearest metric ton (<0.5 t = 0).

Species and FAO code	**Purse seine**	**Longline**	**Albacore troll**	**Tropical troll**	**Handline**	**Pole & line**	**TOTAL**
Albacore (ALB), North Pacific	0	298	1	1	28	0	328
Albacore (ALB), South Pacific	0	3,550	150	0	0	0	3,700
Bigeye tuna (BET)	4,220	4,781	0	74	148	0	9,223
Pacific bluefin tuna (PBF)	0	1	0	0	0	0	1
Skipjack tuna (SKJ)	159,741	282	0	375	9	293	160,699
Yellowfin tuna (YFT)	45,363	1,169	0	453	227	23	47,235
Other tuna (TUN KAW FRI)	51	0	0	7	1	4	63
TOTAL TUNAS	209,375	10,081	151	910	413	320	221,250
Black marlin (BLM)	0	0	0	0	0	0	0
Blue marlin (BUM)	0	367	0	180	1	0	549
Sailfish (SFA)	0	11	0	1	0	0	12
Spearfish (SSP)	0	211	0	0	0	0	211
Striped marlin (MLS), North Pacific	0	411	0	14	0	0	425
Striped marlin (MLS), South Pacific	0	1	0	0	0	0	1
Other marlins (BIL)	0	2	0	13	0	0	15
Swordfish (SWO), North Pacific	0	1,301	0	0	6	0	1,307
Swordfish (SWO), South Pacific	0	7	0	0	0	0	7
TOTAL BILLFISHES	0	2,310	0	208	7	0	2,526
Blue shark (BSH)	0	7	0	0	0	0	7
Mako shark (MAK)	0	109	0	0	0	0	109
Thresher sharks (THR)	0	39	0	0	0	0	39
Other sharks (SKH OCS FAL SPN TIG CCL)	0	4	0	0	0	0	4
TOTAL SHARKS	0	160	0	0	0	0	160
Mahimahi (DOL)	0	335	0	309	18	1	663
Moonfish (LAP)	0	415	0	0	0	0	415
Oilfish (GEP)	0	178	0	0	0	0	178
Pomfrets (BRZ)	0	224	0	1	16	0	241
Wahoo (WAH)	0	326	0	273	5	0	604
Other fish (PEL PLS MOP TRX GBA ALX GES RRU DOT)	0	14	0	8	0	0	22
TOTAL OTHER	0	1,493	0	591	39	1	2,123
TOTAL	**209,375**	**14,043**	**151**	**1,709**	**459**	**321**	**226,058**

Table 1f. Longline landings in metric tons (t) by species and species group, for U.S. and American Samoa vessels operating in the WCPFC Statistical Area in 2008-2012. Totals may not match sums of values due to rounding to the nearest metric ton (<0.5 t = 0).

	U.S. in North Pacific Ocean					**American Samoa in N Pacific**				**American Samoa in South Pacific**					**Total**				
	2012	**2011**	**2010**	**2009**	**2008**	**2012**	**2011**	**2010**	**2009**	**2012**	**2011**	**2010**	**2009**	**2008**	**2012**	**2011**	**2010**	**2009**	**2008**
<u>Vessels</u>	127	128	123	127	129	115	115	11	10	25	24	26	26	28	153	152	146	151	155
<u>Species</u>																			
Albacore, North Pacific	479	497	324	177	307	115	113	48	4						594	610	371	181	307
Albacore, South Pacific						0	0			3,155	2,291	3,943	3,903	3,561	3,155	2,291	3,943	3,903	3,561
Bigeye tuna	3,654	3,565	3,577	3,741	4,649	1,338	1,086	507	156	167	178	178	161	132	5,160	4,829	4,261	4,059	4,781
Pacific bluefin tuna	0	0	0	1	0					7	2	3	1	1	7	2	3	2	1
Skipjack tuna	115	158	114	116	117	123	34	18	5	244	108	110	152	166	483	300	242	272	282
Yellowfin tuna	575	738	462	429	841	272	144	53	15	337	555	445	386	336	1,184	1,437	960	829	1,177
Other tuna	0	0	0	0	0			0						0	0	0	0	0	0
TOTAL TUNA	4,824	4,958	4,477	4,464	5,913	1,849	1,376	625	179	3,910	3,135	4,679	4,603	4,195	10,583	9,469	9,781	9,246	10,109
Black marlin	1	1	0	0	0	0	0	0		2	1	0	0	0	3	2	1	0	0
Blue marlin	226	290	238	333	327	50	45	23	7	36	40	45	42	35	312	375	306	382	362
Sailfish	5	10	9	10	10	3	2	1	0	1	4	2	2	1	9	15	11	12	11
Spearfish	111	169	79	97	207	35	35	9	2	1	5	2	3	1	147	209	89	102	208
Striped marlin, North Pacific	209	263	124	234	407	54	68	13	5						262	331	137	239	407
Striped marlin, South Pacific	0									7	3	2	4	1	7	3	2	4	1
Other marlins	1	1	1	0	2	0									1	1	1	0	2
Swordfish, North Pacific	859	837	1,013	1,243	1,282	38	22	20	5						897	859	1,033	1,248	1,282
Swordfish, South Pacific	0									14	12	11	13	7	14	12	11	13	7
TOTAL BILLFISH	1,410	1,570	1,464	1,917	2,235	180	171	66	19	62	64	62	63	43	1,652	1,805	1,592	1,999	2,279

Table 1f. (Continued.)

	U.S. in North Pacific Ocean					American Samoa in N Pacific				American Samoa in South Pacific					Total				
	2012	**2011**	**2010**	**2009**	**2008**	**2012**	**2011**	**2010**	**2009**	**2012**	**2011**	**2010**	**2009**	**2008**	**2012**	**2011**	**2010**	**2009**	**2008**
Blue shark	12	9	6	9	6	2	2	0		3	2	1	1	1	18	14	7	9	7
Mako shark	42	43	63	102	110	8	8	5	1	0	0	0	0	0	50	51	68	103	110
Thresher	9	15	16	28	38	3	3	0	0	0	0		0		13	18	16	29	38
Other sharks	2	2	3	6	4	0	0	0		0	1	1	0		2	3	3	6	4
TOTAL SHARKS	65	69	87	144	158	14	14	6	1	4	4	2	1	1	83	87	95	147	159
Mahimahi	288	291	230	265	328	52	52	23	7	11	11	9	17	13	351	353	262	289	341
Moonfish	356	309	356	485	409	86	84	42	22	3	3	2	3	2	445	396	400	510	411
Oilfish	169	178	164	194	178	59	55	20	7	0	1	0	3	0	228	233	185	203	179
Pomfret	214	115	169	202	223	56	33	19	10				0		270	148	188	213	223
Wahoo	117	124	101	116	191	39	23	11	4	83	123	133	140	133	239	270	246	260	324
Other fish	8	20	10	8	13	1	0	0	0	0	1	1	0	0	9	21	11	8	14
TOTAL OTHER	1,153	1,036	1,031	1,269	1,344	292	248	115	51	97	137	145	163	149	1,542	1,421	1,291	1,484	1,492
GEAR TOTAL	**7,452**	**7,632**	**7,058**	**7,794**	**9,650**	**2,335**	**1,809**	**812**	**251**	**4,074**	**3,341**	**4,888**	**4,830**	**4,388**	**13,861**	**12,782**	**12,758**	**12,875**	**14,038**

Table 1g. Tropical troll landings in metric tons (t) for Hawaii, Guam, CNMI, and American Samoa vessels by species and species group, for U.S. vessels operating in the WCPFC Statistical Area in 2008-2012. Totals may not match sums of values due to rounding to the nearest metric ton (<0.5 t = 0).

	Hawaii					Guam					CNMI					American Samoa				
	2012	2011	2010	2009	2008	2012	2011	2010	2009	2008	2012	2011	2010	2009	2008	2012	2011	2010	2009	2008
<u>Vessels</u>	1,694	1,598	1,570	1,668	1,541	351	454	432	368	385	35	48	40	47	52	9	10	7	10	16
<u>Species</u>																				
Albacore, North Pacific	3	4	2	3	1															
Albacore, South Pacific																				
Bigeye tuna	170	110	118	59	74															
Pacific bluefin tuna																				
Skipjack tuna	120	126	96	139	157	142	159	154	150	134	130	101	166	123	190	4	9	1	1	7
Yellowfin tuna	651	440	401	436	427	13	37	11	23	9	33	19	14	12	15	4	6	1	1	9
Other tunas	4	2	11	7	4	2	0	1	3	2	13	14	14	2	1	0	0	0	0	
TOTAL TUNAS	948	682	628	644	663	157	196	166	176	145	176	133	193	137	207	8	15	2	3	17
Black marlin																				
Blue marlin	142	188	134		175	6	9	14	15	4	4	2			19					
Sailfish							1	1				1	1		1		0			0
Spearfish	13	11																		
Striped marlin, N. Pacific	12	16	19	10	14															
Striped marlin, S. Pacific																				
Other billfish	4	5	10	8	13															
Swordfish, North Pacific	1			0																
Swordfish, South Pacific																				
TOTAL BILLFISHES	172	220	163	19	202	6	9	15	15	4	4	4	1	0	20	0	0	0	0	0

Table 1g. (Continued.)

	Hawaii					Guam					CNMI					American Samoa				
	2012	**2011**	**2010**	**2009**	**2008**	**2012**	**2011**	**2010**	**2009**	**2008**	**2012**	**2011**	**2010**	**2009**	**2008**	**2012**	**2011**	**2010**	**2009**	**2008**
Mako shark																				
Thresher sharks																				
Other sharks	1	1	1															0		
TOTAL SHARKS	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mahimahi	493	298	305	316	252	38	41	128	67	51	18	25	34	29	37	0	0		0	0
Moonfish																				
Oilfish																				
Pomfrets										1										
Wahoo	212	140	209	199	227	20	17	21	59	45	8	5	6	6	3	0	0	0		0
Other pelagics	1	1	4	2	2	2	3	5	10	3	1	7	7	1	3	0		0	0	
TOTAL OTHER	706	439	518	517	481	60	61	154	136	100	27	37	47	36	43	1	0	0	0	0
GEAR TOTAL	**1,827**	**1,342**	**1,310**	**1,180**	**1,346**	**223**	**267**	**334**	**327**	**249**	**207**	**174**	**241**	**172**	**270**	**9**	**15**	**2**	**3**	**17**

Table 1h. Estimated catch of swordfish, and number of U.S. vessels fishing for swordfish, south of 20° S in the WCPFC Statistical Area in 2000-2012, to fulfill the reporting requirements of WCPFC CMM 2009-03.

	U.S.-flagged vessels south of 20° S	
Year	Catch (t) by all vessels	Number of vessels fishing for swordfish
2000	0	0
2001	confidential	0
2002	confidential	0
2003	2	1
2004	0	0
2005	0	0
2006	29	2
2007	confidential	2
2008	confidential	0
2009	<1	0
2010	confidential	0
2011	confidential	0
2012	confidential	0

Note: The catch is only reported for years when 3 or more vessels fished, although the number of vessels fishing for swordfish may be less than the number that fished. The U.S. does not have any longline vessels operating under charter or lease as part of its domestic fishery south of 20° S nor does it have any other vessels fishing within its waters south of 20° S.

Table 2a. Estimated number of United States and Participating Territories vessels operating in the WCPFC Statistical Area, by gear type, from 2008-2012. Data for 2012 are preliminary.

	2012	**2011**	**2010**	**2009**	**2008**
Purse seine	39	37	37	39	36
Longline (N Pacific-based)[1]	127	128	124	127	129
Longline (American Samoa-based)	25	24	26	26	28
Total U.S. Longline[2]	153	152	146	151	155
Albacore troll (N Pacific) [3]	2	11	2	0	2
Albacore troll (S Pacific) [3]	9	13	6	4	4
Tropical troll	2,089	2,110	2,049	2,093	1,994
Handline	572	508	480	552	475
Tropical Troll and Handline (combined)[4]	2,192	2,214	2,143	2,184	2,076
Pole and line	1	2	2	6	3
TOTAL	**2,395**	**2,418**	**2,334**	**2,384**	**2,274**

[1]Includes only Hawaii-based vessels in 2008-2012.
[2]Some longline vessels fish in both Hawaii and American Samoa and are counted only once in the TOTAL.
[3]Before 2009 most of these vessels fished on both sides of the equator and are counted only once in the TOTAL.
[4]Some vessels fished both tropical troll and handline, and are counted only once in the TOTAL.

Table 2b. Estimated number of United States and Participating Territories purse seine, longline, pole-and-line, and albacore troll vessels operating in the WCPFC Statistical Area, by gross registered tonnage categories, 2008-2012. Data for 2012 are preliminary.

Gear and year	**0-50**		**51-200**	**201-500**	**501-1000**	**1001-1500**	**1500+**
2008 Purse seine					2	20	14
2009 Purse seine					2	19	18
2010 Purse seine					1	18	18
2011 Purse seine					1	17	19
2012 Purse seine					1	17	21
2008 Longline	13		142				
2009 Longline	12		139				
2010 Longline	11		135				
2011 Longline	13		139				
2012 Longline	15		138				
	0-50	**51-150**	**150+**				
2008 Pole and line	1	2					
2009 Pole and line	3	3					
2010 Pole and line		2					
2011 Pole and line		2					
2012 Pole and line		1					
2008 Albacore Troll [1]		2	2				
2009 Albacore Troll [1]		3	1				
2010 Albacore Troll [1]		4	2				
2011 Albacore Troll		7	6				
2012 Albacore Troll		5	4				

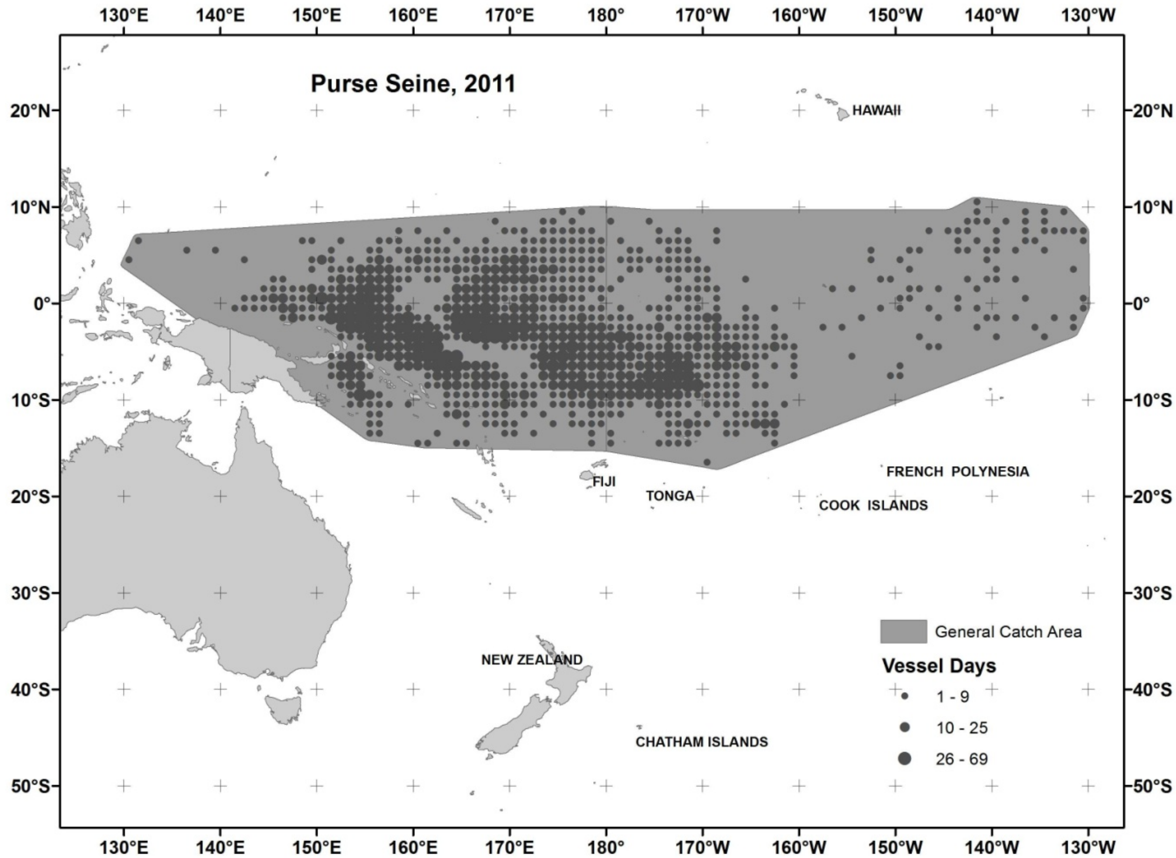

Figure 1. Spatial distribution of reported logbook fishing effort (vessel-days fished) by the U.S. purse seine fleet in the western and central Pacific Ocean in 2011 (updated). Area of circles is proportional to effort. Effort in some areas is not shown in order to preserve data confidentiality.

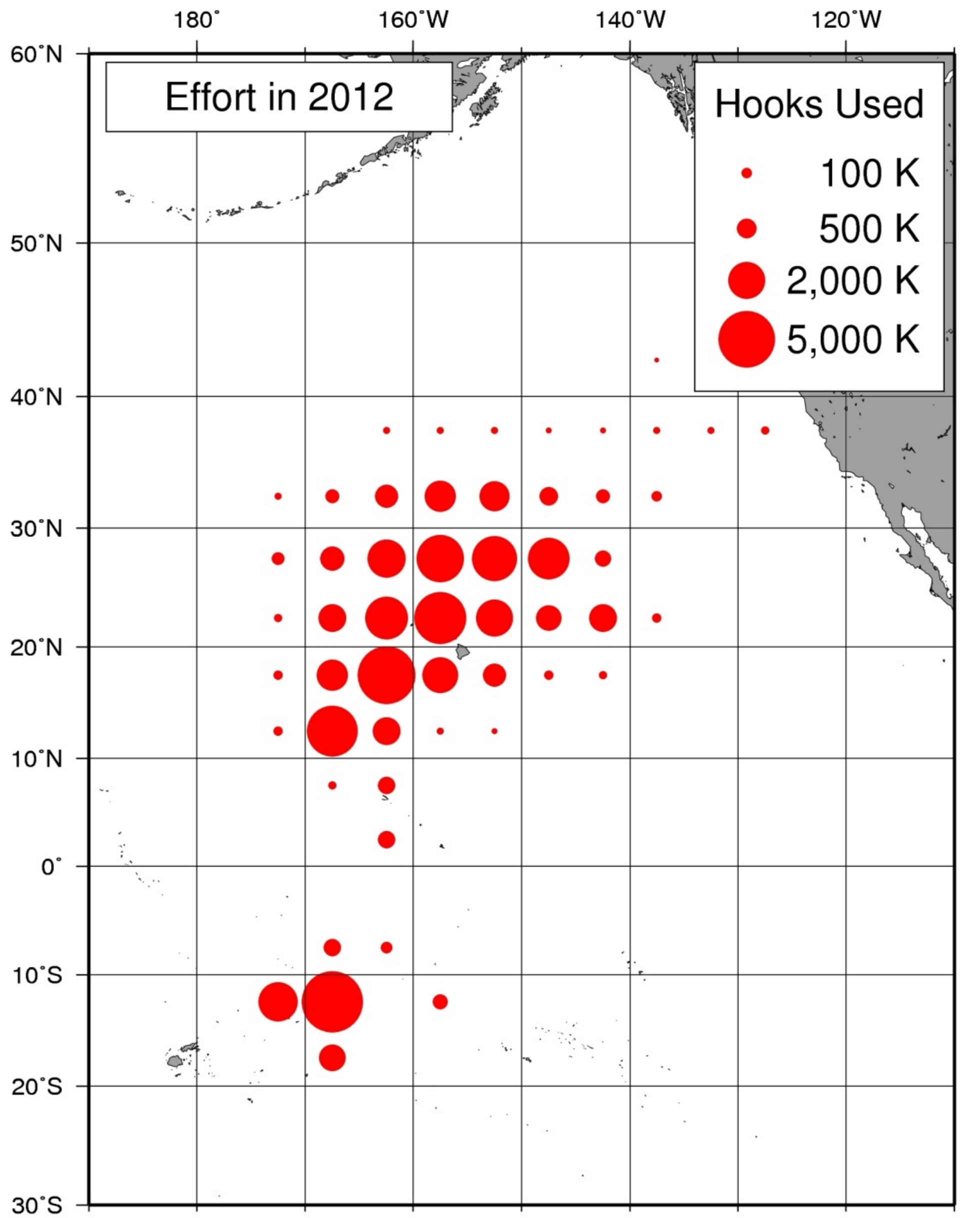

Figure 2a. Spatial distribution of fishing effort reported in logbooks by U.S.-flagged longline vessels, in 1,000's of hooks (K), in 2012 (preliminary data). Area of circles is proportional to effort. Effort in some areas is not shown in order to preserve data confidentiality.

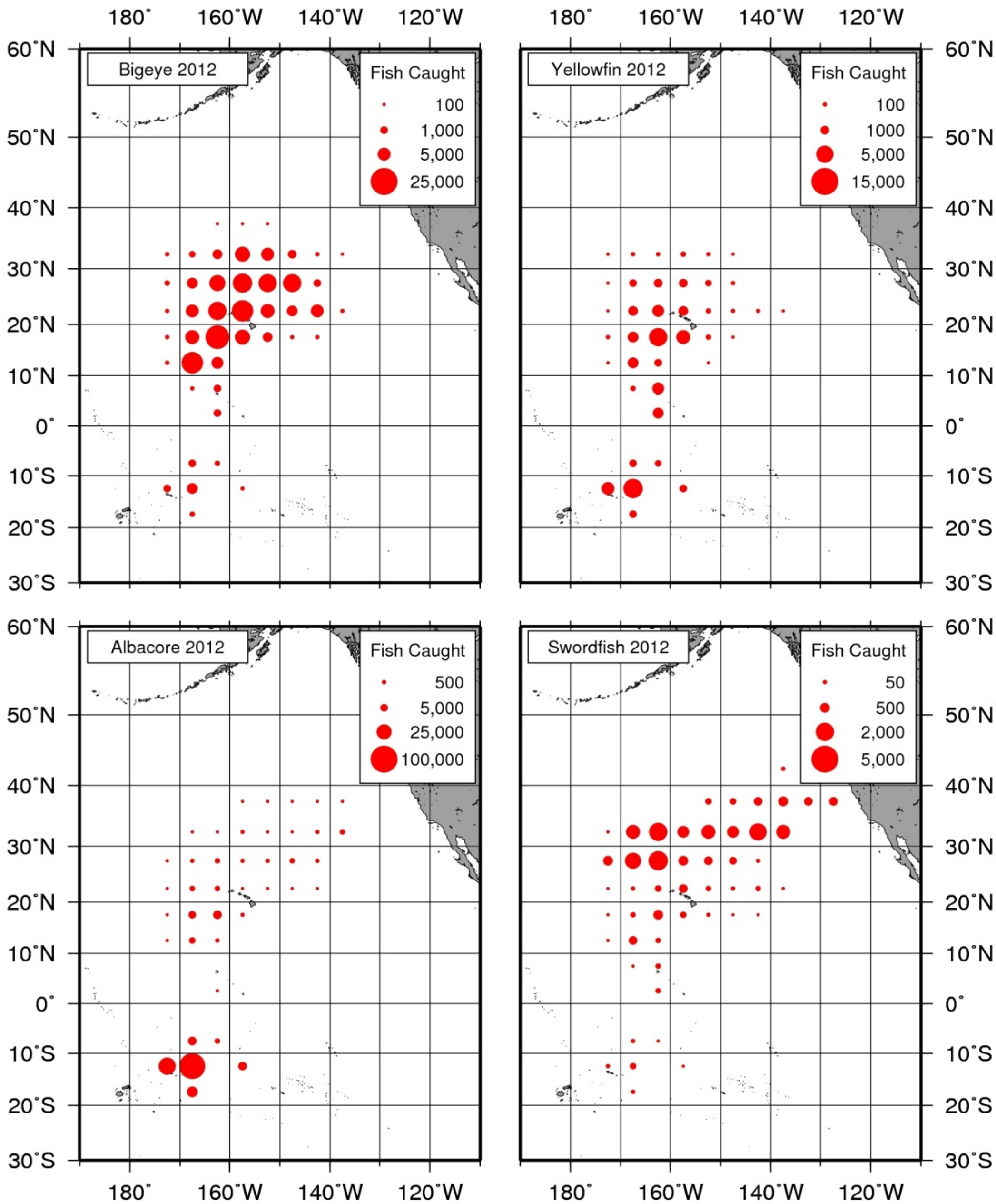

Figure 2b. Spatial distribution of catch reported in logbooks by U.S.-flagged longline vessels, in numbers of fish (includes retained and released catch), in 2012 (preliminary data). Area of circles is proportional to catch. Catches in some areas are not shown in order to preserve data confidentiality.

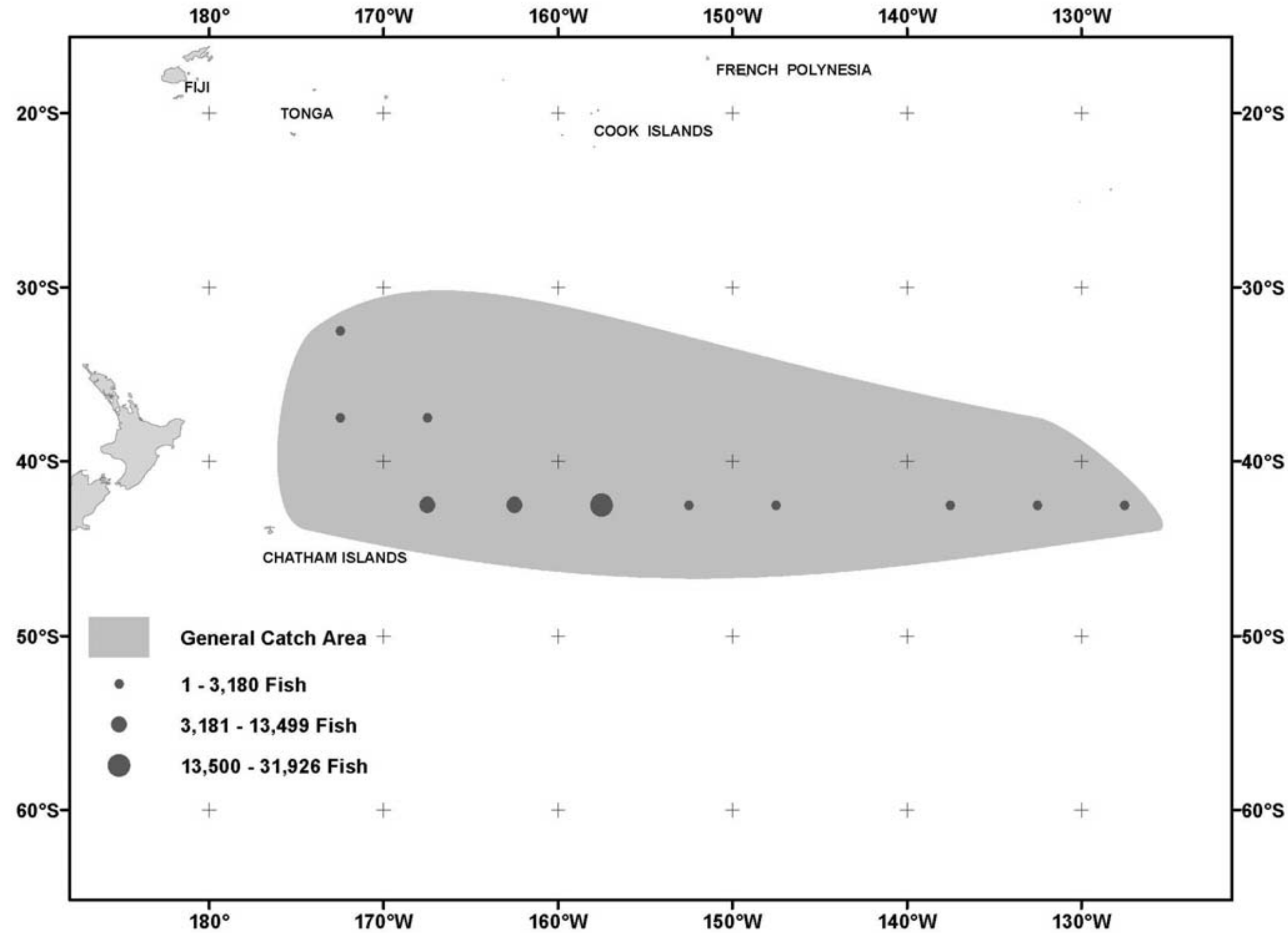

Figure 3. Spatial distribution of reported logbook fishing effort (vessel-days fished) by the U.S. albacore troll fleet in the South Pacific Ocean in 2010 (updated data). Area of circles is proportional to effort. Effort in some areas is not shown in order to preserve data confidentiality.

3. Background

[n/a]

4. Flag State Reporting of National Fisheries

4.1 U.S. Purse-seine Fishery

The most accurate description of the recent U.S. purse-seine catch of tunas in the Western and Central Pacific Ocean is based on the preliminary 2012 data totaling 259,760 t and the updated 2011 data totaling 203,746 t which are primarily composed of skipjack tuna, with smaller catches of yellowfin and bigeye tuna. The total catches of tunas have fluctuated over the past five years (Tables 1a-1c). The number of licensed vessels in 2012 was 39 vessels compared to 37 in 2011 (Table 2a). The fishery operated mainly in areas between 10° N and 15° S latitude and 140° E and 160°W longitude in 2011 (Figure 1).

4.2 U.S. Longline Fisheries

The longline fisheries of the U.S. and the Territory of American Samoa in the WCPO include vessels based in Hawaii, California, and American Samoa. The total number of longline vessels active in the WCPO during 2008-2012 ranged from 146 vessels in 2010 to 155 vessels in 2008 with 153 vessels in 2012 (Table 2). The U.S. North Pacific-based longline fishery consistently had the highest number of vessels in operation with 127 in 2012. Participation in the American Samoa-based fleet declined from 28 vessels in 2008 to 24 in 2011 with 25 vessels participating in 2012. A few vessels occasionally operated in both the Hawaii-based and American Samoa-based longline fisheries during 2009-2012. Longline catches made outside of the U.S. EEZ in the North Pacific Ocean by vessels operating with both American Samoa and Hawaii longline permits and landing their fish in Hawaii were attributed to the longline fishery of American Samoa and not to the U.S. longline fishery in the NPO in accordance with WCPFC CMM 2008-01, WCPFC CCM 2011-01 and federal fisheries regulations (74 FR 63999). These American Samoa longline landings in the NPO (labeled as American Samoa in the NPO in Table 1f) are shown separately from U.S. longline catches in the NPO. The total for American Samoa (Table 1f) includes only the South Pacific portion of the fishery, so the overall American Samoa fishery total would be the sum of catches in its North and South Pacific fisheries. In 2011, the Consolidated and Further Continuing Appropriations Act (CFCAA), 2012 (Pub. L. 112-55, 125 Stat. 552 et seq.) was passed, and if, after November 19, 2011, the U.S. vessel landing the fish was included in a valid arrangement under Sec. 113(a) of the CFCAA, its catch during that period was assigned to the fishery of American Samoa.

The U.S. Hawaii-based longline fishery operated mainly from the equator to 45^{o} N latitude and from 125^{o} W to 175^{o} W in 2012 (Figure 2a), representing some expansion to the east as compared with 2007 and 2008. The American Samoa-based longline fishery operated mostly from 5^{o} S to 20^{o} S latitude and 155^{o} W to 175^{o} W longitude in 2012

(Figure 2a). The Hawaii-based fishery targeted bigeye tuna and swordfish, with significant landings of associated pelagic species, whereas the American Samoa-based fishery targeted mainly albacore. The dominant components of the U.S. longline catch in 2012 were bigeye tuna, albacore, swordfish and yellowfin tuna (Table 1a, Figure 2b). The total catch of all species during the past 5 years ranged from a low of 12,758 t in 2010, to a high of 14,038 t in 2008, with a catch at 13,861 t in 2012 (Tables 1f).

Most of the Hawaii-based longline fishery involved deep-set longline effort directed towards tunas. High ex-vessel tuna prices along with relatively lower operating expenses in this sector of the U.S. longline fishery in the NPO motivated longline fishers to continue targeting bigeye tuna while remaining within the catch limits in the WCPO and EPO (under conservation measures of the Inter-American Tropical Tuna Commission) in 2012. Targeting of swordfish in the Hawaii-based longline fishery was prohibited from 2001 until early 2004. The swordfish fishery was reopened in April 2004 under a new set of regulations intended to reduce interactions with sea turtles. However, the California-based longline fishery was closed concomitantly with the reopening of the Hawaii fishery; this prompted many California-based longline vessels to relocate to Hawaii. In fact, most of these vessels had been home ported in Hawaii before the 2001 closure so their movement in 2004 was essentially a return to their prior base of operations. In 2006, the Hawaii-based shallow-set longline fishery reached its allowable annual limit of loggerhead interactions (17) in March and accordingly was closed for the remainder of the year. This shallow-set longline fishery has managed to stay under the allowable annual sea turtle limits and remained open throughout 2007-2010. However, the shallow-set fishery reached its allowable annual limit of leatherback interactions (16) in November 2011 and was closed through the end of the year. The shallow-set fishery was able to stay under the annual sea turtle limits in 2012. The effort restriction limiting this sector of the longline fishery to 2,120 shallow sets was removed in early 2010. Although a record 1,873 sets was recorded in 2010, this was still less than the maximum number of shallow sets allowed under the previous effort restriction. The number of shallow sets decreased to 1,353 shallow sets in 2012. Swordfish longline landings in the NPO decreased from 1,282 t in 2008 to 859 t in 2012.

4.3 U.S. Albacore Troll Fisheries

In recent years, the U.S. troll fisheries for albacore in the WCPO have experienced significant decline in participation. Nine vessels participated in the WCPO portion of this fishery in 2012 compared to 13 vessels in 2011 (Table 2). Seven vessels fished in the South Pacific in 2012. The South Pacific albacore troll fishery operated mostly between 30° S and 45° S latitude and 145° W and 175° W longitude (Figure 3). The catch in this fishery is composed almost exclusively of albacore. The South Pacific albacore troll catches in the WCPO increased from 150 t in 2008 to 402 t in 2011(Tables 1a-1e). The 2012 catch of albacore by the South Pacific troll fishery was 198 t. The North Pacific albacore catches in the WCPO were minor in 2012 compared to 69 t in 2011.

4.4 Other Fisheries of the U.S. and Participating Territories

Other fisheries of the U.S. and Participating Territories include the small-scale tropical troll, handline, and pole-and-line fleets, as well as miscellaneous recreational and subsistence fisheries. In American Samoa, Guam, and CNMI these fisheries are monitored by creel surveys, and the data are included in the tropical troll statistics, as this fishing method is the one most commonly used in the recreational and subsistence fisheries in these areas. Most of the vessels comprising the U.S. and Participating Territories tropical troll fishery, and all of the U.S. handline and pole-and-line vessels are located in Hawaii. The total catch by these fisheries was 3,333 t in 2012. The catch was composed primarily of yellowfin tuna, mahimahi, bigeye tuna, and skipjack tuna.

5. Coastal State Reporting

[n/a]

6. Socioeconomic Factors and Trends in the Fisheries

6.1 Socio-economic Surveys and Analyses

NMFS staff and colleagues have undertaken surveys and analyses to better understand the socioeconomic considerations of U.S. fisheries in the WCPO. The following summaries describe recent investigations in this area.

Hawaii Longline Fishery Economics – Since 2004, NOAA Fisheries observers have collected data on fishing costs and other economic information from over 3,000 longline trips in order to assess changes in important economic indicators of the Hawaii-based longline fisheries (Pan, 2010). From 2004 to 2012, economic data were collected from a total of 1,526 Hawaii longline trips. During the period 2004-2012, the average trip cost in the longline fishery for tuna-targeting trips increased by 120%, from $13,720 per trip in 2004 to $30,700 per trip in 2012. In 2004, fuel cost made up about 45% of the total trip cost (non-labor items). However, in 2012, fuel cost made up about 58% of the total trip cost. During the period 2005-2012, the average trip cost in the longline fishery for swordfish-targeting trips increased similarly, from $17,600 per trip in 2005 to $39,400 per trip in 2012. Fuel cost made up about 59% of the total trip cost of the swordfish targeting trips in 2012. The routine trip-based economics data collection program is continuing with the Hawaii longline fishery and has extended to the longline fishery in American Samoa.

Hawaii Small Boat Economics – Since 2007, NOAA Fisheries has conducted cost-earnings surveys to assess economic and social characteristics of small boat pelagic fisheries in Hawaii, CNMI, and Guam. The results of these studies provide an important baseline that allows fishery managers to better understand how new fishery regulations and changing macroeconomic conditions may affect the financial performance and behavior of fishers.

In 2011, 147 fishermen from the Guam boat-based fleet were surveyed. This study detailed fisher classifications, levels of fishing activity, financial performance of the fleet, market participation, and social/cultural motivations affecting fishing and selling of catch. Nearly 86% of vessels were reported to be less than 25 feet in length. Fishermen reported approximately 39 boat fishing trips in the past 12 months. On average, fishermen reported the use of three different gear types/target species during the past 12 months, with pelagic trolling as the most popular gear type followed by shallow-water bottomfish fishing and deepwater bottomfish fishing. On average, fishermen reported selling approximately 24% of their total catch. The majority considers the fish they sell to contribute very little to their personal income, as cost recovery is a major motivation for selling a portion of catch. During 2010 and 2011, the cost of a trolling trip averaged approximately $235, and as anticipated, fuel expenses accounted for a majority (72%) of total trip expenditures (Hospital and Beavers, 2012).

6.2 Relevant Publications

Chan H. L. and M. Pan. 2012. Spillover effects of environmental regulation for sea turtle protection: the case of the Hawaii shallow-set longline fishery. U.S. Dept. of Commerce, NOAA Technical Memorandum NOAA-TM-NMFS-PIFSC-30, 38 p. + Appendices.

Criddle, K., M. Pan, and K. Davidson. 2011. A Summary of the Pacific Islands Region Catch Share Workshop Honolulu, HI March 9-12, 2010. Pacific Islands Fisheries Science Center Administrative Report H-11-03, 28 p + Appendices.

Davidson, K., M. Pan, W. Hu, and D. Poerwanto. 2012. Consumers' willingness to pay for aquaculture fish products vs. wild-caught seafood - a case study in Hawaii. Aquaculture Economics and Management 16(2): 136-154.

Hospital J., C. Beavers. 2012. Economic and social characteristics of Guam's small boat fisheries. Pacific Islands Fisheries Science Center Administrative Report H-12-06, 59 p. + Appendices.

Park, S.K., K. Davidson, and M. Pan. 2012. Economic relationships between aquaculture and capture fisheries in the Republic of Korea. Aquaculture Economics and Management 16(2): 102-116.

7. Disposition of Catch

The purse-seine catch is stored on board as a frozen whole product. Most of the catch has historically been off-loaded to canneries in Pago Pago, American Samoa, however most vessels now transship their catches in the ports of other Pacific Island countries for canning and loining destinations in Southeast Asia and Latin America. Cannery products from American Samoa are typically destined for U.S. canned tuna markets. Catches of non-tuna species are consumed onboard the vessel or discarded at sea.

U.S. longline vessels in the NPO store their catch on ice and deliver their product to the market as a fresh product. Large tunas, marlins, and mahimahi are gilled and gutted before storage on the vessel, swordfish are headed and gutted, and the rest of the catch is kept whole. These products are primarily sold fresh locally in Hawaii to restaurants and retail markets, or exported to the U.S. mainland with a small proportion of high quality bigeye tuna exported to Japan. The American Samoa-based longline albacore catch is gilled and gutted and delivered as a frozen product to the cannery in Pago Pago, American Samoa. Other associated catch is either marketed fresh (for vessels making day trips) or frozen (for vessels making extended trips).

The catch in the albacore troll fishery in the South Pacific is frozen whole and sold in Pacific Island ports or transported to Vancouver, Canada for sale. The other fisheries store their catch in ice. Large tunas and marlins are gilled and gutted while other species are kept whole. The small-scale tropical troll fisheries chill their products with ice and sell it fresh, mainly to local markets.

8. Onshore Developments

[n/a]

9. Future Prospects of the Fisheries

Generally high fuel costs and increasing prices for supplies and goods will result in higher operating costs which will likely continue to constrain the economic performance of most U.S. pelagic fisheries.

In each of the calendar years 2009-2012, the U.S. longline fishery has been subject to a limit of 3,763 t of retained catches of bigeye tuna in the WCPO. The fishery managed to stay under the limit in the WCPO with retained catches of 3,741 t in 2009, 3,577 t in 2010, 3,566 t in 2011, and 3,654 t in 2012. Catch limits in the eastern Pacific Ocean (EPO) established pursuant to decisions of the Inter-American Tropical Tuna Commission (IATTC) affected the portion of the Hawaii-based longline fleet that operated in the EPO in 2006 when it was projected that the U.S. longline fishery would reach its annual bigeye tuna catch limit of 150 t. The fishery operated throughout 2007 without reaching that year’s limit of 500 t. There was no bigeye tuna limit in the EPO in 2008, but a limit of 500 t for vessels greater than 24 m in length was established for 2009 through 2012. This limit was not reached from 2009 through 2012. The future prospect of the U.S. longline fishery will continue to be a predominantly deep-set effort directed towards bigeye tuna.

The Hawaii-based longline fishery is likely to continue to target tunas primarily. Removal of an effort limit in the Hawaii-based shallow-set longline fishery for swordfish in 2009 was thought to have resulted in increased effort in the swordfish segment of the fishery in 2009-2010. Shallow set effort decreased thereafter, and may continue to do so if demand for tunas remains strong. The swordfish segment of the Hawaii-based longline fishery is highly seasonal and will continue to operate under strict regulations to limit interactions with sea turtles, seabirds, and false killer whales.

The closure of one of two canneries in Pago Pago, American Samoa in 2009 did not curtail the operation of the American Samoa-based longline fishery in 2010, though the catches were reduced in 2011 and 2012. This longline fishery is expected to continue targeting albacore and delivering its catch frozen to the remaining cannery. In Pago Pago Harbor, an economical and energy efficient 5,000-plus metric ton cold storage facility was completed in April, 2013 and is operational. It is the largest and most modern cold storage facility in the South Pacific. There are plans to complete a new processing and packing facility for high quality fresh and frozen tuna by the end of 2013, and a new cannery by the end of 2014.

The prospect for the U.S. small-scale fisheries is expected to be fairly stable although participation is sensitive to a slow economy and high fuel prices. Fuel prices continue to increase slowly although they were lower in 2012 compared to the peak prices in 2008. These fisheries are expected to continue to make single-day trips targeting tunas, billfish, and other pelagic fish, and deliver their catch fresh to local markets.

10. Status of Fisheries Data Collection Systems

10.1 Logsheet Data Collection and Verification

Various sources of data are used to monitor U.S. pelagic fisheries. The statistical data systems that collect and process fisheries data consist of logbooks and fish catch reports submitted by fishers, at-sea observers, and port samplers; market sales reports from fish dealers; and creel surveys. The coverage rates of the various data systems vary considerably.

The primary monitoring system for the major U.S. fisheries (purse seine, longline, and albacore troll) in the WCPO consists of the collection of federally mandated logbooks that provide catches (in numbers of fish or weight), fishing effort, fishing location, and some details on fishing gear and operations. U.S. purse-seine logbook and landings data are submitted as a requirement of the South Pacific Tuna Treaty (100% coverage) since 1988. The Hawaii-, American Samoa-, and California-based longline fisheries are monitored using the NOAA Fisheries Western Pacific Daily Longline Fishing Logs for effort and resulting catch. The coverage of logbook data is assumed to be complete (100%), except for the American Samoa fishery where under-reporting of a very small percentage of trips is estimated via a creel survey that monitors catch by small longline vessels. Beginning in 1995, all U.S. vessels fishing on the high seas have been required to submit logbooks to NOAA Fisheries.

In Hawaii, fish sales records from the Hawaii Division of Aquatic Resources (DAR) Commercial Marine Dealer Report database are an important supplementary source of information, covering virtually 100% of the Hawaii-based longline landings. The Western Pacific Fisheries Information Network (WPacFIN) has recently improved its procedures for integrating Hawaii fisheries catch data (numbers of fish caught, from logbooks) and information on fishing trips from fishermen's reports with fish weight and sales data from the dealers' sales reports. As a result, data on the weight and value of most catches on a trip level can be linked. This integration of data provides average fish weight data by gear type, time period, and species that are used to estimate total catch weights for the Hawaii fisheries in this report. Other enhancements to this integration are under development, such as linking the weight of longline-caught fish from the Hawaii Marine Dealer Report records with the Hawaii-based longline logbook data to approximate the weight of catch by geographic location. In addition, species misidentifications on a trip level have been corrected by cross-referencing the longline logbook data, the Hawaii Marine Dealer Report data, and data collected by NOAA Fisheries observers deployed on Hawaii-based longline vessels (see below). Information on these corrections is published (Walsh et al., 2007) but is not yet operationally applied to routine data reporting (i.e., the data reported here).

Small-scale fisheries in Hawaii, i.e., tropical troll, handline, and pole-and-line, are monitored using the Hawaii DAR Commercial Fishermen's Catch Report data and Commercial Marine Dealer Report data. The tropical troll fisheries in American Samoa, Guam, and CNMI are monitored with a combination of Territory and Commonwealth creel survey and market monitoring programs, as part of WPacFIN.

10.2 Observer Programs

U.S. purse seine vessels operating in the WCPO under the Treaty on Fisheries between the Governments of Certain Pacific Island States and the United States of America (The South Pacific Tuna Treaty) pay for, and are monitored by, observers deployed by the Pacific Islands Forum Fisheries Agency (FFA). Monitoring includes both the collection of scientific data as well as information on operator compliance with various Treaty-related and Pacific Island country (PIC)-mandated requirements. These data are not described here. NOAA Fisheries has a field station in Pago Pago, American Samoa, that facilitates the placement of FFA-deployed observers on U.S. purse seine vessels.

Starting on January 1, 2010, the observer coverage rate in the U.S. purse seine fishery in the Convention Area has been 100%. Through an agreement with the FFA, the 100% observer coverage rate was maintained throughout 2010, 2011 and 2012. The data collected under this arrangement by FFA-deployed observers are currently provided directly to the WCPFC. NOAA Fisheries has also continued to work with counterpart offices in the Federated States of Micronesia to assist with monitoring and sampling of U.S. purse seine vessels transshipping their catches through Pohnpei.

All U.S. longline vessels are subject to observer placement as a condition of the fishing permits issued by NOAA Fisheries. The main focus of the longline observer program is to collect scientific data on interactions with protected species. The observer program also collects relevant information on the fish catch and on the biology of target and non-target species. Fish catch data collection now includes measurement of a systematic subsample of 33% of all fish brought on deck, including bycatch species. Prior to 2006, observers attempted to measure 100% of tunas, billfishes and sharks brought on deck, but not other species. Researchers use observer-collected protected species data to estimate the total number of interactions with those species.

Overall, 267 out of 1,309 deep-set trips were observed, as well as all 72 shallow-set trips, resulting in a combined coverage rate of 24.5% for the Hawaii-based longline fishery in 2012 (Table 3). The results indicated a lower number of interactions with sea turtles and marine mammals and a higher number of interactions with seabirds in 2012 as compared with 2011.

For the American Samoa-based component of the U.S. longline fishery, 2012 was the sixth full calendar year monitored by observers. The coverage rate was 19.8% for a total of 24 trips and 662 sets. Scientists have not yet provided rigorous estimates of the total interactions with protected species for this fishery. Detailed information on the U.S. Pacific Islands Regional Observer Program can be found at http://www.fpir.noaa.gov/OBS/obs_index.html.

Table 3. Estimated total numbers of fishery interactions (not necessarily resulting in mortalities or serious injury) with non-fish species by shallow-set and deep-set (combined) longline fishing in the Hawaii-based fishery during 2008-2012[2]. Estimates of total marine mammal interactions by the deep-set fishery in 2012 have not yet been completed; only the observed values are included here. Statistically rigorous estimates have not yet been developed for the American Samoa-based fishery given the low level of observer coverage in that fleet.

Species	2008	2009	2010	2011	2012
Marine mammals					
Striped dolphin (*Stenella coeruleoalba*)	1	0	2	4	1
Bottlenose dolphin (*Tursiops truncatus*)	0	5	6	2	1
Risso's dolphin (*Grampus griseus*)	6	3	10	4	0
Blainville's beaked whale (*Mesoplodon blainvillei*)	0	0	0	1	0
Bryde's whale (*Balaenoptera edeni*)	0	0	0	0	0
False killer whale (*Pseudorca crassidens*)	12	56	19	11	4
Humpback whale (*Megaptera novangliae*)	1	0	0	1	0
Shortfinned pilot whale (*Globicephala macrorhynchus*)	5	0	0	0	0
Spotted dolphin (*Stenella attenuate*)	3	0	0	0	0
Unspecified false killer whale or shortfinned pilot whale	10	0	3	11	0
Unidentified Cetacean (Cetacea)	3	17	13	0	3
Unspecified member of beaked whales (Ziphiidae)	0	0	0	1	0
Unspecified pygmy sperm whales (Kogia)	1	0	0	0	0
TOTAL MARINE MAMMALS	42	81	53	35	9
Sea turtles					
Loggerhead turtle (*Caretta caretta*)	0	3	11	14	5
Leatherback turtle (*Dermochelys coriacea*)	13	12	13	31	13
Olive Ridley turtle (*Lepidochelys olivacea*)	19	17	10	36	23
Green turtle (*Chelonia mydas*)	1	1	1	9	0
Unidentified hardshell turtle (Cheloniidae)	0	0	0	0	0
TOTAL SEA TURTLES	33	33	35	90	41

[2] The estimates are made by raising the number of observed interactions by a factor determined according to the design of the observer sampling program. The species listed are those that have been observed. Sources: Pacific Islands Regional Office observer program reports (http://www.fpir.noaa.gov/OBS/obs_qrtrly_annual_rprts.html) and Pacific Islands Fisheries Science Center Internal Reports IR-08-007, IR-09-011, IR-10-009, IR-11-005, IR-12-012 and IR-13-014. Hawaii-based longline logbook reported data on fish discards are available at http://www.pifsc.noaa.gov./fmsd/reports.php

Table 3. (Continued.)

Species	2008	2009	2010	2011	2012
Albatrosses					
Blackfooted albatross (*Phoebastria nigripes*)	122	133	103	92	194
Laysan albatross (*Phoebastria diomedia*)	87	138	196	236	163
TOTAL ALBATROSSES	209	271	299	328	357
Other Seabirds					
Red-footed booby (*Sula sula*)	4	0	0	0	0
Brown booby (*Sula leucogaster*)	0	0	0	0	0
Unspecified bird	64	25	1	19	36
TOTAL OTHER SEABIRDS	68	25	1	19	36
Observer Information					
Total trips	1,409	1,325	1,285	1329	1380
Observed trips	380	355	362	336	338
Proportion of trips observed	27.00%	26.80%	28.17%	25.29%	24.49%
Observed sets	5,402	5,084	5,476	5,119	4,966
Observed hooks	10,126,078	9,644,989	9,980,848	9,871,487	10,187,571

10.3 Port Sampling

Less than 2% of the fish caught by U.S. purse seine, longline, and albacore troll fisheries in the WCPO are measured (fork length) by NOAA Fisheries personnel as vessels are unloading in American Samoa and by SPC port samplers in ports where transshipping takes place. Species composition samples are also taken for more accurately determining catches of yellowfin tuna and bigeye tuna from U.S. purse seine vessel landings. Fish caught by U.S. albacore troll vessels are also measured (fork length) by port samplers in American Samoa when vessels unload there.

10.4 Unloading / Transshipment

A small amount of transshipping of highly migratory fish stocks typically occurs in the U.S. longline fishery, typically between domestic vessels. In 2012, there were no reported transshipments for the Hawaii or American Samoa-based longline fisheries. There were no at-sea transshipments and no information is available on in-port transshipments of troll-caught albacore in 2012.

For the U.S. purse seine fishery in the WCPFC Statistical Area in 2012, there were 277 transshipments of fish offloaded from U.S. vessels, and no transshipments of fish received by U.S. vessels. All transshipments occurred in port; no transshipments occurred at sea. Of the 195,894 mt of purse seine-caught HMS transshipped in 2012, 168,435 mt were skipjack tuna, 26,601 mt were yellowfin tuna, and 858 mt were bigeye tuna. Approximately 75% of the total landings of yellowfin, skipjack, and bigeye were transshipped to foreign ports for processing in 2012. In 2011, there were an estimated 238 transshipments of purse seine-caught fish in port.

10.5 Scientific Survey Data

Cooperative Data Collection Program for North Pacific Albacore – NOAA Fisheries has been collaborating with the American Fishermen’s Research Foundation (AFRF) and the American Albacore Fishing Association (AAFA) on monitoring programs for North Pacific albacore. Since 1961, a port sampling program using State fishery personnel has been collecting biological and size data from albacore landings made by the U.S. and Canadian troll fleets along the U.S. Pacific coast. In recent years, with AFRF support, fishermen have collected biological data during selected fishing trips to help fill in gaps in coverage by the port sampling program. Sizes of albacore recorded by fishermen and port samplers were found to be generally similar. In 2001 NOAA Fisheries and American Fishermen's Research Foundation (AFRF) initiated a 5-year program to use archival tagging technology to determine detailed migration patterns of juvenile (3-5 year old) albacore in the North Pacific (Childers et al., 2011). As of June, 2013 more than 800 archival tags have been deployed on albacore off the west coast of North America and twenty-six tags have been recovered. Two tagged albacore were recently recaptured near Japan and returned with assistance from NRIFSF staff. Prior to these two, only one of the first 24 recaptured albacore had migrated into the western Pacific.

International Billfish Angler Survey – NOAA Fisheries has been collaborating with the billfish angling community since 1963 to study various aspects of billfish biology and to obtain an index of angler success in the Pacific Ocean. The International Billfish Angler Survey, initiated in 1969, provides a 41-year time series of recreational billfish angling catch and effort (number caught per angler fishing day), and is the only billfish survey independent of commercial fisheries in the Pacific Ocean. The main fishing areas include Hawaii, southern California, Baja California (Mexico), Guatemala, Costa Rica, Panama, Tahiti, and Australia.

Central and Western Pacific Fisheries Monitoring – WPacFIN collects and manages data from most of the U.S. central and western Pacific fisheries (Hawaii, American Samoa, Guam, Commonwealth of the Northern Mariana Islands). This includes longline, skipjack pole-and-line, tropical troll, and tropical handline fisheries. In 2012, WPacFIN completed and published the 26th edition of Fishery Statistics of the Western Pacific (Hamm et al., 2012). Annual reports for the Hawaii-based longline fishery and the American Samoa longiine fishery were also published (PIFSC FRMD, 2013; PIFSC FRMD, 2013).

10.6 Relevant Publications

Brodziak J., T. Gedamke, C. Porch, J. Walter, D. Courtney, J. O'Malley, and B. Richards. 2012. A workshop on methods to estimate total and natural mortality rates using mean length observations and life history parameters. U.S. Dept. of Commerce, NOAA Technical Memorandum NOAA-TM-NMFS-PIFSC-32, 26 p. + Appendix.

Childers, J., and A. Pease. 2012. Summary of the 2009 and 2010 U.S.A. north and South Pacific albacore troll and pole-and-line fisheries. Southwest Fisheries Science Center Admin. Rep., La Jolla, LJ-12-02, 26 p.

Fisheries Research and Monitoring Division, Pacific Islands Fisheries Science Center. 2013. PIFSC Report on the American Samoa Longline Fishery, Year 2012. Pacific Islands Fisheries Science Center, PIFSC Data Report, DR-13-013, 12 p.

Fisheries Research and Monitoring Division, Pacific Islands Fisheries Science Center. 2013. The Hawaii-based Longline Logbook Summary Report, January-December 2012. Pacific Islands Fisheries Science Center, PIFSC Data Report, DR-13-004, 14 p.

Hamm D.C., M.M.C. Quach, K.R. Brousseau, and A.S. Tomita. 2012. Fishery statistics of the western Pacific, Volume 27. Pacific Islands Fisheries Science Center Administrative Report H-12-05, var. pag.

Jackson, A. R. 2012. A description of the tuna-porpoise observer data collected by the U.S. National Marine Fisheries Service from 1971 to 1990. U.S. Dep. Commer., NOAA Tech. Memo. NMFS-SWFSC-493, 406 p.

Jackson, A. R. 2012. The tuna-porpoise observer photograph collection and database. Southwest Fisheries Science Center Admin. Rep., La Jolla, LJ-12-05, 10 p.

Lee H-H, Maunder MN, Piner KR, and RD Methot. 2012. Can steepness of the stock-recruitment relationship be estimated in fishery stock assessment models? Fisheries Research 125-126: 254-261.

Link JS, Ihde TF, Harvey CJ, Gaichas SK, Field JC, Brodziak JKT, Townsend HM, Peterman RM. 2012. Dealing with uncertainty in ecosystem models: the paradox of use for living marine resource management. Progress in Oceanography 102: 102-114.

MacCall, A. D., and S.L.H. Teo. 2013. A hybrid stock synthesis - Virtual population analysis model of Pacific bluefin tuna. Fish. Res. 142:22–26.

Piner, K.R., H.H. Lee, A. Kimoto, I.G. Taylor, M. Kanaiwa, and C.L. Sun. 2013. Population dynamics and status of striped marlin (*Kajikia audax*) in the western and central northern Pacific Ocean. Marine and Freshwater Research 64(2) 108-118.

Simon M., J.M. Fromentin, S. Bonhommeau, D. Gaertner, J. Brodziak, and M.P. Etienne. 2012. Effects of stochasticity in early life history on steepness and population growth rate estimates: an illustration on Atlantic bluefin tuna. PLoS ONE 7(10): e48583.

11. Research Activities

11.1 Biological and Oceanographic Research - TUNAS

Microchemistry Analysis of Albacore Otoliths

Since 2011, otolith chemistry has been used to investigate whether there are two substocks of albacore that utilize the waters of the California Current Large Marine Ecosystem. Based on differences in growth rates and movement patterns, it is hypothesized that albacore caught in southern California and Mexico waters comprise a separate substock from those caught on the commercial fishing grounds of Oregon and Washington with relatively little mixing during their subadult years. Preliminary analyses show that significant differences exist in otolith chemistry from fish aged 2-4 collected between the two regions. Overall cross-validated classification success was 100%, with age-specific comparisons exceeding 90% success. Otolith $\delta^{18}O$ was significantly enriched in the southern region relative to the northern region, similar to reported seawater $\delta^{18}O$ differences. In addition, significantly higher concentrations of sodium and magnesium, combined with lower phosphorus concentrations in otoliths from fish collected in the southern region, are consistent with regional physicochemical conditions (i.e., salinity, temperature, phosphate). These preliminary findings support previous studies that have shown limited regional mixing of albacore in the EPO.

Projected Climate Impacts on the Pelagic Ecosystem Size Structure and Catches in the North Pacific over the 21st Century – NOAA Fisheries scientists paired output from an earth system model with a size-based food web model to investigate the effects of climate change on the abundance of large fish over the 21st century. The earth system model combines a coupled climate model with a biogeochemical model including major nutrients, three phytoplankton functional groups, and zooplankton grazing. The size-based food web model includes linkages between two overlapping size-structured pelagic communities: primary producers and consumers. This study focused on seven sites in the north Pacific, each highlighted a specific aspect of forecasted climate change, and included ecosystem exploitation through fishing. Climate-induced phytoplankton changes had a larger effect on the abundance of large fish than did physical warming changes. Projected changes in large phytoplankton density are estimated to result in declines of large fish abundance ranging from 0 - 78% in the central North Pacific and increases of up to 43% in the California Current region. Overall, the model projects changes in the abundance of large fish being of the same order of magnitude as changes in the abundance of large phytoplankton (Woodworth et al. 2012).

Impacts of fishing, climate, and primary productivity changes on the Hawaii longline fishery – NOAA Fisheries updated and modified an existing Ecopath with Ecosim (EwE) model for the Central North Pacific to focus on the area used by the Hawaii-based pelagic longline fishery. The EwE model was combined with output from a coupled NOAA Geophysical Fluid Dynamics Laboratory climate and biogeochemical model to investigate the likely ecosystem impacts of fishing and climate-induced primary productivity changes. Four simulations were conducted based on 2 fishing effort and climate scenarios from 2010 to 2100. Modeled small and large phytoplankton biomass decreased by 10 % and 20 % respectively, resulting in a 10 % decline in the total biomass of all higher trophic level groups combined. Climate impacts also affected the Hawaii longline fishery, with a 25–29 % reduction in modeled target species yield. Climate impacts on the ecosystem and the fishery were partially mitigated by a drop in fishing effort. Scenarios with a 50 % reduction in fishing effort partially restored longline target species yield to current levels, and decreased longline nontarget species yield. These model results suggest that a further reduction in fishery landings mortality over time than the 2010 level may be necessary to mitigate climate impacts and help sustain yields of commercially preferred fish species targeted by the Hawaii longline fishery through the 21st century (Howell et al., 2012).

11.2 Biological Research – BILLFISHES

Billfish Life History Studies – NOAA Fisheries is collaborating with Charles Sturt University, Australia on a Pelagic Fisheries Research Program (University of Hawaii Joint Institute for Marine and Atmospheric Research) grant to conduct an age and growth study of striped marlin harvested in the Hawaii-based longline fishery. Dorsal fin rays and otoliths for age determination are being collected by observers deployed on Hawaii-based longline vessels. Gonad sub-samples are concurrently collected for determination of gender and sex-specific length at 50% reproductive maturity. Observers also continue to collect small (<110 cm eye-fork length) whole juvenile specimens since billfish of this size are rarely available.

Swordfish Deep-Set Buoy Gear Research – NMFS and Pfleger Institute of Environmental Research (PIER) are examining how a deep-set vertical line configuration to target swordfish within the California exclusive economic zone affects bycatch and catch rates. Gear trials were conducted during the 2011 and 2012 swordfish seasons off the coast of southern California using both research and cooperative fisher vessels. A total of 54 sets were completed resulting in the capture of 15 swordfish. No interactions with species of concern were recorded across all 4,320 hook-hours. Additional non-target catch included: bigeye thresher sharks, *Alopias superciliosus*, opah, blue sharks, and common thresher shark, *Alopias vulpinus*. These data suggest that deep-set buoy gear can selectively be used to target swordfish in deep waters during the day off southern California. Additional trials that investigate alternative configurations (i.e., gear modification, bait presentation) and reduce the probability of lost gear are currently underway.

Modeling Swordfish Vertical Habitat from Pop-up Archival Tags – A study of the daytime foraging depth of swordfish (*Xiphias gladius*) was conducted using data from an eight-year tagging program in which 28 Wildlife Computer pop-up archival tags were deployed on swordfish in the North Pacific. The tags transmitted data from 1°S to 44°N latitude and from 111° to 154°W longitude. Five tags were recovered, providing a full archival record that showed that when swordfish did not engage in daytime basking behavior, they remained within a narrow range of light level during both day and night. This suggests that swordfish stay within a sound-scattering layer (SSL) to feed during both day and night. Daytime mean depth of non-basking swordfish ranged from 32 to 760 m. Seventy-seven percent of variation in daytime mean depth occupied could be explained with a generalized additive model that used three environmental indices: satellite-derived surface chlorophyll as a proxy for light at depth, oxygen at 400 m obtained from the World Ocean Atlas, and temperature at 400 m inferred from the tag data. This model, when used in a predictive mode, generated a basin-wide map of swordfish daytime mean depth that showed depths exceeding 600 m to the north of Hawaii, shoaling to 300 m off the coast of California. This information could improve daytime swordfish catch by longliners and potentially allow them to switch from shallow night sets that result in interactions with sea turtles. This approach in effect defines the habitat of swordfish prey, giving us insight into the vertical behavior of those mid-trophic level organisms inhabiting the SSL. This model could be easily applied to other deep-foraging species (Abecassis et al., 2012).

11.3 Biological Research – PELAGIC SHARKS

Electronic Tagging of Sharks -- Since 1999, NMFS scientists have used data logging tags and satellite technology to characterize the essential habitats of large pelagic fish and subsequently to better understand how populations might shift in response to changes in environmental conditions on short or long time scales; the target fish are primarily blue, shortfin mako, and common thresher sharks, while other species are tagged opportunistically. In recent years, NMFS has collaborated with Mexican colleagues at CICESE, Canadian colleagues at the DFO Pacific Biological Station in Nanaimo, British Columbia, and the TOPP program (www.topp.org).

In 2012, a number of large pelagic fish were tagged: five shortfin mako sharks, five blue sharks, and one common thresher were tagged with either PTT tags or towed GPS tags. Three mako sharks, two blue sharks, and six opah were released with pop-off archival tags. In addition, five mako sharks were released with acoustic tracking tags to monitor their movements within the vicinity of coastal acoustic receivers. The average size of blue sharks (n=5) tagged with a PTT in 2012 was 229 cm fork length. Two of the five blue sharks were tracked for close to 200 days. Combined data from many years suggest that both sexes spend considerable time in the California Current, with the females possibly extending farther north and south. When offshore, generally, the females move south into the subtropical convergence zone, whereas the males make more westerly migrations. Both habitat separation by sex, and site fidelity have implications for the management of blue shark populations. Three PTT tags deployed in July 2012 on mako sharks were still transmitting in early 2013.

Oxytetracycline Age Validation Studies on Sharks – Age and growth of shortfin mako, common thresher, and blue sharks are being estimated from band formation in vertebrae. In addition to being important for studying basic biology, accurate age and growth curves are needed in stock assessments. NMFS scientists are validating aging methods for these three species based on band deposition periodicity determined using oxytetracycline (OTC). Annual research surveys provide an opportunity to tag animals with OTC. When the shark is recaptured and the vertebrae recovered, the number of bands laid down since the known date of OTC injection can be used to determine band deposition periodicity. Since the beginning of the program in 1997, 3,183 OTC-marked individuals have been released during juvenile shark surveys. Sharks tagged include 1,221 shortfin mako, 1,187 common thresher, 757 blue, 15 silky (*Carcharhinus falciformis*), and 3 pelagic thresher (*Alopias pelagicus*) sharks.

The results of OTC age validation of 29 juvenile shortfin mako sharks tagged with oxytetracycline in the Southern California Bight were recently published (Wells et al., 2013) and showed vertebral band pair deposition rates of two per year. The results of this study differ from two other studies on shortfin makos that used a direct age validation technique: one study validated a single band pair deposition rate in an estimated 18 year old shortfin mako shark tagged with OTC and recaptured in the Atlantic after one year at liberty; and the second used a bomb radiocarbon signal as a marker in 37 sharks collected in the Northwest Atlantic between 1950 and 1984 ranging in estimated ages of 1 to 31 years. Age and growth in shortfin mako sharks continues to be uncertain because growth curves estimated from length frequency analysis and tag-recapture methods tend to show faster growth rates than obtained from vertebral counts based on deposition of a single band pair per year. Furthermore, this validation study applies to juvenile sharks in the northeast Pacific. This study raises questions about potential regional differences in band pair deposition rates or the possibility of an ontogenetic shift from a period of more rapid growth with 2 band pair deposition per year to slower growth and a switch to a band pair deposition rate of one per year. In winter 2013/2014, the ISC plans to convene its second Shark Age and Growth Workshop during which participants hope to resolve some of the uncertainties regarding shortfin mako age and growth.

11.4 Research on Bycatch and Fishing Technology – SEA TURTLES

Gear Modification to Reduce Turtle Bycatch – Since 2006 NOAA Fisheries has provided funds and technical expertise to support research experiments to identify means to reduce sea turtle bycatch in both longline and gillnet fisheries. During the last year, trials were underway in Brazil, Peru, Mexico and on board a Taiwanese vessel in the North Atlantic Ocean to test the effects of gear modifications (e.g., use of large circle hooks, hook rings, net illumination) on the rates of hooking and entanglement of sea turtles in longline and gillnet fisheries. These trials are also aimed at determining catch rates of target species in order to understand the potential viability of this modification in a commercial fishery.

Research from the past few years indicates that relatively large circle hooks can effectively reduce the bycatch of both loggerhead (*Caretta caretta*) and leatherback sea turtles (*Dermochelys coriacea*) in longline fishing gear (Domingo et al., 2012; Piovano et al., 2012; Serafy et al., 2012). These hooks also show acceptable catch rates of tuna species, but slightly reduced catch rates of targeted swordfish. In the North Atlantic Ocean, relatively large circle hooks were not found to reduce rates of sea turtle captures, but increased catch rates of bigeye tuna (*Thunnus obesus*). (Huang et al., 2013).

Based on recent findings from studies to reduce capture rates of sea turtles in UV-illuminated gill net fishing gear (Wang et al., 2013), work has expanded to Northern Peru where preliminary results also suggest the potential utility of illuminating nets with light sources as a means to both maintain target species catch rates and reduce catch of sea turtles.

Post-release Survival of Turtles in Longline Fisheries -- Another NOAA Fisheries objective is to improve estimates of sea turtles' post-release fate, specifically shallow longline gear (Swimmer and Gilman, 2012). Currently, methods to estimate post-release survival of turtles involve pop-up satellite archival tags (PSATs) and platform terminal transmitters (PTTs). Research has been conducted using both methods in the North Pacific and South Atlantic Oceans, as well as the Mediterranean Sea. Preliminary results of tracking studies indicate no differences in duration of transmissions as a function of the turtle's 'severity' of injury, specifically deep or shallow hookings, and that most sea turtles were tracked for the duration of the tag's battery life. Hall et al. (2012) describe additional work to clarify the role of safe handling and the valuable investment of education and outreach with regards to ensuring turtles' maximal chance of survival after their release from fishing gear.

These works have also lead to new findings regarding the movement patterns of loggerhead sea turtles in the South Atlantic Ocean (Barcelo et al., 2013). Recent work has also identified the energetic costs of sea turtles outfitted with various types of tags in relation to the turtles' body size (Jones et al., 2012). And new information on drag effects has been incorporated by the NOAA Fisheries permits office in regard to guidelines for tagging turtles.

11.5 Research on Bycatch and Fishing Technology – PELAGIC SHARKS

***Longline Hook Effects on Catch* --** NOAA Fisheries conducted a study which tested the effects of using large (16/0) circle hooks on catch rates in three pelagic longline fisheries in the South Pacific Ocean. Large (16/0) circle hooks were tested against a variety of smaller hooks already in use by longline vessels in American Samoa, Cook Islands, and New Caledonia. A total of 4,912 fishes of 33 species were observed on 145,982 hooks from 67 sets. In the Cook Islands fishery, there was no significant difference in catch by hook type for two main target species, but there was an increase in catchability for swordfish. In the New Caledonia fishery, there was no significant difference in catch by hook size for any species. In the American Samoa fishery, 16/0 circle hooks did not significantly affect the catch of albacore, but did significantly reduce the catch of skipjack tuna, dolphinfish, and wahoo. For all locations, catch rates on 16/0 circle hooks were nominally lower, but not always significant for smaller pelagic species. (Curran and Beverly, 2012).

***Electromagnetic Deterrents to Shark Bycatch in Longline Fisheries* –** One potential strategy for reducing shark bycatch in the longline fisheries is to exploit the unique electrosensory system of sharks, which can detect the strong electric fields in water produced by lanthanide series metals, neodymium (Nd) and praseodymium (Pr). NOAA Fisheries tested the effects of an Nd/Pr alloy on shark catch rates. Using longline fishing gear, the catch rates of baited hooks affixed with either a block of the metal alloy (experimental) or a lead weight (control) were compared. Four experiments were conducted in different regions of the Pacific Ocean. Two bottom longline experiments were conducted inside and offshore of Kaneohe Bay, Hawaii. One of these experiments targeted young of the year scalloped hammerhead sharks (*Sphyrna lewini*), while the other targeted sandbar (*Carcharhinus plumbeus*) and tiger sharks (*Galeocerdo cuvier*). In the Southern California Bight (SCB), pelagic longlines were deployed to target mako (*Isurus oxyrinchus*) and blue sharks (*Prionace glauca*) and in the Eastern Tropical Pacific (ETP) off Ecuador, longlines also targeted pelagic sharks. There was a significant reduction in juvenile hammerhead sharks caught on hooks with the lanthanide metal compared to the controls. In contrast, there was no difference in the catch rates for experiments targeting sandbar sharks in Hawaii or those conducted in the SCB and Ecuador. These results suggest that there are inter-specific differences regarding the effects of lanthanide metals on catch rates. This may reflect the diverse feeding strategies and sensory modalities used by shark species for detecting and attacking prey (Hutchinson et al., 2012).

11.6 Research on Bycatch and Fishing Technology – CETACEAN

***Longline Hook Effects on False Killer Whale Bycatch* –** The Hawaii-based deep-set longline fleet targets bigeye tuna (*Thunnus obesus*) and infrequently takes false killer whales (FKW, *Pseudorca crassidens*) as bycatch. From 2004 to 2008 with 20%–26% observer coverage, NOAA Fisheries documented nine mortalities of and serious injuries to FKW in the deep-set fishery in the Hawaii EEZ, yielding a mean take estimate of 7.3 FKW yr^{-1}. Weak hook technology can utilize the size disparity between target and other species to promote the release of larger non-target species. Four longline vessels tested the catch efficacy and size selectivity of 15/0 “strong” circle hooks (4.5 mm wire diameter) that straighten at 138 kg of pull in comparison with 15/0 “weak” (4.0 mm) that straighten at 93 kg of pull. Vessels alternated hook types throughout the longline gear and maintained a 1:1 ratio of strong and weak hooks. Observers monitored a total of 127 sets of 302,738 hooks. Randomization tests were applied to test for significant differences in catch between the strong and weak hook types for 22 species. There were no significant catch differences for bigeye tuna; however, there may be limitations to these inferences because trials were not conducted during spring when larger bigeye tuna are available to the fishery. There were no significant differences between hook types in the mean length of 15 fish species. Observers collected 76 straightened hooks, of which six were control and 70 were weak hooks. There was one observation of a FKW released from a stronger circle hook. Overall, there was no statistical reduction in catch rates of bycatch species (Bigelow et al., 2012).

11.7 Relevant Publications

Abecassis, M., H. Dewar, J. Polovina and D. Hawn. 2012. Modeling swordfish daytime vertical habitat in the North Pacific Ocean from pop-up archival tags. Mar. Ecol. Prog. Ser. 452:219-236.

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Barceló, C., Domingo, A., Miller, P. Ortega, L., Giffoni, B., Sales, G., McNaughton, L., Marcovaldi, M., Heppell, S., and Y. Swimmer. 2013. General movement patterns of tracked loggerhead sea turtles (*Caretta caretta*) in the southwestern Atlantic Ocean. Marine Ecology Progress Series.

Benhardouze, W., M. Aksissou, and M. Tiwari. 2012. Incidental captures of sea turtles in the driftnet and longline fisheries in northwestern Morocco. Fish. Res. 127–128:125–132.

Bigelow K.A., D.W. Kerstetter, M.G. Dancho, and J.A. Marchetti. 2012. Catch rates with variable strength circle hooks in the Hawaii-based tuna longline fishery. Bulletin of Marine Science 88(3): 425-447.

Caballero S., D. Cardeñosa, G. Soler, and J. Hyde. 2012. Application of multiplex PCR approaches for shark molecular identification: feasibility and applications for fisheries management and conservation in the Eastern Tropical Pacific. Mol. Ecol. Res. 12:233–237.

Carretta, J. V., and L. Enriquez. 2012. Marine mammal and seabird bycatch in California gillnet fisheries in 2010. Southwest Fisheries Science Center Admin. Rep., La Jolla, LJ-12-01, 16 p.

Curran D., and S. Beverly. 2012. Effects of circle hooks on pelagic catches in three south Pacific albacore longline fisheries. Bulletin of Marine Science 88(3):485-497.

Domeier, M. L., N. Nasby-Lucas, and D. M. Palacios. 2012. The northeastern Pacific white shark Shared Offshore Foraging Area (SOFA): A first examination and description from ship observations and remote sensing. In M. L. Domeier (ed.), Global perspectives on the biology and life history of the white shark, p. 147–158. CRC Press.

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