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2015 Annual Report to the Western and Central Pacific Fisheries Commission

United States of America

PART I. INFORMATION ON FISHERIES, RESEARCH, AND STATISTICS [1] (For 2014)

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 2015	**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.), escolar (*Lepidocybium flavobrunneum*), 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 retained catch by U.S. and U.S. associated-Participating Territory fisheries in the Western and Central Pacific Fisheries Commission (WCPFC) Statistical Area in 2014 are dominated by the catch of the purse-seine fishery. Preliminary 2014 purse seine catch estimates total 257,316 t of skipjack, 21,913 t of yellowfin, and 4,050 t of bigeye tuna. The estimate of total U.S. purse-seine catch in 2013 has been revised to 258,044 t from last year's preliminary

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[1] PIFSC Data Report DR-15-016
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estimate. Longline retained catch increased slightly in 2014. Longline catch in the North Pacific Ocean in 2014 increased to its highest level recorded during the 2010-2014 period; longline retained catch by American Samoa in the South Pacific Ocean decreased to its lowest level recorded during the 2010-2014 period. Bigeye tuna catch by U.S. and American Samoa longliners increased to 5,143 t in 2014. Albacore catch decreased to a five-year low of 1,634 t in 2014. Excluding catch attributed to the U.S. Participating Territories (i.e., American Samoa, Commonwealth of the Northern Mariana Islands), longline catch of bigeye tuna by U.S. longline vessels increased to 3,815 t in 2014. These bigeye tuna catch estimates by the U.S. longline fishery were above the limit of 3,763 t established in U.S. fishery regulations (50 CFR Part 300) pursuant to the provisions of WCPFC Conservation and Management Measure (CMM) 2008-01 for bigeye and yellowfin tuna during 2009 through 2011, CMM 2011-01 in 2012, CMM 2012-01 in 2013 and CMM 2013-01 in 2014. U.S. longline catch of swordfish in the North Pacific Ocean (NPO) increased to 880 t in 2014. 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 catch. The longline fleet was the next largest fleet, numbering 162 vessels in 2014, while there were 40 purse-seine vessels in 2014.

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 2014, socio-economic studies addressed retail seafood prices in Hawaii and the 2010 bigeye tuna longline closure in Hawaii. 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 the Inter-American Tropical Tuna Commission (IATTC). The 2014 stock assessment work on albacore, blue marlin and striped marlin is not described in this report but is detailed in other publications (Chang et al., 2015; Kvamsdal and Stohs, 2014; Lee et al., 2014a; Lee et al., 2014b; Martin et al., 2014; Maunder and Piner, 2014; Phillips et al., 2014; Soykan et al., 2014; Walsh and Brodziak, 2014; Wang et al., 2014).

NOAA Fisheries biological and oceanographic research on tunas, billfishes, and sharks addressed fish movements, habitat preferences, post-release survival, feeding habits, sexual maturity, and age and growth. Research on North Pacific albacore distribution focused on the effects of subtropical fronts and coastal upwelling fronts. Foraging ecology of tunas and swordfish was investigated in southern California waters. 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, pelagic sharks, and cetaceans.

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 2010-2014 for fisheries of the United States and its Participating Territories operating in the western and central Pacific Ocean (WCPO). All statistics for 2014 are provisional. Statistics for 2013 have been updated from those reported provisionally in the 2014 U.S. Annual Report (NMFS NOAA 2014a). Statistics for 2010–2012 have not been updated. 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 95% 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 4%, 0.7%, 0.2%, and 0.1% of the total catch, respectively.

Fisheries of the U.S. and its Participating Territories for tunas, billfishes and other HMS produced an estimated catch of 297,957 t in 2014 (Table 1a), up from 272,865 t in 2013 (Table 1b). The catch consisted primarily of skipjack tuna (87%), yellowfin tuna (8%), bigeye tuna (3%), and albacore (1%). Catches of skipjack tuna increased in 2014 due to higher purse-seine catches while bigeye and yellowfin tuna decreased from the previous year due to lower purse seine catches.

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. In the future, the weight estimates of longline catch may include at-sea discards.

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

Table 1a. Estimated weight (in metric tons) of catch 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 2014 (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	Total
Albacore (ALB), North Pacific		186	0	3	49	238
Albacore (ALB), South Pacific		1,448	263			1,711
Bigeye tuna (BET)	4,050	5,143		128	205	9,526
Pacific bluefin tuna (PBF)		3				3
Skipjack tuna (SKJ)	257,316	288		370	7	257,981
Yellowfin tuna (YFT)	21,913	1,023		577	381	23,894
Other tuna (TUN KAW FRI)		0		14	2	16
TOTAL TUNAS	283,279	8,090	263	1,092	644	293,368
Black marlin (BLM)		1		3		4
Blue marlin (BUM)		486		160	4	650
Sailfish (SFA)		17		1		18
Spearfish (SSP)		175		8		183
Striped marlin (MLS), North Pacific		357		12		369
Striped marlin (MLS), South Pacific		7				7
Other marlins (BIL)		1				1
Swordfish (SWO), North Pacific		880		1	7	888
Swordfish (SWO), South Pacific		10				10
TOTAL BILLFISHES		1,932		185	11	2,128
Blue shark (BSH)		1				1
Mako shark (MAK)		37				37
Thresher sharks (THR)		6		1		7
Other sharks (SKH OCS FAL SPN TIG CCL)		0		1		1
TOTAL SHARKS		43		2		45
Mahimahi (DOL)		263		532	26	821
Moonfish (LAP)		408				408
Oilfish (GEP)		182				182
Pomfrets (BRZ)		391		0	18	409
Wahoo (WAH)		319		258	10	587
Other fish (PEL PLS MOP TRX GBA ALX GES RRU DOT)		6		1		8
TOTAL OTHER		1,570		792	54	2,415
TOTAL	**283,279**	**11,636**	**263**	**2,071**	**709**	**297,957**

Table 1b. Estimated weight (in metric tons) of catch 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 2013 (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	Total
Albacore (ALB), North Pacific		298		2	46	346
Albacore (ALB), South Pacific	1	2,128	390			2,519
Bigeye tuna (BET)	8,157	4,534		148	393	13,232
Pacific bluefin tuna (PBF)		3				3
Skipjack tuna (SKJ)	226,609	288		539	14	227,450
Yellowfin tuna (YFT)	23,277	1,083		531	442	25,333
Other tuna (TUN KAW FRI)		0		5	1	6
TOTAL TUNAS	258,044	8,335	390	1,224	896	268,889
Black marlin (BLM)		1		3		4
Blue marlin (BUM)		378		137	3	518
Sailfish (SFA)		12		2		14
Spearfish (SSP)		177		11		188
Striped marlin (MLS), North Pacific		328		8		336
Striped marlin (MLS), South Pacific		4				4
Other marlins (BIL)		1				1
Swordfish (SWO), North Pacific		583		1	6	590
Swordfish (SWO), South Pacific		11				11
TOTAL BILLFISHES		1,493		161	9	1,664
Blue shark (BSH)		2				2
Mako shark (MAK)		39				39
Thresher sharks (THR)		5			1	6
Other sharks (SKH OCS FAL SPN TIG CCL)		0		1		1
TOTAL SHARKS		46		1	1	48
Mahimahi (DOL)		293		406	22	721
Moonfish (LAP)		450				450
Oilfish (GEP)		216				216
Pomfrets (BRZ)		359		0	20	379
Wahoo (WAH)		274		206	8	487
Other fish (PEL PLS MOP TRX GBA ALX GES RRU DOT)		10		1		11
TOTAL OTHER		1,602		613	50	2,265
TOTAL	**258,044**	**11,476**	**390**	**1,999**	**956**	**272,865**

Table 1c. Estimated weight (in metric tons) of catch 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. 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 MOPTRX GBA ALX GES RRU DOT)		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 1d. Estimated weight (in metric tons) of catch 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. 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	1	2,291	402	0	0		2,694
Bigeye tuna (BET)	7763	4,829		110	296		12,998
Pacific bluefin tuna (PBF)	0	2		0	0		2
Skipjack tuna (SKJ)	171242	300		394	9		171,945
Yellowfin tuna (YFT)	24009	1,437		501	357		26,304
Other tuna (TUN KAW FRI)	69	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 1e. Estimated weight (in metric tons) of catch 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 1f. Longline retained catch in metric tons (t) by species and species group, for U.S. and American Samoa vessels operating in the WCPFC Statistical Area in 2009-2013. 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					CNMI in North Pacific Ocean		American Samoa in North Pacific Ocean					American Samoa in South Pacific Ocean					Total				
	2014	**2013**	**2012**	**2011**	**2010**	**2014**	**2013**	**2014**	**2013**	**2012**	**2011**	**2010**	**2014**	**2013**	**2012**	**2011**	**2010**	**2014**	**2013**	**2012**	**2011**	**2010**
Vessels	140	135	127	128	123	109	113	18	17	115	114	11	22	22	25	24	26	162	157	153	152	146
Species																						
Albacore, North Pacific	177	265	480	497	324		23	9	11	115	113	48						186	298	595	610	371
Albacore, South Pacific													1,448	2,128	3,147	2,291	3,943	1,448	2,128	3,147	2,291	3,943
Bigeye tuna	3,815	3,654	3,660	3,565	3,577	1,000	492	245	305	1,338	1,086	507	82	84	164	178	178	5,143	4,534	5,162	4,829	4,261
Pacific bluefin tuna	0	0	0	0	0								3	2	7	2	3	3	3	7	2	3
Skipjack tuna	167	188	115	158	114		25	9	9	123	34	18	112	66	251	108	110	288	288	490	300	242
Yellowfin tuna	565	568	576	738	462		93	31	32	272	144	53	426	390	348	555	445	1,023	1,083	1,196	1,437	960
Other tuna	0	0	0	0	0		0					0						0	0	0	0	0
TOTAL TUNA	4,725	4,674	4,831	4,958	4,477	1,000	633	294	357	1,849	1,376	625	2,071	2,671	3,916	3,135	4,679	8,090	8,335	10,596	9,469	9,781
Black marlin	1	1	1	1	0			0	0	0	0	0		0	2	1	0	1	1	3	2	1
Blue marlin	427	305	226	290	238		20	32	22	50	45	23	27	31	36	40	45	486	378	313	375	306
Sailfish	15	7	5	10	9		3	0	1	3	2	1	2	2	1	4	2	17	12	9	15	11
Spearfish	162	133	111	169	79		34	12	9	35	35	9	1	1	1	5	2	175	177	147	209	89
Striped marlin, North Pacific	342	262	209	263	124		42	14	23	54	68	13						357	328	263	331	137
Striped marlin, South Pacific													7	4	7	3	2	7	4	7	3	2
Other marlins	0	1	1	1	1		0			0			0					1	1	1	1	1
Swordfish, North Pacific	865	558	862	837	1,013		8	15	17	38	22	20						880	583	900	859	1,033
Swordfish, South Pacific													10	11	14	12	11	10	11	14	12	11
TOTAL BILLFISH	1,812	1,266	1,414	1,570	1,464		107	73	72	180	171	66	47	48	62	64	62	1,932	1,493	1,656	1,805	1,592

Table 1f. (Continued.)

	U.S. in North Pacific Ocean					CNMI in North Pacific Ocean		American Samoa in North Pacific Ocean					American Samoa in South Pacific Ocean					Total				
	2014	**2013**	**2012**	**2011**	**2010**	**2014**	**2013**	**2014**	**2013**	**2012**	**2011**	**2010**	**2014**	**2013**	**2012**	**2011**	**2010**	**2014**	**2013**	**2012**	**2011**	**2010**
Blue shark	**0**	**1**	**12**	**9**	**6**					**2**	**2**	**0**	**1**	**1**	**3**	**2**	**1**	**1**	**2**	**18**	**14**	**7**
Mako shark	**35**	**31**	**42**	**43**	**63**		**3**	**1**	**4**	**8**	**8**	**5**	**0**		**0**	**0**	**0**	**37**	**39**	**50**	**51**	**68**
Thresher	**5**	**5**	**9**	**15**	**16**		**0**	**1**	**0**	**3**	**3**	**0**			**0**	**0**		**6**	**5**	**13**	**18**	**16**
Other sharks	**0**	**0**	**0**	**2**	**3**					**0**	**0**	**0**				**1**	**1**	**0**	**0**	**1**	**3**	**3**
Oceanic whitetip shark		**0**	**1**										**0**	**0**	**0**			**0**	**0**	**1**		
Silky shark	**0**	**0**											**0**	**0**	**0**			**0**	**0**	**0**		
Hammerhead shark																						
Tiger shark																						
Porbeagle																						
TOTAL SHARKS	**41**	**37**	**65**	**69**	**87**		**3**	**2**	**5**	**14**	**14**	**6**	**1**	**1**	**4**	**4**	**2**	**44**	**46**	**83**	**87**	**95**
Mahimahi	**236**	**238**	**288**	**291**	**230**		**9**	**15**	**27**	**52**	**52**	**23**	**12**	**19**	**11**	**11**	**9**	**263**	**293**	**351**	**353**	**262**
Moonfish	**385**	**377**	**356**	**309**	**356**		**37**	**22**	**35**	**86**	**84**	**42**	**1**	**2**	**3**	**3**	**2**	**408**	**450**	**445**	**396**	**400**
Oilfish	**169**	**171**	**169**	**178**	**164**		**28**	**13**	**17**	**59**	**55**	**20**	**0**	**1**	**0**	**1**	**0**	**182**	**216**	**228**	**233**	**185**
Pomfret	**372**	**315**	**215**	**115**	**169**		**26**	**19**	**18**	**56**	**33**	**19**						**391**	**359**	**270**	**148**	**188**
Wahoo	**242**	**154**	**117**	**124**	**101**		**17**	**19**	**15**	**39**	**23**	**11**	**58**	**87**	**85**	**123**	**133**	**319**	**274**	**241**	**270**	**246**
Other fish	**6**	**9**	**8**	**20**	**10**		**0**	**0**	**0**	**1**	**0**	**0**	**0**	**0**	**0**	**1**	**1**	**6**	**10**	**9**	**21**	**11**
TOTAL OTHER	**1,410**	**1,263**	**1,154**	**1,036**	**1,031**		**117**	**88**	**113**	**292**	**248**	**115**	**72**	**109**	**99**	**137**	**145**	**1,570**	**1,602**	**1,545**	**1,421**	**1,291**
GEAR TOTAL	**7,988**	**7,241**	**7,464**	**7,632**	**7,058**	**1,000**	**860**	**457**	**546**	**2,335**	**1,809**	**812**	**2,191**	**2,829**	**4,081**	**3,341**	**4,888**	**11,636**	**11,476**	**13,880**	**12,782**	**12,758**

Table 1g. Estimated catch of tropical troll fishery 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 2009-2013. Totals may not match sums of values due to rounding to the nearest metric ton (<0.5 t = 0).

	Hawaii					Guam					CNMI					American Samoa					Total Tropical Troll				
	2014	2013	2012	2011	2010	2014	2013	2012	2011	2010	2014	2013	2012	2011	2010	2014	2013	2012	2011	2010	2014	2013	2012	2011	2010
Vessels	1,647	1,661	1,698	1,598	1,570	394	496	351	454	432	19	28	35	48	40	22	13	9	10	7	2,082	2,198	2,093	2,110	2,049
Species																									
Albacore, North Pacific	3	2	3	4	2																3	2	3	4	2
Albacore, South Pacific																									
Bigeye tuna	128	148	155	110	118																128	148	155	110	118
Pacific bluefin tuna																									
Skipjack tuna	78	149	109	126	96	177	227	142	159	154	109	159	130	101	166	6	3	4	9	1	370	539	385	394	417
Yellowfin tuna	550	488	597	440	401	15	24	13	37	11	8	16	33	19	14	3	3	4	6	1	577	531	648	501	427
Other tunas	12	4	4	2	11	0	0	2	0	1	2	1	13	14	14						14	5	18	16	25
TOTAL TUNAS	771	791	868	682	628	192	251	157	196	166	120	176	176	133	193	9	6	8	15	2	1,092	1,224	1,209	1,026	989
Black marlin	3	3	3																		3	3	3		
Blue marlin	144	128	131	188	134	13	7	6	9	14	3	1	4	2		1					160	137	141	199	148
Sailfish	1	1	1			0	1		1	1	0	0		1	1	0					1	2	1	2	2
Spearfish	8	11	12	11																	8	11	12	11	
Striped marlin, N. Pacific	12	8	11	16	19																12	8	11	16	19
Striped marlin, S. Pacific																									
Other billfish				5	10																			5	10
Swordfish, North Pacific	1	1	1																		1	1	1		
Swordfish, South Pacific																									
TOTAL BILLFISHES	169	152	159	220	163	13	8	6	9	15	3	1	4	4	1	1					185	161	169	233	179

Table 1g. (Continued.)

	Hawaii					Guam					CNMI					American Samoa					Total Tropical Troll				
	2014	**2013**	**2012**	**2011**	**2010**	**2014**	**2013**	**2012**	**2011**	**2010**	**2014**	**2013**	**2012**	**2011**	**2010**	**2014**	**2013**	**2012**	**2011**	**2010**	**2014**	**2013**	**2012**	**2011**	**2010**
Blue shark																									
Mako shark																									
Thresher sharks	**1**																				**1**				
Other sharks	**1**	**1**	**1**	**1**	**1**		**0**														**1**	**1**	**1**	**1**	**1**
TOTAL SHARKS	**2**	**1**	**1**	**1**	**1**		**0**														**2**	**1**	**1**	**1**	**1**
Mahimahi	**405**	**290**	**452**	**298**	**305**	**87**	**75**	**38**	**41**	**128**	**39**	**41**	**18**	**25**	**34**	**1**	**0**	**0**	**0**		**532**	**406**	**508**	**364**	**466**
Moonfish																									
Oilfish																									
Pomfrets											**0**	**0**									**0**	**0**			
Wahoo	**210**	**180**	**194**	**140**	**209**	**42**	**23**	**20**	**17**	**21**	**5**	**2**	**8**	**5**	**6**	**0**	**0**	**0**			**258**	**206**	**222**	**162**	**236**
Other pelagics	**1**	**1**	**1**	**1**	**4**	**0**		**2**	**3**	**5**			**1**	**7**	**7**						**1**	**1**	**4**	**12**	**17**
TOTAL OTHER	**616**	**471**	**647**	**439**	**518**	**130**	**98**	**60**	**61**	**154**	**44**	**43**	**27**	**37**	**47**	**1**	**1**	**0**	**0**		**792**	**613**	**734**	**538**	**719**
GEAR TOTAL	**1,558**	**1,415**	**1,675**	**1,342**	**1,310**	**335**	**358**	**223**	**267**	**334**	**167**	**220**	**207**	**174**	**241**	**11**	**7**	**9**	**15**	**2**	**2,071**	**1,999**	**2,114**	**1,797**	**1,887**

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 2010-2014, 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
2009	<1	0
2010	confidential	0
2011	confidential	0
2012	confidential	0
2013	confidential	0
2014	0	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 2010-2014. Data for 2014 are preliminary.

	2014	**2013**	**2012**	**2011**	**2010**
Purse seine	40	40	39	37	37
Longline (N Pac-based) [1]	140	135	127	128	123
Longline (American Samoa-based)	22	22	25	24	26
Total U.S. Longline [2]	162	157	153	152	146
Albacore troll (N Pac) [3]	3		2	11	2
Albacore troll (S Pac) [3]	8	6	9	6	6
Tropical troll	2,082	2,198	2,093	2,110	2,049
Handline	494	534	576	508	480
Tropical Troll and Handline (combined)4	2,158	2,303	2,197	2,214	2,143
TOTAL	**2,368**	**2,506**	**2,398**	**2,409**	**2,332**

[1]Includes only Hawaii-based vessels in 2010-2014.
[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, from 2010-2014. Data for 2014 are preliminary.

Gear and year	**0-50**		**51-200**	**201-500**	**501-1000**	**1001-1500**	**1500+**
2010 Purse seine					1	18	18
2011 Purse seine					1	17	19
2012 Purse seine					1	17	21
2013 Purse seine						19	21
2014 Purse seine						19	21
2010 Longline	11		135				
2011 Longline	13		139				
2012 Longline	15		138				
2013 Longline	15		142				
2014 Longline	13		149				
	0-50	**51-150**	**150+**				
2010 Pole and line		2					
2011 Pole and line		2					
2012 Pole and line		1					
2013 Pole and line	1	1					
2014 Pole and line	1	1					
2010 Albacore troll		4	2				
2011 Albacore troll		7	6				
2012 Albacore troll		6	5				
2013 Albacore troll		3	2				
2014 Albacore troll		6	5				

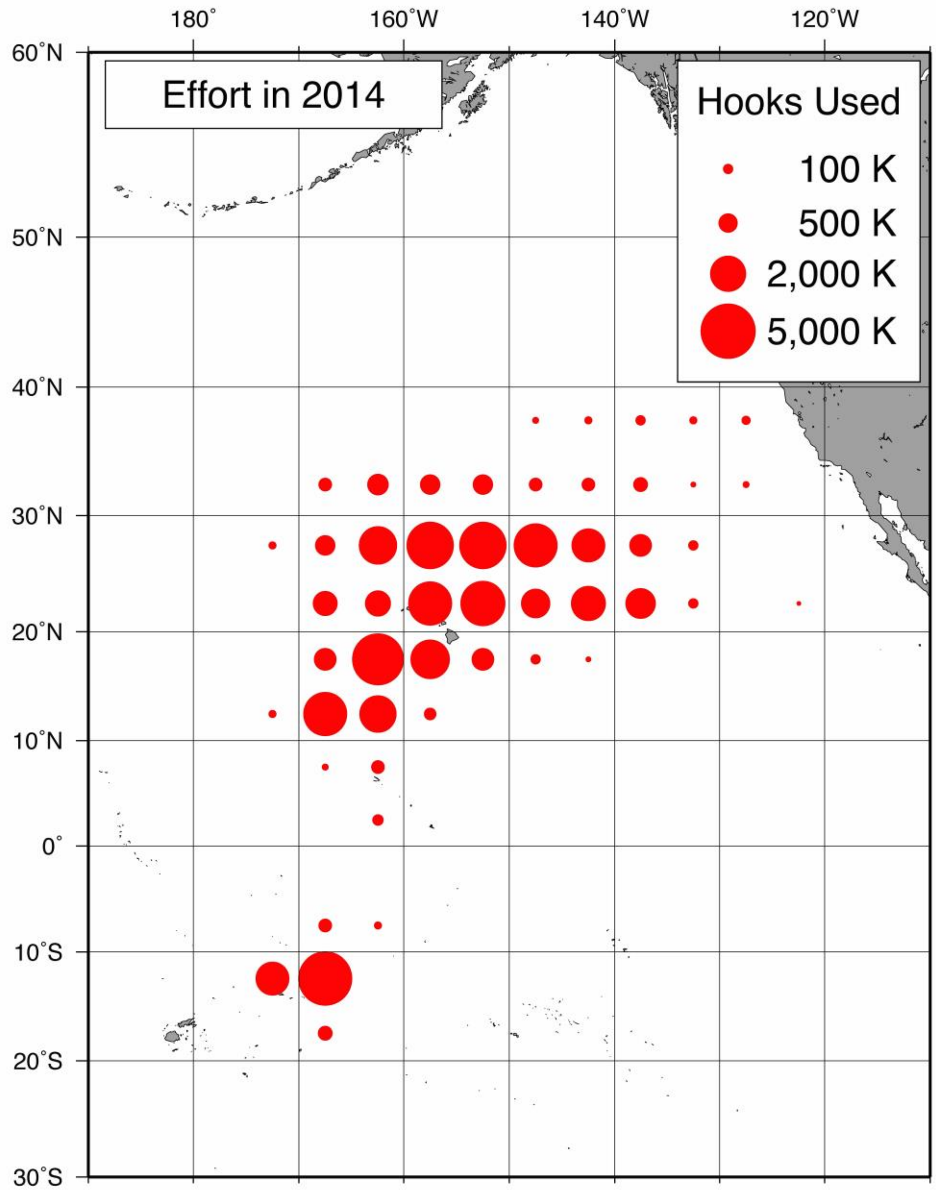

Figure 1a. Spatial distribution of fishing effort reported in logbooks by U.S.-flagged longline vessels, in 1,000's of hooks (K), in 2014 (preliminary data). Area of circles is proportional to effort. Effort in some areas is not shown in order to preserve data confidentiality.

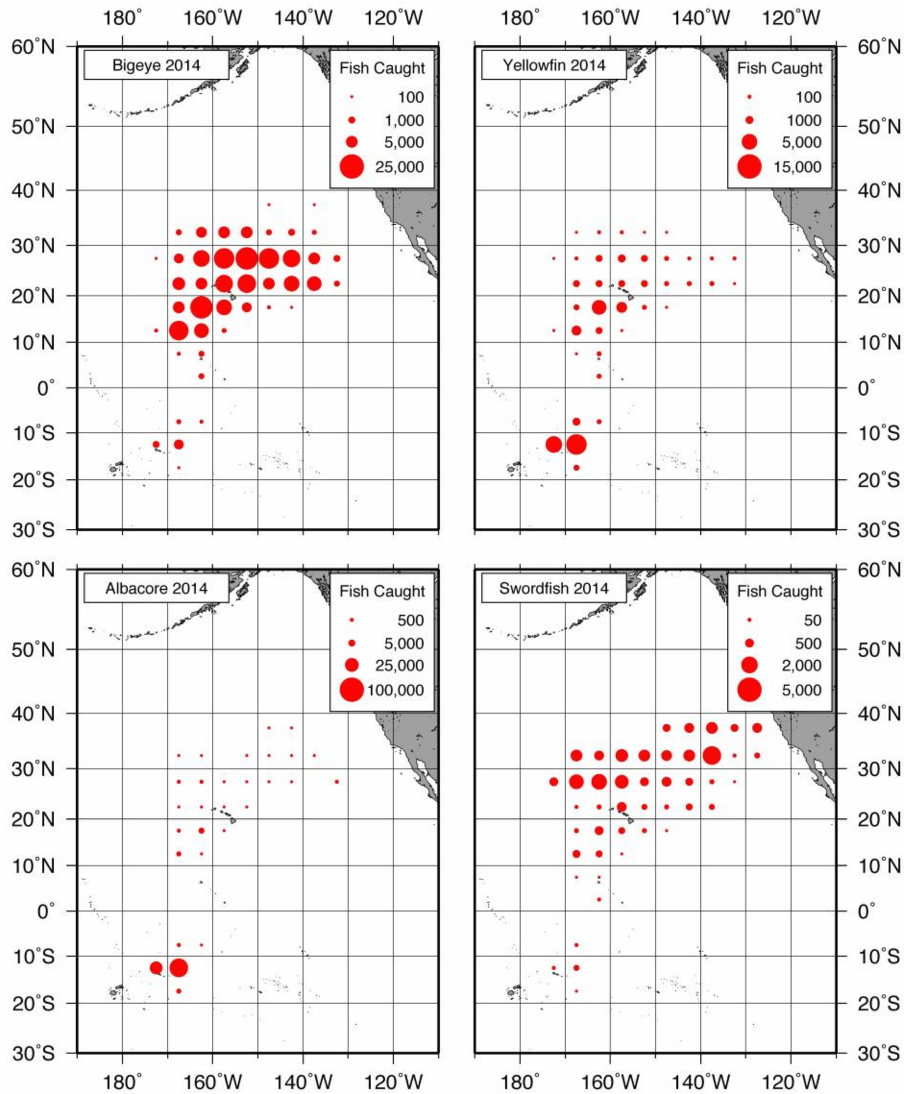

Figure 1b. Spatial distribution of catch reported in logbooks by U.S.-flagged longline vessels, in numbers of fish (includes retained and released catch), in 2014 (preliminary data). Area of circles is proportional to catch. Catches in some areas are not shown in order to preserve data confidentiality.

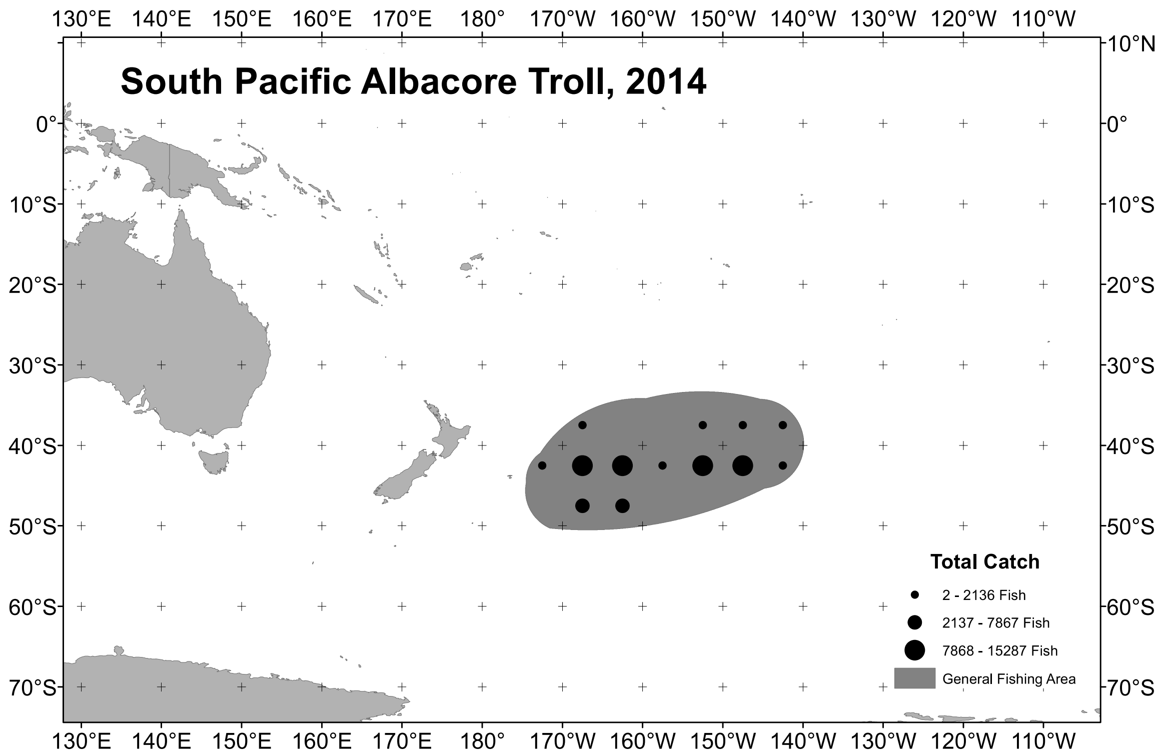

Figure 2a. Spatial distribution of reported logbook fishing effort (vessel-days fished) by the U.S. albacore troll fleet in the South Pacific Ocean in 2014 (preliminary data). Effort in some areas is not shown in order to preserve data confidentiality.

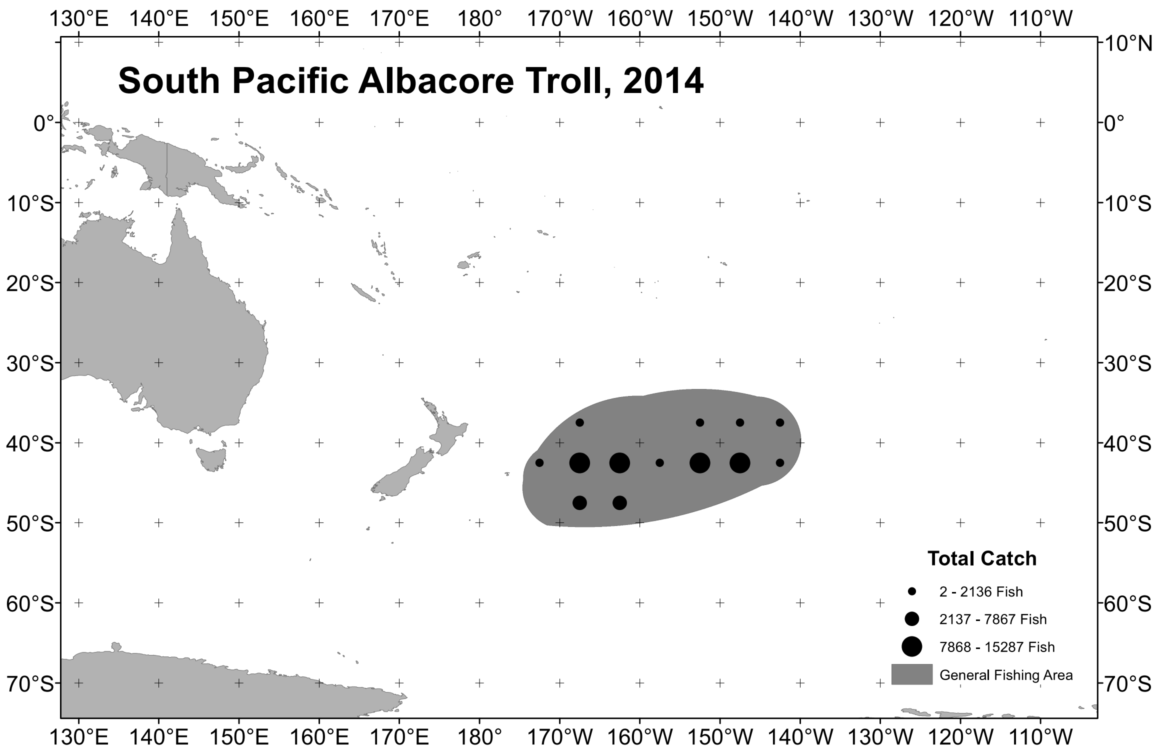

Figure 2b. Spatial distribution of reported logbook fishing catch (number of fish caught) by the U.S. albacore troll fleet in the South Pacific Ocean in 2014 (preliminary data). Catch in some areas is not shown in order to preserve data confidentiality.

3. Background

[n/a]

4. Flag State Reporting of National Fisheries

4.1 U.S. Purse-seine Fishery

The U.S. purse-seine catch of tunas in the Western and Central Pacific Ocean was 283,279 t in 2014 compared to 258,044 t in 2013, and was 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-1e). The number of licensed vessels in 2014 was 40 vessels, the same as in 2013 (Table 2a). The fishery operated mainly in areas between 10° N and 15° S latitude and 140° E and 160°W longitude.

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 2009-2013 ranged from 146 vessels in 2010 to 162 vessels in 2014 (Table 2). The U.S. longline fishery in the NPO consistently had the highest number of vessels in operation with 140 in 2014. Participation in the American Samoa-based fleet operating in the South Pacific declined from 26 vessels in 2010 to 22 vessels in 2013 and 2014. A few vessels occasionally operated in both the Hawaii-based and American Samoa-based longline fisheries during 2010-2014. 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 federal fisheries regulations (50 CFR 300.224). 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 table entry for American Samoa (Table 1f) includes its catches in the South Pacific landed in American Samoa. The overall American Samoa fishery total is the sum of its catches in the South Pacific and the U.S. longline catch in the NPO attributed to American Samoa. In 2011, the Consolidated and Further Continuing Appropriations Act (CFCAA), (Pub. L. 112-55, 125 Stat. 552 et seq.) was passed. Pursuant to this act and NMFS regulations under 50 CFR 300.224, if the U.S. vessel landing the fish was included in a valid arrangement under Sec. 113(a) of the CFCAA, its catch during those periods was attributed to the fishery of American Samoa in the NPO in 2011 and 2012, and CNMI in 2013 and 2014.

The U.S. longline fishery in the NPO operated mainly from the equator to 40^{o} N latitude and from 120^{o} W to 175^{o} W in 2014 (Figure 1a). The American Samoa-based longline fishery operated mostly from 5^{o} S to 20^{o} S latitude and 160^{o} W to 175^{o} W longitude in

2014 (Figure 1a). The U.S. longline fishery in the NPO 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 2014 were bigeye tuna, albacore, yellowfin tuna, and swordfish (Table 1a, Figure 1b). The total catch of all species during the past 5 years ranged from a low of 11,476 t in 2013, to a high of 13,880 t in 2012 with catch at 11,636 t in 2014 (Tables 1f).

Most of the U.S. longline fishery in the NPO 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. U.S. longline landings of swordfish in the NPO increased to 880 t in 2014, from 583 t in 2013. The shallow-set U.S. longline fishery for swordfish accounts for the majority of the swordfish catch and has operated under the allowable number of sea turtle interaction limits in nine out of eleven years since its reopening in 2004.

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. Eight vessels participated in the South Pacific albacore troll fishery in 2014 compared to six vessels in 2013 (Table 2). The South Pacific albacore troll fishery operates mostly between 30° S and 45° S latitude and 145° W and 175° W longitude (Figure 2). The catch in this fishery is composed almost exclusively of albacore. The South Pacific albacore troll catches in the WCPO decreased from 390 t in 2013 to 263 t in 2014 (Tables 1a-1e). Three vessels from the North Pacific albacore troll fishery caught less than 0.5 t in the WCPO in 2014.

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 2,780 t in 2014. The catch was composed primarily of yellowfin tuna, skipjack tuna, bigeye tuna, and mahimahi.

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.

Longline Fishery Economics – Since August 2004, NOAA Fisheries economists and the NOAA Observer Program have implemented a "real-time" data collection program in Hawaii in order to assess changes in important economic indicators of the Hawaii-based longline fisheries (Pan et al., 2014). Through 2013, trip cost data were collected from over 1,600 Hawaii-based longline trips. Trip costs were made up of non-labor variable cost items including diesel fuel, engine oil, bait, ice, trip base gear resupply, provisions, and communications. During the period 2005-2014, trip costs show an increasing trend, with swordfish-targeting trips generally lasting longer and costing more than tuna-targeting trips. The average trip cost in the longline fishery in 2014 was $30,255 for a tuna-targeting trip, and $51,200 for a swordfish-targeting trip, increasing 88% and 44% respectively compared to 2005. The rising cost of fuel was the main cause of the increase in trip costs. Fuel price reported from the fishermen increased from $2.06 per gallon in 2005 to $3.87 per gallon in 2014. As a result, fuel cost made up about 56% of the total trip costs in 2014, compared to 47% in 2005.

Since 2006, NOAA Fisheries economists and observers have collected real-time trip level cost data from the American Samoa-based longline fishery. Additionally, since 2012 NOAA economists have conducted in-person interviews in American Samoa with vessel owners and owner operators/captains to collect trip expenditure information. Since the length of afishing trip (total days of a trip) for the American Samoa longline fleet varied substantially across the years, the cost per set (usually one set per day) is a better index than cost per trip for comparison across years. In general, the fishing cost in the American Samoa longline fishery showed an increasing trend during the period 2006-2014. The average cost per set peaked in 2013 at $2,137 per set, but decreased in 2014 to $1,553 per set. While the fishing cost was high in 2013, revenue decreased, resulting in a negative net revenue of -$372 per set. The economic performance of the American Samoa longline fleet in 2014 improved slightly over 2013. The revenue increased slightly to $1933 per set while the variable costs decreased to $1553 per set in 2014, resulting in a positive net revenue.

Socioeconomic impacts of Hawaii's 2010 bigeye tuna longline closure **–** Results are presented from a NOAA Fisheries study to monitor the socioeconomic impacts of the first extended closure of the western and central Pacific Ocean (WCPO) bigeye tuna (bigeye) fishery to U.S. longliners from the state of Hawaiʻi (Richmond et al, 2015). We applied qualitative and quantitative approaches to examine how diverse members of Hawaiʻi's bigeye fishery community, including fishermen, a large fish auction, dealers, processors, retailers, consumers, and support industries, perceived and were affected by the constraints of the 40-

day closure of the WCPO bigeye fishery at the end of 2010. The analysis revealed that there was reduced supply and reduced quality of bigeye landed along with increased prices for bigeye during the closure period. In addition, Hawai‘i longliners were forced to travel longer distances to fish during the closure. However, overall impacts to the bigeye community were not as severe as had been anticipated at the outset. Several mitigating factors meant this was not a true closure, as U.S. boats could continue to fish for bigeye in the Eastern Pacific Ocean and foreign and dual permitted vessels could still fish in the WCPO. This study highlights the challenges and equity considerations inherent in efforts to achieve meaningful conservation benefits from localized management actions within a global fishery. It also demonstrates the importance of interdisciplinary socioeconomic monitoring to examine how global fisheries policies scale down to individual fishing communities.

***Summary of consumer-level fish price data from Hawaii retail seafood markets* –** This NOAA Fisheries study provides a summary of retail (consumer-level) fish price data collected from Honolulu seafood markets during the period 2007 to 2011 (Hospital and Beavers, 2014). A small sample (n=7) of local seafood retailers was selected for participation in the data collection and monitoring effort. These included owners, operators, or representatives of local seafood outlets and both local and remotely owned grocery stores and supermarkets. Retailers were visited on a weekly basis and posted price data were collected for fish species and product forms common in the marketplace. Observations regarding country of origin labeling practices were documented in conjunction with pricing. The goal of this study is to advance a preliminary understanding of: the prevalence of local species and product forms in Honolulu retail fish markets; price differentials along the value chain; consumer demand for various species; and the role of imports in the Hawaii seafood market. Data summaries include: retail market presence/absence estimates; weekly retail price averages by species, product form and origin; retail pricing time series by month; and annual retail price spreads for the study period.

6.2 Relevant Publications

Hospital J, Beavers C. 2014. Economic and social characteristics of small boat fishing in the Commonwealth of the Northern Mariana Islands. Pacific Islands Fisheries Science Center Administrative Report H-14-02, 58 p. + Appendices.

Pan M. 2014. Economic characteristics and management challenges of the Hawaii pelagic longline fisheries: Will a catch share program help?. Marine Policy 44: 18-26. DOI: 10.1016/j.marpol.2013.08.008.

Pan M, Criddle K, Severance C. 2014. Guest editors' introductions: Catch shares and Pacific Islands Region fisheries. Marine Policy 44: 1-2. DOI: 10.1016/j.marpol.2013.08.010.

Pan, M. H.L. Chan, and K. Kalberg. 2014. Tracking the Changes of Economic Performance Indicators for the Main Commercial Fisheries in the Western Pacific Areas 2012 Update. Pacific Islands Fisheries Science Center (PIFSC) Internal Report IR-14-017, Issued 7 May 2014.

Pan, M., and S. Li. (In Press). Evaluation of fishing opportunities under the sea turtle interactions caps – a decision support model for the Hawaii-based longline swordfish fishery management. Our Living Oceans.

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 to canneries 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 air freighted to U.S. mainland destinations with a very 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 the U.S. west coast and 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

High fuel costs moderated in 2015 but prices for supplies and goods continued to increase and will result in more favorable overall operating costs which will likely benefit the economic performance of most U.S. pelagic fisheries. However, relatively lower fish prices observed thus far in 2015 may have a negative effect on the economic performance of the fisheries.

In each of the calendar years 2009-2014, 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 during 2009-2013 but exceeded the bigeye tuna limit with a catch of 3,815 t in 2014. 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. An IATTC limit of 500 t for vessels greater than 24 m in length was established from 2009. This limit was not reached from 2009 through 2012 but it was exceeded by 98 t in 2013 and 36 t in 2014. The future prospect of the U.S. longline fishery will continue to be a predominantly deep-set effort directed towards bigeye tuna.

The U.S. longline fishery in the NPO is likely to continue to have a greater proportion of effort in the deep-set sector to target tunas. Removal of an effort limit in the shallow-set longline fishery for swordfish in 2009 resulted in slightly increased effort in the swordfish segment of the fishery in 2009-2010. Shallow set effort decreased gradually thereafter, and may continue to do so if demand for tunas remains strong. The shallow-set swordfish segment of the longline fishery is highly seasonal and will continue to operate under strict regulations to limit interactions with sea turtles. Interactions with cetaceans, particularly false killer whales, are concerns with the deep-set segment of the U.S. longline fishery in the NPO.

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 have continued to decrease in 2011-2014. 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 were plans to complete a new processing and packing facility for high quality fresh and frozen tuna and a new cannery by the end of 2014.

The prospect of participation and catch from the U.S. small-scale fisheries is expected to be fairly stable although these fisheries are sensitive to an improving but unstable economy, fuel prices, and increasing expenses. Fuel prices dropped dramatically in 2015 and should make for a more favorable environment for small-scale operations though fish prices appear to be a constraining factor in 2015. 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- and American Samoa-based longline fisheries are monitored using the NOAA Fisheries Western Pacific Daily Longline Fishing Logs for effort and resulting catch. The California-based longline fishery is monitored using the High Seas Pelagic Longline/Gillnet Logbook. The coverage of logbook data is assumed to be complete (100%); for the American Samoa fishery, there may be under-reporting of a very small percentage of trips which can be 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' purchase 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 2010-2014. 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.

Under the Fishery Ecosystem Plan for Pacific Pelagic Fisheries of the Western Pacific Region established under the Magnuson-Stevens Fishery Conservation and Management Act, observers are required to be placed aboard Hawaii-based pelagic longline vessels targeting swordfish (shallow-set, 100% coverage) and tunas (deep-set, 20% coverage) and American Samoa-based longline vessels targeting tuna (deep-set, 20% coverage). 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.

For the U.S. longline fishery in the NPO, there were observers on 271 trips out of a total of 1,301 deep-set trips, as well as on all 75 shallow-set trips, resulting in coverage rates of 20.8% and 100%, respectively in 2014. For the American Samoa-based longline fishery, 2014 was the eighth full calendar year monitored by observers. The coverage rate was 19.4% for a total of 19 trips out of 98 trips. These coverage statistics are from 2014 reports of the NOAA Pacific Islands Regional Observer Program (PIROP) and are based on longline trips that departed with observers in calendar year 2014. Detailed information on the U.S. Pacific Islands Regional Observer Program can be found at http://www.fpir.noaa.gov/OBS/obs_index.html

Per reporting requirements agreed to at WCPFC 11, Table 3 contains estimates on observer coverage in U.S. longline fisheries for 2014 in the WCPFC Area exclusive of the U.S. EEZ.

Table 3. Observer coverage in 2014 of the U.S. longline fisheries in the WCPFC Area exclusive of the U.S. EEZ.

Fishery	Number of Hooks			Days Fished			Number of Trips		
	Total estimated	Observed	%	Total estimated	Observed	%	Total estimated	Observed	%
Hawaii and California-based	23,547,416	5,423,486	23	9,560	2,448	26	1,009	257	25
American Samoa	395,354	78,443	20	129	26	20	12	2	17

Fishery Interactions with Protected Species

Information on estimated fishery interactions with non-fish species by the Hawaii-based longline fishery in 2014 is not yet available, but counts of observed interactions are provided. In 2014, NOAA observers recorded 53 fishery interactions with sea turtles, 112 with sea birds, and 31 with marine mammals.

Information on estimated fishery interactions with non-fish species by the Hawaii-based longline fishery during 2009-2013 is provided in Table 4. The results indicated a higher number of interactions with seabirds, sea turtles and marine mammals in 2013 as compared with 2012. For the American Samoa-based component of the U.S. longline fishery, scientists have not yet provided rigorous estimates of the total interactions with protected species.

CMM 2011-01 requires CCMs to report instances in which cetaceans have been encircled by purse seine nets of their flagged vessels. In 2014, purse seine vessels reported 13 instances of interactions with marine mammals.

CMM 2011-04 requires CCMs to estimate the number of releases of oceanic whitetip sharks including their status upon release. For the U.S. purse seine fishery, limited observer data has been processed for 2014, and information available as of July 1, 2015 indicate that there were 58 oceanic whitetip sharks released in 2014. In the longline fishery, observer data indicate that 368 oceanic whitetip sharks were released (301 alive and 67 dead) in the Hawaii-based deep set fishery (21% observer coverage), 21 oceanic whitetip sharks were released (18 alive and 3 dead) in the Hawaii-based shallow set fishery (100% observer coverage), and 103 oceanic whitetip sharks were released (65 alive and 38 dead) in the American Samoa-based fishery (19% observer coverage).

CMM 2012-04 requires CCMs to report instances in which whale sharks have been encircled by purse seine nets of their flagged vessels. In 2014, purse seine vessels reported 35 instances of interactions with 35 individuals of whale sharks.

CMM 2013-08 requires CCMs to estimate the number of releases of silky sharks including their status upon release. For the U.S. purse seine fishery, limited observer data has been processed for 2014, and information available as of July 1, 2015 indicate that there were 1,883 silky sharks released in 2014. In the longline fishery, observer data indicate that 254 silky sharks were released (189 alive and 65 dead) in the Hawaii-based deep set fishery (21%

observer coverage), 1 silky shark was released (alive) in the Hawaii-based shallow set fishery (100% observer coverage), and 424 silky sharks were released (245 alive and 179 dead) in the American Samoa-based fishery (19% observer coverage).

Table 4. 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 2009-2013[2]. Estimates of total marine mammal interactions by the deep-set fishery in 2013 have not yet been completed; only the observed values are included here.

Species	2009	2010	2011	2012	2013
Marine mammals					
Striped dolphin (*Stenella coeruleoalba*)	0	2	4	1	0
Bottlenose dolphin (*Tursiops truncatus*)	5	6	2	1	4
Risso's dolphin (*Grampus griseus*)	3	10	4	0	3
Blainville's beaked whale (*Mesoplodon blainvillei*)	0	0	1	0	0
Bryde's whale (*Balaenoptera edeni*)	0	0	0	0	0
False killer whale (*Pseudorca crassidens*)	56	19	11	16	4
Humpback whale (*Megaptera novangliae*)	0	0	1	0	0
Shortfinned pilot whale (*Globicephala macrorhynchus*)	0	0	0	0	1
Spotted dolphin (*Stenella attenuate*)	0	0	0	0	0
Rough-toothed dolphin	0	0	0	0	2
Sperm whale	0	0	6	0	0
Northern elephant seal	0	0	0	0	1
Pygmy killer whale	0	0	0	0	1
Unspecified member of Mesoplodont beaked whale	0	0	0	0	1
Unspecified false killer whale or shortfinned pilot whale	0	3	11	5	0
Unidentified Cetacean (Cetacea)	17	13	0	7	2
Unspecified member of beaked whales (Ziphiidae)	0	0	1	0	1
Unspecified pygmy sperm whales (Kogia)	0	0	0	0	0
TOTAL MARINE MAMMALS	81	53	41	30	20
Sea turtles					
Loggerhead turtle (*Caretta caretta*)	3	11	14	5	16
Leatherback turtle (*Dermochelys coriacea*)	12	13	31	13	22
Olive Ridley turtle (*Lepidochelys olivacea*)	17	11	36	34	42
Green turtle (*Chelonia mydas*)	1	1	9	0	5
Unidentified hardshell turtle (Cheloniidae)	0	0	0	0	1
TOTAL SEA TURTLES	33	36	90	52	86

[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, IR-13-014, IR-13-029, and IR-14-022. Hawaii-based longline logbook reported data on fish discards are available at http://www.pifsc.noaa.gov./fmsd/reports.php

Table 4. (Continued.)

Species	2009	2010	2011	2012	2013
Albatrosses					
Blackfooted albatross (*Phoebastria nigripes*)	133	103	92	194	285
Laysan albatross (*Phoebastria diomedia*)	138	196	236	163	282
TOTAL ALBATROSSES	271	299	328	357	567
Other Seabirds					
Red-footed booby (*Sula sula*)	0	0	0	0	0
Brown booby (*Sula leucogaster*)	0	0	0	0	0
Unidentified Shearwater	24	1	19	36	45
TOTAL OTHER SEABIRDS	24	1	19	36	45
Observer Information					
Total trips	1,325	1,285	1329	1380	1379
Observed trips	355	362	336	338	324
Proportion of trips observed	26.80%	28.17%	25.29%	24.49%	23.50%
Observed sets	5,084	5,476	5,119	4,966	4,742
Observed hooks	9,644,989	9,980,848	9,871,487	10,187,571	10,278,217

10.3 Port Sampling

Less than 2% of the fish caught by U.S. purse seine, and longline 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.

10.4 Unloading / Transshipment

Information on the quantities transshipped and the number of transshipments by the U.S. longline and purse seine fisheries in 2014 is provided in Table 5.

For the U.S. purse seine fishery in the WCPFC Statistical Area in 2014, approximately 75% of the total landings of yellowfin, skipjack, and bigeye were transshipped to foreign ports for processing in 2014. There were an estimated 292 transshipments of purse seine-caught fish in port in 2014, as compared to 274 transshipments in 2013.

For the U.S. longline fishery in the WCPFC Statistical Area in 2014, fewer than 3 vessels offloaded and fewer than 3 vessels received transshipments. Further information on catch and numbers of transshipments in the U.S. longline fishery cannot be provided for confidentiality purposes. There was no available information on transshipments for the albacore troll fishery or any other HMS gear type in 2014.

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 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 size 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 an archival tagging program to study migration patterns and stock structure of juvenile (3-5 year old) albacore in the North Pacific (Childers et al., 2011). As of June, 2014, 920 archival tags have been deployed on albacore off the west coast of North America and 29 tags have been recovered. Three tagged albacore were recaptured in 2014 ranging from 25 to 1,035 days at liberty and in recapture areas ranging from the coast of Washington to tropical waters of the western Pacific. Following procedures established by NOAA Fisheries, biological and size data were collected from two cooperating vessels in 2013 and 2014, with 726 and 755 fish measured, respectively.

Table 5. Information on quantities transshipped and numbers of transshipments of HMS species by U.S. longline and purse seine fisheries in 2014 to satisfy reporting requirements of CMM 2009-06. * indicates data are not provided for confidentiality reasons.

Gear Type		Purse Seine		Longline	
		Quantities transshipped	Number of Transshipments	Quantities transshipped	Number of Transshipments
Offloaded	Transshipped in Port	211,911	292	*	*
	Transshipped at sea in areas of national jurisdiction	0	0	*	*
	Transshipped beyond areas of national jurisdiction	0	0	*	*
Received	Transshipped in Port	0	0	*	*
	Transshipped at sea in areas of national jurisdiction	0	0	*	*
	Transshipped beyond areas of national jurisdiction	0	0	*	*
Transshipped inside the Convention Area		211,911	292	*	*
Transshipped outside the Convention Area		0	0	*	*
Caught inside the convention area		211,911	292	*	*
Caught outside the convention area		0	0	*	*
Species	BET	1,868		*	
	SKJ	195,484		*	
	YFT	14,559		*	
Product Form	Fresh	0		*	
	Frozen	211,911		*	

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 greater than 40-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 2014, WPacFIN completed and published the 28th edition of Fishery Statistics of the Western Pacific (Lowe et al., 2014). Annual reports for the Hawaii-based longline fishery and the American Samoa longline fishery were also published (PIFSC FRMD, 2014a; PIFSC FRMD, 2014b; PIFSC FRMD, 2015a; PIFSC FRMD, 2015b).

10.6 Relevant Publications

Chang, Y.J., J.M. O'Malley, J. Brodziak, H.H. Lee, G. DiNardo. 2015. Model selection uncertainty and multi-model inference in the generalized fishery production modeling: simulation study of the Pacific blue marlin and WCNPO striped marlin stocks. Fish. Res. 166:129-139. DOI: http://dx.doi.org/10.1016/j.fishres.2014.08.023

Fisheries Research and Monitoring Division, Pacific Islands Fisheries Science Center. 2014. PIFSC Report on the American Samoa longline fishery year 2013. Pacific Islands Fisheries Science Center, PIFSC Data Report, DR-14-006, 13 p.

Fisheries Research and Monitoring Division, Pacific Islands Fisheries Science Center. 2015. PIFSC Report on the American Samoa longline fishery year 2014. Pacific Islands Fisheries Science Center, PIFSC Data Report, DR-15-0xx, 13 p.

Fisheries Research and Monitoring Division, Pacific Islands Fisheries Science Center. 2014. The Hawaii-based Longline Logbook Summary Report, January-December 2013. Pacific Islands Fisheries Science Center, PIFSC Data Report, DR-14-016, 14 p.

Fisheries Research and Monitoring Division, Pacific Islands Fisheries Science Center. 2015. The Hawaii-based Longline Logbook Summary Report, January-December 2014. Pacific Islands Fisheries Science Center, PIFSC Data Report, DR-15-007, 14 p.

Kvamsdal, S. F., and Stohs, S. M. 2014. Estimating endangered species interaction risk with the Kalman filter. Am. J. Agr. Econ. 96 (2): 458-468.

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McCracken ML. 2014. Estimation of incidental interactions with sea turtles and seabirds in the 2013 Hawaii deep-set longline fishery. Pacific Islands Fisheries Science Center, PIFSC Internal Report, IR-14-022, 4 p.

McCracken M. 2014. Assessment of incidental interactions with marine mammals in the Hawaii longline deep and shallow set fisheries from 2008-2012. Pacific Islands Fisheries Science Center, PIFSC Internal Report, IR-14-006, 1 p.

Martin, S. L., Stohs, S. M., Moore, J. E. 2014. Bayesian inference and assessment for rare-event bycatch in marine fisheries: a drift gillnet fishery case study. Ecol. Apps. 25:416–429. DOI: 10.1890/14-0059.1.

Maunder, M. N., and Piner, K. R. 2014. Contemporary fisheries stock assessment: many issues still remain. ICES Journal of Marine Science: Journal du Conseil, fsu015.

National Marine Fisheries Service, National Oceanic and Atmospheric Administration. 2014a. 2014 Annual Report to the Western and Central Pacific Fisheries Commission. United States of America. Part 1. Information on Fisheries, Research, and Statistics (For 2013). Pacific Islands Fisheries Science Center, PIFSC Data Report, DR-14-012, 42 p.

National Marine Fisheries Service, National Oceanic and Atmospheric Administration. 2014b. Submission of 2012-2013 U.S. fishery statistics for the Western and Central Pacific Ocean and other areas to the Western and Central Pacific Fisheries Commission. Pacific Islands Fisheries Science Center, PIFSC Data Report, DR-14-008, 11 p.

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Pacific Ocean and other areas to the Western and Central Pacific Fisheries Commission. Pacific Islands Fisheries Science Center, PIFSC Data Report, DR-15-010, 11 p.

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11. Research Activities

11.1 Biological and Oceanographic Research - TUNAS

Albacore genetic sex marker project **–** NOAA's Improve a Stock Assessment program funded a collaborative project in early 2015 between scientists from Canada, Japan, Taiwan, and the U.S.A. entitled "Improving the stock assessment of North Pacific albacore tuna by developing cost-effective genetic markers to identify sex". The main driver for this project is that North Pacific albacore show evidence of sex-differentiated growth and movements, and the 2014 assessment performed by the ISC Albacore Working Group uses a sex-differentiated population model. However, data on albacore gender is very limited, and the 2014 assessment did not include any sex data. Sex data on tunas are difficult to obtain because gonadal samples are needed to identify the sex of the tuna, as well as a cost-effective method for sex identification. This project aims to develop a genetic sex marker for albacore using modern genetic techniques. If the genetic markers are successfully developed, each sample is expected to cost US$3-5 to analyze subsequently. To date, genetic samples of known sex have been obtained from Japan and the U.S.A. The initial project is expected to run for two years.

Albacore distribution and environmental effects – NOAA Fisheries scientists, in collaboration with scientists of Canada's Department of Fisheries and Oceans (DFO), received funding in 2012 from NOAA's Fisheries and the Environment (FATE) program to study the "Influence of the North Pacific Current on the spatial distribution and availability of North Pacific albacore in the northeast Pacific Ocean." As a result of this collaborative study, two manuscripts have been published in a special issue of *Progress in Oceanography*. These studies have improved the development of abundance indices for albacore in the northeast Pacific. One NOAA study examined the influence of subtropical fronts on the spatial distribution of albacore in the northeast Pacific over the past 30 years by relating albacore CPUE from U.S. and Canadian logbooks with subtropical fronts derived from an analysis of sea surface temperature (SST) gradients (Xu et al., 2015) using an improved version of the Cayula-Cornillion frontal detection algorithm (Nieto et al., 2012). Results suggest that areas with high albacore CPUE tend to occur in regions with high SST gradients, such as the North Pacific Transition Zone (NPTZ) and the North American coast. Approaching the North American coast along the NPTZ, SST gradients drop off substantially around 130°W before increasing rapidly near the coast, which corresponded to a similar pattern in albacore CPUE. In the NPTZ, the centroid of albacore CPUE showed a seasonal shift northwards in summer and southwards in fall, which coincided with seasonal spatial shifts of areas with high SST gradients. A similar pattern was found on an inter-annual scale, with the exception of several years with limited fishery data in the NPTZ due to changes in fishery operations.

Another NOAA study examined coastal upwelling fronts as key habitat for albacore tuna in the northeast Pacific Ocean (Nieto et al., 2015). The study uses satellite-derived SST data to characterize coastal fronts in an automatic way and boosted regression trees (BRTs) to relate the effects of these fronts on albacore distribution. The results suggest that albacore CPUE distribution is strongly influenced by SST and chlorophyll at fishing locations, albeit with substantial seasonal and inter-annual variation. Albacore CPUEs were higher near warm, low chlorophyll oceanic waters, and near SST fronts. Sequential leave-one-year-out cross-validations were performed for all years and it was found that the relationships in the BRT models were robust for the entire study period. Spatial distributions of model-predicted albacore CPUE were similar to observations, but the model was unable to predict very high CPUEs in some areas.

Tuna Foraging Ecology – NOAA Fisheries scientists have been investigating the foraging ecology of a range of species since 1999 to determine the trophic relationships of highly migratory species in the California Current. Analyses of stomach contents of tunas conducted to date reveal a number of interesting patterns across species, regions and years. Looking across years for albacore and yellowfin tuna, it becomes apparent that there was a shift in the available prey species in the Southern California Bight (SCB) from 2007-2008. By comparing these results to other studies and across years, it is apparent that tuna in the SCB showed an increase in diet diversity, a reduced reliance on anchovies and sardines, and an increased reliance on squid, crustaceans, and other fish species. This likely relates to shifts in prey availability associated with changes in oceanography that have also been documented in other biological indices. Stomach content analysis is helping to better understand both tuna behavior, and how fluctuations in the availability of forage fish relate to changes in oceanography. Detailed data on tuna behavior and forage fish abundance are important components of stock assessments and integral to making informed management decisions. Stomach content data on the abundance of juvenile fish and other forage in the SCB could be valuable additions to the metrics used in stock assessment models for forage fish. As tuna feed primarily on juvenile fish and squid, stomach content analysis can further our understanding of how egg and larval trawl data translates into the availability of forage for larger predators later in the year. Stomach content processing is currently ongoing with samples collected through 2014.

Ecosystem impacts of climate change and fishing in the central North Pacific –NOAA Fisheries scientists compare two ecosystem models projections of 21st century climate change and fishing impacts in the central North Pacific (Woodworth-Jefcoats et al., 2015). Both a species-based and a size-based ecosystem modeling approach are examined. While both models project a decline in biomass across all sizes in response to climate change and a decline in large fish biomass in response to increased fishing mortality, the models vary significantly in their handling of climate and fishing scenarios. For example, based on the same climate forcing the species-based model projects a 15% decline in catch by the end of the century while the size-based model projects a 30% decline. Disparities in the models' output highlight the limitations of each approach by showing the influence model structure can have on model output. The aspects of bottom-up change to which each model is most sensitive appear linked to model structure, as does the propagation of inter-annual variability through the food web and the relative impact of combined top-down and bottom-up change. Incorporating integrated size- and species-based ecosystem modeling approaches into future ensemble studies may help separate the influence of model structure from robust projections of ecosystem change.

11.2 Biological Research – BILLFISHES

Billfish Life History Studies – NOAA Fisheries is collaborating with the University of Hawaii graduate school on an ongoing age and growth study of striped marlin harvested in the Hawaii-based longline fishery. Dorsal fin rays and otoliths for age determination were collected by observers deployed on Hawaii-based longline vessels during 2008–2011. Gonad sub-samples were concurrently collected for determination of gender and sex-specific length at 50% reproductive maturity, and histological analysis is nearing completion. Current sampling of the Hawaii and American Samoa longline fleet by the NOAA Observer Program is providing otolith and gonad samples of wahoo (*Acanthocybium solandri*) for future studies of age & growth, and length and age at 50% maturity for both locations.

Foraging Ecology of Swordfish in the SCB– In support of ecosystem-based studies, the foraging ecology of swordfish is being investigated by NOAA Fisheries scientists to examine predator-prey interactions and niche overlap with other pelagic predators. Stomach contents for this work have been predominantly provided through the California drift gillnet observer program. Since 2013, 56 stomachs have been analyzed. Current levels of analysis have allowed NOAA researchers to identify some of the most frequently encountered prey species (F=frequency of prey occurrence). Broadbill swordfish stomachs in season 2013 contained jumbo squid (*Dosidicus gigas*) (F=47), *Gonatopsis borealis* squid (F=31), and *Abraliopsis* sp. squid (F=28). These preliminary results show a possible shift in feeding trends. In 2012–2013 jumbo squid showed a resurgence in dietary importance for swordfish compared to the previous season.

11.3 Biological Research – PELAGIC SHARKS

Oxytetracycline Age Validation of Shortfin Makos **–** NOAA Fisheries scientists have been validating aging methods for shortfin mako, common thresher, and blue sharks based on band deposition periodicity determined using oxytetracycline (OTC) since 1997. To date 3,183 OTC-marked individuals have been released during juvenile shark surveys, including 1,221 shortfin mako, 1,187 common thresher, 757 blue, 15 silky (*Carcharhinus falciformis*), and 3 pelagic thresher (*Alopias pelagicus*) sharks. In July of 2014 a large adult male shortfin mako shark which had been injected with OTC in 2008 was recaptured after more than 6 years at liberty (2,196 days). This represents the first recapture of a large adult male mako injected with OTC and subsequently recaptured in the northeastern Pacific after an extended period at liberty. Originally measured at 194 cm fork length (FL), the animal measured 217 cm FL upon recapture, indicating that over a six-year period the animal had grown 23 cm, an average of 3.8 cm per year. This is well below estimated growth rates for juvenile makos (27-36 cm between their first and second summer and 20-29 cm in the following year). Previous ageing work on makos in the northeastern Pacific indicated that juveniles deposit band pairs in their vertebrae at a rate of two band pairs per year. The band pair count from this adult animal clearly indicates that, post OTC injection, the shark displayed annual band pair deposition (5+ bands in six years). Based on the juvenile age validation work done by Wells et al. (2013) the results from this animal indicate that male makos experience a shift in deposition rates from two band pairs per year as juveniles, to one band pair per year as adults. The findings will result in more reliable growth models (length-at-age) for shortfin mako in the northeast Pacific. In January 2014, the ISC convened its second Shark Age and Growth Workshop in order 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 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.

NOAA Fisheries have conducted studies to examine the effectiveness of illuminating gillnets with ultraviolet (UV) light-emitting diodes for reducing green sea turtle (*Chelonia mydas*) interactions (Wang et al., 2014). In collaboration with commercial fishermen, UV net illumination was tested in coastal and pelagic gillnet fisheries off the coasts of Baja California, Mexico and northern Peru. Recent experiments with net illumination are yielding encouraging results by reducing sea turtle interactions without affecting target fish catch species. Work has expanded to other gillnet fisheries in Brazil, Chile, and Indonesia.

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. 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.

A recent NOAA study in the North Pacific estimated an overall post-release mortality rate of 28% (95% bootstrap CI: 16–52%) for loggerhead sea turtles (*Caretta caretta*) caught by the U.S.-based pelagic longline fishery operating from California and Hawaii. This range of estimates is consistent with those used to shape some U.S. fisheries management plans, suggesting that conservation goals are being achieved at the expected level and ideally striking a balance between the interests of industry and those of protected species. Another recent NOAA study in the South Atlantic Ocean involved satellite tagging of juvenile loggerhead sea turtles that were captured as bycatch in the Uruguayan and Brazilian pelagic longline fisheries to investigate high-use areas, seasonal movements, and dive patterns. Results support defining the waters off southern Brazil and Uruguay as an identified juvenile loggerhead developmental high-use area in the southwestern Atlantic Ocean.

Enhancing the NOAA TurtleWatch product for endangered leatherback turtles – Fishery management measures to reduce interactions between fisheries and endangered or threatened species have typically relied on static time-area closures. While these efforts have reduced interactions, they can be costly and inefficient for managing highly migratory species such as sea turtles. The NOAA TurtleWatch product was created in 2006 as a tool to reduce the rates of interactions of loggerhead sea turtles with shallow-set longline gear deployed by the Hawaii-based pelagic longline fishery targeting swordfish. TurtleWatch is expanded here to include information on endangered leatherback turtles to help reduce incidental capture rates in the central North Pacific (Howell et al, 2015). Fishery-dependent data were combined with fishing effort, bycatch and satellite tracking data of leatherbacks to characterize sea surface temperature (SST) relationships that identify habitat or interaction 'hotspots'. Analysis of SST identified two zones, centered at 17.2° and 22.9°C, occupied by leatherbacks on fishing grounds of the Hawaii-based swordfish fishery. This new information was used to expand the TurtleWatch product to provide managers and industry near real-time habitat information for both loggerheads and leatherbacks. The updated TurtleWatch product provides a tool for dynamic management of the Hawaii-based shallow-set fishery to aid in the bycatch reduction of both species. Updating the management strategy to dynamically adapt to shifts in multi-species habitat use through time is a step towards an ecosystem-based approach to fisheries management in pelagic ecosystems.

11.5 Research on Bycatch and Fishing Technology – PELAGIC SHARKS

Net illuminations to reduce shark bycatch in coastal gillnets – NOAA Fisheries researchers have conducted recent studies to examine the effectiveness of illuminating gillnets with ultraviolet (UV) light-emitting diodes for reducing interactions with sharks, rays and guitarfish. In collaboration with commercial fishermen, UV net illumination was tested in coastal gillnet fisheries off the coasts of Baja California, Mexico. Recent experiments with net illumination are yielding encouraging results as with sea turtles by reducing elasmobranch interactions without affecting target fish catch species.

***Post-release survival of juvenile silky sharks captured in a tropical tuna purse seine fishery* –** Juvenile silky sharks (*Carcharhinus falciformis*) comprise the largest component of the incidental elasmobranch catch taken in tropical tuna purse seine fisheries. During a chartered fishing trip on board a tuna purse seine vessel conducting typical fishing operations, University of Hawaii and NOAA researchers investigated the post-release survival and rates of interaction with fishing gear of incidentally captured silky sharks using a combination of satellite linked pop-up tags and blood chemistry analysis (Hutchinson et al., 2015). To identify trends in survival probability and the point in the fishing interaction when sharks sustain the injuries that lead to mortality, sharks were sampled during every stage of the fishing procedure. The total mortality rates of silky sharks captured in purse seine gear was found to exceed 84%. Survival declined precipitously once the silky sharks had been confined in the sack portion of the net just prior to loading. Additionally, shark interactions recorded by the scientists were markedly higher than those recorded by vessel officers and the fishery observer. Future efforts to reduce the impact of purse seine fishing on silky shark populations should be focused on avoidance or releasing sharks while they are still free swimming.

11.6 Research on Bycatch and Fishing Technology – CETACEANS

***Injury determinations for cetaceans interacting with longline fisheries* –** Cetacean interactions (i.e., hookings and entanglements) with the Hawaii and American Samoa longline fisheries observed during 2008-2012 were compiled, and the number of cetacean deaths, serious injuries, and non-serious injuries by fishery, species, and management area were assessed (Bradford and Forney, 2014). These values form the basis of the mortality and serious injury estimates included in the stock assessment reports of stocks impacted by these fisheries. Injury determinations were made using a revised process for distinguishing serious from non-serious injuries (National Marine Fisheries Service, 2012). In the Hawaii deep-set fishery, 47 cetacean interactions were observed from 2008 to 2012; most involved false killer whales (48.9%), resulted in death or serious injury (74.5%), and occurred outside the U.S. exclusive economic zone, or EEZ (53.2%). In the Hawaii shallow-set fishery, 43 cetacean interactions were observed from 2008 to 2012; most involved Risso's dolphins (41.9%), resulted in death or serious injury (67.4%), and occurred outside the U.S. EEZ (90.7%). In the American Samoa deep-set fishery, 14 cetacean interactions were observed from 2008 to 2012; most involved rough-toothed dolphins (42.9%), resulted in death or serious injury (92.9%), and occurred within the U.S. EEZ (85.7%).

***Line-Transect Abundance Estimates of False Killer Whales in Hawaiian Waters* –** For biological populations that form aggregations (or clusters) of individuals, cluster size is an important parameter in line-transect abundance estimation and should be accurately measured. Cluster size in cetaceans has traditionally been represented as the total number of individuals in a group, but group size may be underestimated if group members are spatially diffuse.

Groups of false killer whales (*Pseudorca crassidens*) can comprise numerous subgroups that are dispersed over tens of kilometers, leading to a spatial mismatch between a detected group and the theoretical framework of line-transect analysis. Three stocks of false killer whales are found within the U.S. Exclusive Economic Zone of the Hawaiian Islands (Hawaiian EEZ): an insular main Hawaiian Islands stock, a pelagic stock, and a Northwestern Hawaiian Islands (NWHI) stock. A ship-based line-transect survey of the Hawaiian EEZ was conducted in the summer and fall of 2010 (Bradford et al, 2014), resulting in six systematic-effort visual sightings of pelagic (n = 5) and NWHI (n = 1) false killer whale groups. The maximum number and spatial extent of subgroups per sighting was 18 subgroups and 35 km, respectively. These sightings were combined with data from similar previous surveys and analyzed within the conventional line-transect estimation framework. Hawai'i pelagic and NWHI false killer whales were estimated to number 1,552 (CV = 0.66; 95% CI = 479–5,030) and 552 (CV = 1.09; 95% CI = 97–3,123) individuals, respectively. Subgroup structure is an important factor to consider in line-transect analyses of false killer whales and other species with complex grouping patterns.

11.7 Research on Bycatch and Fishing Technology – OTHER BYCATCH

DNA barcoding reveals species complex for opah **–** The cornerstone of fisheries management relies on a solid taxonomic base and an understanding of how animals can be grouped into coherent management units. Surprisingly, little is known about the basic biology and ecology of opah (*Lampris guttatus*), a globally distributed species that is commercially exploited and regionally common in the North Pacific. Recent efforts to collect life history data on this species uncovered evidence of two North Pacific morphotypes. Sequencing of the mitochondrial cytochrome c oxidase I gene (655 bp) for these morphotypes and other specimens collected worldwide (n = 480) produced five strongly diverged and well-supported clades. Additional sequence data from the cytochrome b gene (1141 bp) as well as the nuclear recombination activating gene 1 (1323 bp) corroborated these results, suggesting these five clades probably represent separate species. Our conclusion that opah is a complex of five separate species has implications for management and indicates a need to gather additional data on these poorly understood fishes (Hyde et al, 2014).

11.7 Relevant Publications

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