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ANNUAL REPORT TO THE COMMISSION
PART 1: INFORMATION ON FISHERIES, RESEARCH, AND STATISTICS

WCPFC-SC10-AR/CCM-27

UNITED STATES OF AMERICA

2014 Annual Report to the Western and Central Pacific Fisheries Commission

United States of America

PART I. INFORMATION ON FISHERIES, RESEARCH, AND STATISTICS [1]
(For 2013)

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 2014	**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 2013 are dominated by the catch of the purse-seine fishery. Preliminary 2013 purse seine catch estimates total 233,175 t of skipjack, 16,717 t of yellowfin, and 4,456 t of bigeye tuna. Total U.S. purse-seine catch estimates in 2012 have been revised to 259,760 t from last year's preliminary estimate. Longline retained catch decreased in 2013, its lowest level recorded during the 2009-2013 period; longline catch by American

[1] PIFSC Data Report DR-14-012
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Samoa in the South Pacific Ocean decreased significantly in 2013. Bigeye tuna catch by U.S. longliners decreased to 4,472 t, from a five-year high in 2012. Albacore catch decreased to 2,407 t in 2013. Excluding catch by the U.S. Participating Territories (i.e., American Samoa, Commonwealth of the Northern Mariannas Islands), longline catch of bigeye tuna decreased slightly to 3,612 t in 2013. These bigeye tuna catch estimates 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, CMM 2011-01 in 2012 and CMM 2012-01 in 2013. Longline catch of swordfish in the North Pacific Ocean (NPO) decreased to 569 t in 2013, its lowest level during the 2009-2013 period. 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 155 in 2013, while there were 40 purse-seine vessels in 2013.

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 2013, socio-economic studies addressed catch shares analyses 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 the Inter-American Tropical Tuna Commission (IATTC). The stock assessment work is not described in this report but is detailed in other publications (Brodziak and Walsh, 2013; Chang et al., 2013a; Chang et al., 2013b; Kvamsdal and Stohs, 2014; MacCall and Teo, 2013; Mangel et al., 2013; Maunder and Piner, 2014; Piner et al., 2013; Soykan et al., 2014; Su et al., 2013).

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 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.

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 2009-2013 for fisheries of the United States and its Participating Territories operating in the western and central

Pacific Ocean (WCPO). All statistics for 2013 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 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%, 0.4%, 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 268,969 t in 2013 (Table 1a), down from 277,152 t in 2012 (Table 1b). The catch consisted primarily of skipjack tuna (87%), yellowfin tuna (7%), bigeye tuna (4%), and albacore (1%). Catches of skipjack and yellowfin tuna decreased in 2013 due to lower purse-seine catches while bigeye tuna decreased from the previous year due to lower purse seine and longline 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 2013 (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**	**Tropical Handline**	**Tropical Pole & line**	**TOTAL**
Albacore (ALB), North Pacific	0	307	0	2	46	0	355
Albacore (ALB), South Pacific	0	2,100	390	0	0	0	2,490
Bigeye tuna (BET)	4,456	4,472	0	147	392	0	9,467
Pacific bluefin tuna (PBF)	0	3	0	0	0	0	3
Skipjack tuna (SKJ)	233,175	280	0	538	14	0	234,007
Yellowfin tuna (YFT)	16,717	1,051	0	527	440	0	18,734
Other tuna (TUN KAW FRI)	0	0	0	4	1	0	5
TOTAL TUNAS	254,348	8,213	390	1,217	893	0	265,061
Black marlin (BLM)	0	1	0	3	0	0	4
Blue marlin (BUM)	0	352	0	137	3	0	492
Sailfish (SFA)	0	12	0	2	0	0	14
Spearfish (SSP)	0	176	0	11	0	0	187
Striped marlin (MLS), North Pacific	0	321	0	8	0	0	329
Striped marlin (MLS), South Pacific	0	3	0	0	0	0	3
Other marlins (BIL)	0	1	0	0	0	0	1
Swordfish (SWO), North Pacific	0	569	0	1	6	0	576
Swordfish (SWO), South Pacific	0	10	0	0	0	0	10
TOTAL BILLFISHES		1,445		161	9	0	1,616
Blue shark (BSH)	0	2	0	0	0	0	2
Mako shark (MAK)	0	38	0	0	0	0	38
Thresher sharks (THR)	0	5	0	0	1	0	6
Other sharks (SKH OCS FAL SPN TIG CCL)	0	0	0	1	0	0	1
TOTAL SHARKS		44		1	1	0	46
Mahimahi (DOL)	0	295	0	403	22	0	720
Moonfish (LAP)	0	448	0	0	0	0	448
Oilfish (GEP)	0	210	0	0	0	0	210
Pomfrets (BRZ)	0	353	0	0	20	0	374
Wahoo (WAH)	0	270	0	204	9	0	483
Other fish (PEL PLS MOP TRX GBA ALX GES RRU DOT)	0	10	0	1	0	0	11
TOTAL OTHER		1,587		608	51	0	2,245
TOTAL	**254,348**	**11,289**	**390**	**1,987**	**954**	**0**	**268,969**

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 2012 (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	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 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 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 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 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 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 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 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**				
	2013	**2012**	**2011**	**2010**	**2009**	**2013**	**2013**	**2012**	**2011**	**2010**	**2009**	**2013**	**2012**	**2011**	**2010**	**2009**	**2013**	**2012**	**2011**	**2010**	**2009**
Vessels	133	127	128	123	127	113	15	115	114	11	10	22	25	24	26	26	155	153	152	146	151
Species																					
Albacore, North Pacific	272	480	497	324	177	23	13	115	113	48	4						307	595	610	371	181
Albacore, South Pacific	0	0										2,100	3,147	2,291	3,943	3,903	2,100	3,147	2,291	3,943	3,903
Bigeye tuna	3,612	3,660	3,565	3,577	3,741	501	276	1,338	1,086	507	156	84	164	178	178	161	4,472	5,162	4,829	4,261	4,059
Pacific bluefin tuna	0	0	0	0	1							2	7	2	3	1	3	7	2	3	2
Skipjack tuna	181	115	158	114	116	25	9	123	34	18	5	65	251	108	110	152	280	490	300	242	272
Yellowfin tuna	546	576	738	462	429	92	29	272	144	53	15	383	348	555	445	386	1,051	1,196	1,437	960	829
Other tuna	0	0	0	0	0	0	0			0		0					0	0	0	0	0
TOTAL TUNA	4,612	4,831	4,958	4,477	4,464	640	327	1,849	1,376	625	179	2,634	3,916	3,135	4,679	4,603	8,213	10,596	9,469	9,781	9,246
Black marlin	1	1	1	0	0	0	0	0	0	0		0	2	1	0	0	1	3	2	1	0
Blue marlin	283	226	290	238	333	20	18	50	45	23	7	30	36	40	45	42	352	313	375	306	382
Sailfish	7	5	10	9	10	3	1	3	2	1	0	2	1	4	2	2	12	9	15	11	12
Spearfish	132	111	169	79	97	34	9	35	35	9	2	1	1	5	2	3	176	147	209	89	102
Striped marlin, North Pacific	256	209	263	124	234	45	20	54	68	13	5						321	263	331	137	239
Striped marlin, South Pacific	0	0				0						3	7	3	2	4	3	7	3	2	4
Other marlins	1	1	1	1	0	0	0	0									1	1	1	1	0
Swordfish, North Pacific	545	862	837	1,013	1,243	8	17	38	22	20	5						569	900	859	1,033	1,248
Swordfish, South Pacific	0	0				0						10	14	12	11	13	10	14	12	11	13
TOTAL BILLFISH	1,224	1,414	1,570	1,464	1,917	109	65	180	171	66	19	47	62	64	62	63	1,445	1,656	1,805	1,592	1,999

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				
	2013	**2012**	**2011**	**2010**	**2009**	**2013**	**2013**	**2012**	**2011**	**2010**	**2009**	**2013**	**2012**	**2011**	**2010**	**2009**	**2013**	**2012**	**2011**	**2010**	**2009**
Blue shark	1	12	9	6	9	0	0	2	2	0		1	3	2	1	1	2	18	14	7	9
Mako shark	30	42	43	63	102	3	5	8	8	5	1	0	0	0	0	0	38	50	51	68	103
Thresher	4	9	15	16	28	0	0	3	3	0	0	0	0	0		0	5	13	18	16	29
Other sharks	0	0	2	3	6	0	0	0	0	0		0	0	1	1	0	0	1	3	3	6
Oceanic whitetip shark	0	1										0	0				0	1			
Silky shark	0	0										0	0				0	0			
Hammerhead shark	0	0															0	0			
Tiger shark																					
Porbeagle																					
TOTAL SHARKS	35	64	69	87	144	3	5	14	14	6	1	1	4	4	2	1	44	82	87	95	147
Mahimahi	240	288	291	230	265	9	27	52	52	23	7	19	11	11	9	17	295	351	353	262	289
Moonfish	373	356	309	356	485	37	36	86	84	42	22	2	3	3	2	3	448	445	396	400	510
Oilfish	166	169	178	164	194	26	17	59	55	20	7	1	0	1	0	3	210	228	233	185	203
Pomfret	309	215	115	169	202	26	19	56	33	19	10						353	270	148	188	213
Wahoo	153	117	124	101	116	17	14	39	23	11	4	87	85	123	133	140	270	241	270	246	260
Other fish	9	8	20	10	8	0	0	1	0	0	0	0	0	1	1	0	10	9	21	11	8
TOTAL OTHER	1,250	1,154	1,036	1,031	1,269	116	113	292	248	115	51	108	99	137	145	163	1,587	1,545	1,421	1,291	1,484
GEAR TOTAL	**7,121**	**7,463**	**7,632**	**7,058**	**7,794**	**869**	**509**	**2,335**	**1,809**	**812**	**251**	**2,790**	**4,081**	**3,341**	**4,888**	**4,830**	**11,289**	**13,879**	**12,782**	**12,758**	**12,875**

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**				
	2013	**2012**	**2011**	**2010**	**2009**	**2013**	**2012**	**2011**	**2010**	**2009**	**2013**	**2012**	**2011**	**2010**	**2009**	**2013**	**2012**	**2011**	**2010**	**2009**
Vessels	1655	1698	1598	1570	1668	496	351	454	432	368	28	35	48	40	47	13	9	10	7	10
Species																				
Albacore, North Pacific	2	3	4	2	3															
Albacore, South Pacific																				
Bigeye tuna	147	155	110	118	59															
Pacific bluefin tuna																				
Skipjack tuna	148	109	126	96	139	227	142	159	154	150	159	130	101	166	123	3	4	9	1	1
Yellowfin tuna	484	597	440	401	436	24	13	37	11	23	16	33	19	14	12	3	4	6	1	1
Other tunas	3	4	2	11	7	0	2	0	1	3	1	13	14	14	2					
TOTAL TUNAS	784	868	682	628	644	251	157	196	166	176	176	176	133	193	137	6	8	15	2	3
Black marlin	3	3																		
Blue marlin	128	131	188	134		7	6	9	14	15	1	4	2							
Sailfish	1	1				1		1	1		0		1	1						
Spearfish	11	12	11																	
Striped marlin, N. Pacific	8	11	16	19	10															
Striped marlin, S. Pacific																				
Other billfish			5	10	8															
Swordfish, North Pacific	1	1			0															
Swordfish, South Pacific																				
TOTAL BILLFISHES	152	159	220	163	19	8	6	9	15	15	1	4	4	1	0	0	0	0	0	0

Table 1g. (Continued.)

	Hawaii					Guam					CNMI					American Samoa				
	2013	**2012**	**2011**	**2010**	**2009**	**2013**	**2012**	**2011**	**2010**	**2009**	**2013**	**2012**	**2011**	**2010**	**2009**	**2013**	**2012**	**2011**	**2010**	**2009**
Blue shark																				
Mako shark																				
Thresher sharks																				
Other sharks	1	1	1	1		0														
TOTAL SHARKS	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mahimahi	287	452	298	305	316	75	38	41	128	67	41	18	25	34	29	0	0	0		
Moonfish																				
Oilfish																				
Pomfrets											0									
Wahoo	178	194	140	209	199	23	20	17	21	59	2	8	5	6	6	0	0			
Other pelagics	1	1	1	4	2		2	3	5	10		1	7	7	1					
TOTAL OTHER	466	647	439	518	517	98	60	61	154	136	43	27	37	47	36	1	0	0	0	0
GEAR TOTAL	**1,403**	**1,675**	**1,342**	**1,310**	**1,180**	**358**	**223**	**267**	**334**	**327**	**220**	**207**	**174**	**241**	**172**	**7**	**9**	**15**	**2**	**3**

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 2009-2013, 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

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 2009-2013. Data for 2013 are preliminary.

	2013	2012	2011	2010	2009
Purse seine	40	39	37	37	39
Longline (N Pacific-based)[1]	133	127	128	124	127
Longline (American Samoa-based)	22	25	24	26	26
Total U.S. Longline[2]	155	153	152	146	151
Albacore troll (N Pacific) [3]	0	2	11	2	0
Albacore troll (S Pacific) [3]	6	9	6	6	4
Tropical troll	2,192	2,093	2,110	2,049	2,093
Handline	534	576	508	480	552
Tropical troll and Handline (combined)[4]	2,297	2,197	2,214	2,143	2,184
Pole and line	2	1	2	2	6
TOTAL	**2,500**	**2,399**	**2,411**	**2,334**	**2,384**

[1]Includes only Hawaii-based vessels in 2009-2013.
[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 2009-2013. Data for 2013 are preliminary.

Gear and year	**0-50**		**51-200**	**201-500**	**501-1000**	**1001-1500**	**1500+**
2009 Purse seine					2	19	18
2010 Purse seine					1	18	18
2011 Purse seine					1	17	19
2012 Purse seine					1	17	21
2013 Purse seine						19	21
2009 Longline	12		139				
2010 Longline	11		135				
2011 Longline	13		139				
2012 Longline	15		138				
2013 Longline	15		142				
	0-50	**51-150**	**150+**				
2009 Pole and line	3	3					
2010 Pole and line		2					
2011 Pole and line		2					
2012 Pole and line		1					
2013 Pole and line	1	1					
2009 Albacore troll		3	1				
2010 Albacore troll		4	2				
2011 Albacore troll		7	6				
2012 Albacore troll		5	4				
2013 Albacore troll		2	4				

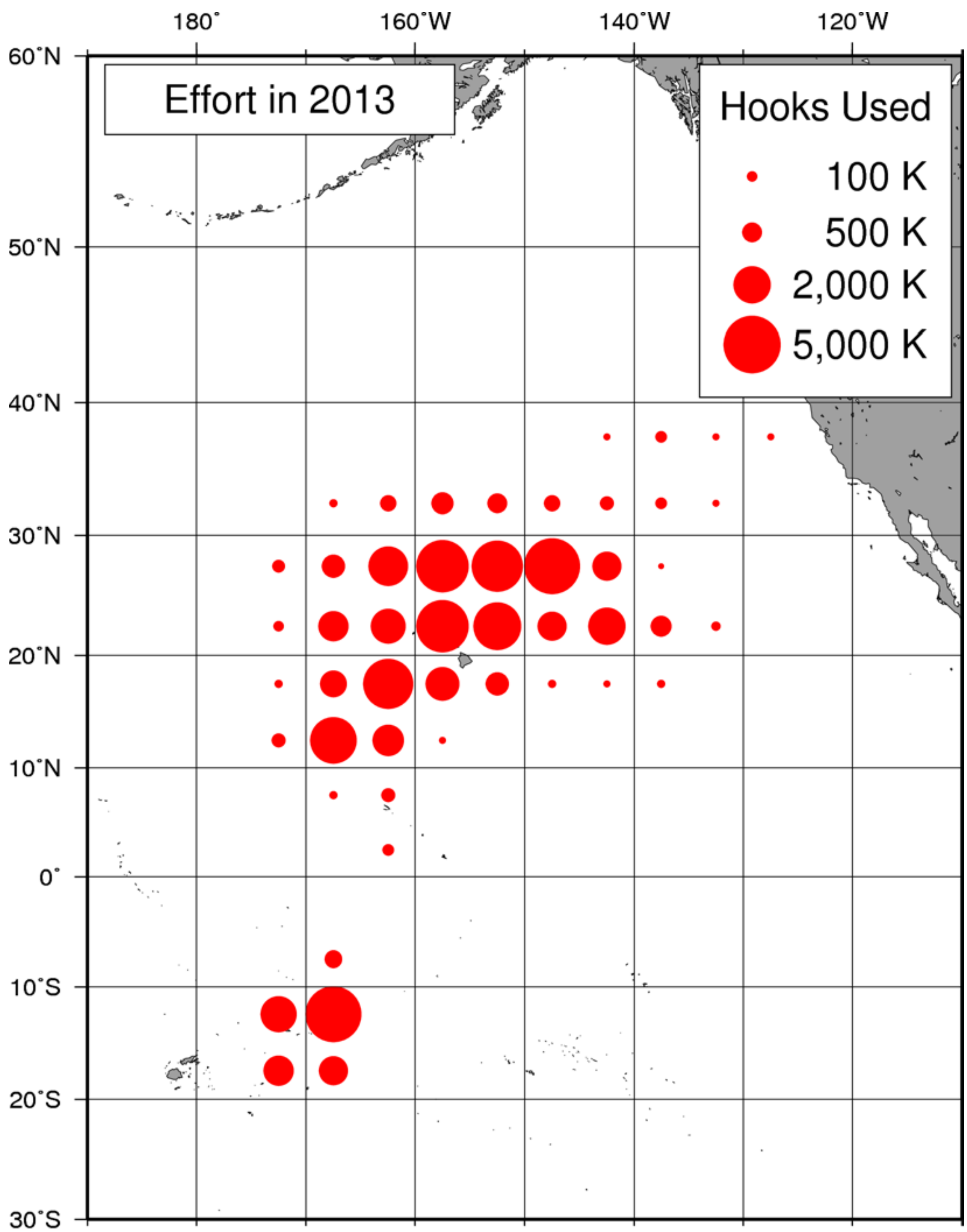

Figure 1a. Spatial distribution of fishing effort reported in logbooks by U.S.-flagged longline vessels, in 1,000's of hooks (K), in 2013 (preliminary data). Area of circles is proportional to effort. Effort in some areas is not shown in order to preserve data confidentiality.

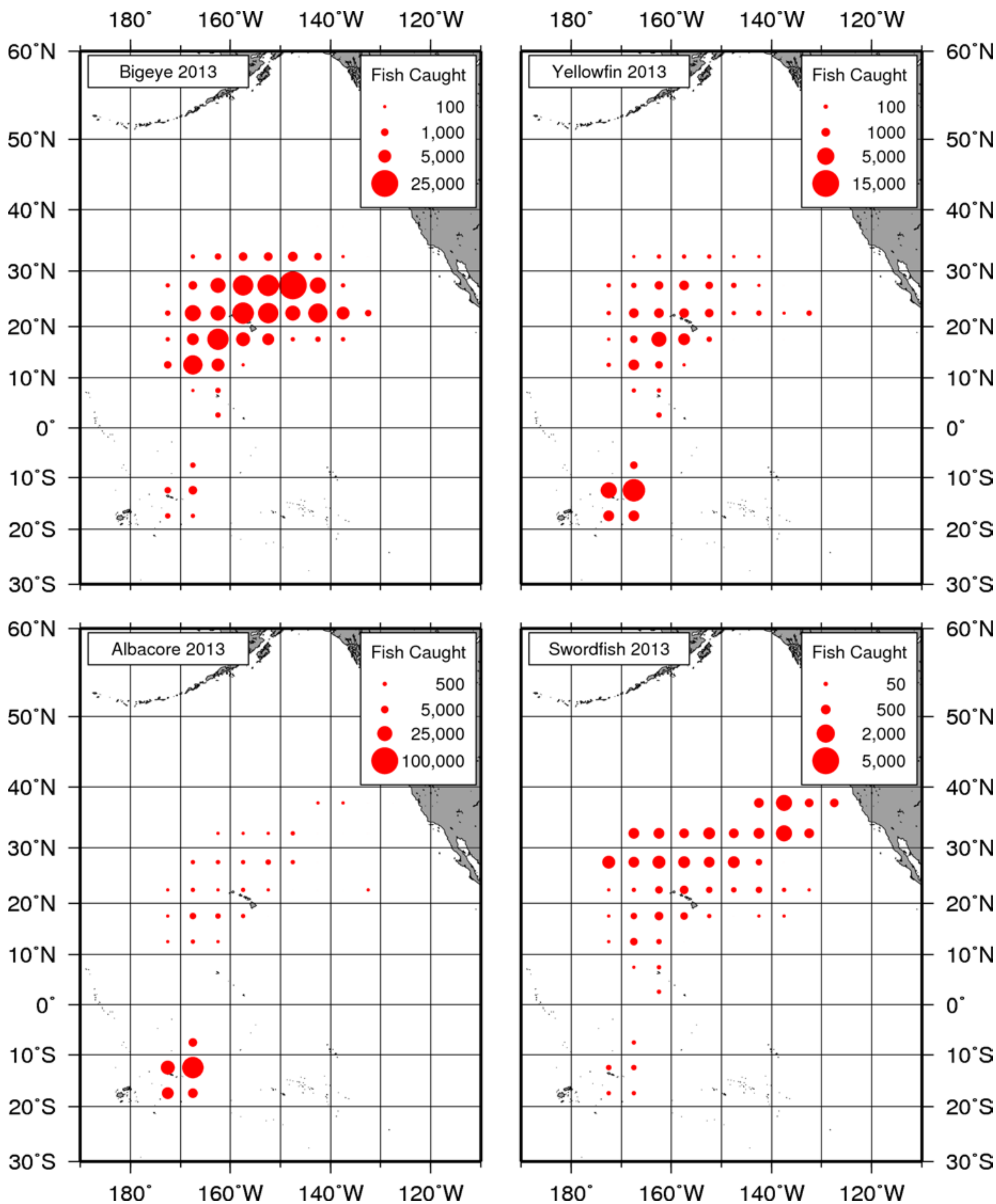

Figure 1b. Spatial distribution of catch reported in logbooks by U.S.-flagged longline vessels, in numbers of fish (includes retained and released catch), in 2013 (preliminary data). Area of circles is proportional to catch. Catches in some areas are not shown in order to preserve data confidentiality.

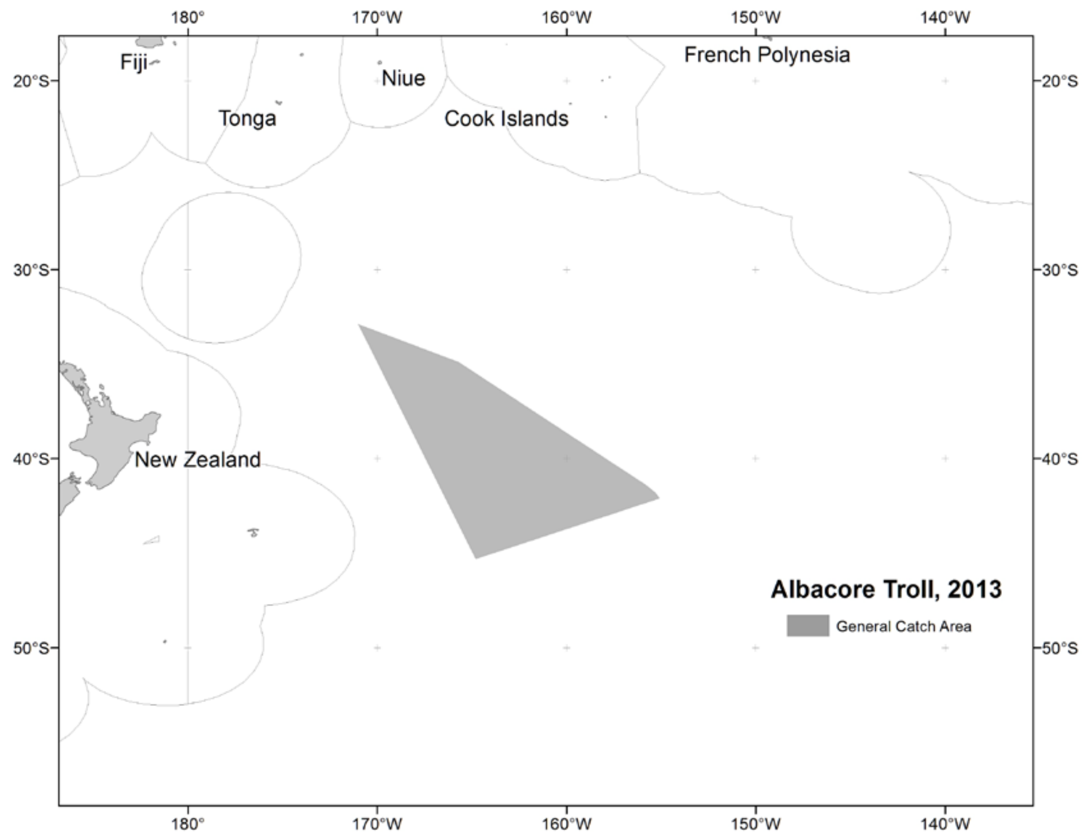

Figure 2. Spatial distribution of reported logbook fishing effort (vessel-days fished) by the U.S. albacore troll fleet in the South Pacific Ocean in 2013 (preliminary data). Effort in some areas is not shown in order to preserve data confidentiality.

3. Background

[n/a]

4. Flag State Reporting of National Fisheries

4.1 U.S. Purse-seine Fishery

The U.S. purse-seine catch of tunas in the Western and Central Pacific Ocean was 254,348 t in 2013 compared to 259,760 t in 2012, 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-1c). The number of licensed vessels in 2013 was 40 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.

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 155 vessels in 2013 (Table 2). The U.S. North Pacific-based longline fishery consistently had the highest number of vessels in operation with 133 in 2013. Participation in the American Samoa-based fleet operating in the South Pacific declined from 26 vessels in 2009 to 22 vessels in 2013. A few vessels occasionally operated in both the Hawaii-based and American Samoa-based longline fisheries during 2009-2013. 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), (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 2011 and 2012, and CNMI in 2013.

The U.S. Hawaii-based longline fishery operated mainly from the equator to 40° N latitude and from 125° W to 175° W in 2013 (Figure 1a). The American Samoa-based longline fishery operated mostly from 5° S to 20° S latitude and 155° W to 175° W longitude in 2013 (Figure 1a). 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 2013 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 11,289 in 2013, to a high of 13,879 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 from the time the limit was implemented and EPO (under conservation measures of the Inter-American Tropical Tuna Commission) through 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 and 2013. 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 969 shallow sets in 2013. Swordfish longline landings in the NPO decreased from 1,248 t in 2009 to 569 in 2013.

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. Six vessels participated in the WCPO portion of this fishery in 2013 compared to 9 vessels in 2012 (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 increased from 235 t in 2012 to 390 t in 2013 (Tables 1a-1e). There were no North Pacific albacore catches in the WCPO in 2013.

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 2,941 t in 2013. 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.

Hawaii Longline Fishery Economics **–** Since 2004, NOAA Fisheries observers have collected data on fishing costs and other economic information from over 3,350 longline trips in order to assess changes in important economic indicators of the Hawaii-based longline fisheries (Pan et al., 2014). From 2004 to 2013, economic data were collected from a total of 1,673 Hawaii longline trips. During the period 2004-2013, the average trip cost in the longline fishery for tuna-targeting trips increased by 116%, from $13,720 per trip in 2004 to $28,931 per trip in 2013. In 2004, fuel cost made up about 45% of the total trip cost (non-labor items). However, in 2013, fuel cost made up about 56% of the total trip cost. During the period 2005-2013, the average trip cost in the longline fishery for swordfish-targeting trips increased similarly, from $17,600 per trip in 2005 to $51,533 per trip in 2013. Fuel cost made up about 59% of the total trip cost of the swordfish targeting trips in 2013. Compared to 2012, the average trip cost was slightly lower in 2013, linked to lower fuel prices in 2013 as reported from fishermen. Fuel price was $2.72 per gallon in 2013, $0.19 less per gallon than 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, 112 fishermen from the Commonwealth of the Northern Mariana Islands (Saipan, Tinian, Rota) 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 marketing of catch. The median vessel size reported was 18 feet with all vessels reported to be less than 25 feet in length. Fishermen reported approximately 37 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 deepwater bottomfish fishing and shallow-water bottomfish fishing. On average, fishermen reported selling approximately 28% of their total catch, and sold fish after approximately 35% of their fishing trips. The majority of fishermen consider 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. However, 86% of fishermen consider the pelagic fish they catch to be an important source of food for their family. During 2010 and 2011, the cost of a trolling trip averaged approximately $188, and as anticipated, fuel expenses accounted for a majority (78%) of total trip expenditures. The study concluded the CNMI small boat fisheries to be a complex mix of subsistence, cultural, recreational, and quasi-commercial fishermen whose fishing behaviors provide evidence of the deep social and cultural importance of fishing to the people of the CNMI (Hospital and Beavers, 2014).

***Feasibility of a Catch Share Program for Hawaii longline fishery* –** In 2010, NOAA released a policy to encourage the use of catch shares as a fishery management tool, but to date, none of the fisheries in the U.S. Pacific Islands Region is managed under a catch share program. In response to the NOAA catch share policy, the Western Pacific Fishery Management Council (WPFMC) identified six commercial fisheries, including the high-value Hawaii pelagic longline fishery, the largest in the region, as potential candidates for catch share programs. NOAA conducted a study to examine the baseline economic and operational characteristics of, and the management challenges facing the Hawaii pelagic longline fishery and evaluate the impact of these on the desirability and feasibility of a catch share program for this particular fishery (Pan, 2014; Pan et al., 2014).

6.2 Relevant Publications

Arita S, Pan M, Hospital J, Leung P. 2013. The distributive economic impacts of Hawaii's commercial fishery: a SAM analysis. Fisheries Research 145: 82-89. DOI: 10.1016/j.fishres.2013.02.005.

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.

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 exported to the U.S. mainland 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

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. The overall economy and employment environment continue to improve, albeit, slowly and may have a positive effect on the demand for fish.

In each of the calendar years 2009-2013, 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, 3,565 t in 2011, 3,660 t in 2012, and 3,612 t in 2013. 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 2013. This limit was not reached from 2009 through 2012 but it was exceeded by 92 t in 2013. 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 have a greater proportion of effort in the deep-set sector to target tunas. 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 gradually 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. Interactions with cetaceans, particularly false killer whales, are concerns with the longline fishery.

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 2011-2013. 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 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, high fuel prices, and increasing expenses. Fuel prices continue to increase slowly although they were lower in 2013 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-, 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' 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 2010-2013. 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 Hawaii-based longline fishery, 271 out of 1326 deep-set trips were observed, as well as all 53 shallow-set trips, resulting in a combined coverage rate of 23.5% in 2013 (Table 3). For the American Samoa-based component of the U.S. longline fishery, 2013 was the seventh full calendar year monitored by observers. The coverage rate was 19.4% for a total of 19 trips and 585 sets. Detailed information on the U.S. Pacific Islands Regional Observer Program can be found at http://www.fpir.noaa.gov/OBS/obs_index.html

Information on estimated fishery interactions with non-fish species by the Hawaii-based longline fishery during 2009-2013 is provided in Table 3. 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 2013, purse seine vessels reported 9 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 (~15%) in 2013, and data available to date indicate that there were 13 releases of oceanic whitetip sharks. No information on status upon release is currently available. In the longline fishery, observer data indicate that 189 oceanic whitetip sharks were released (155 alive and 34 dead) in the Hawaii-based deep set fishery (20% observer coverage), 26 oceanic whitetip sharks were released (24 alive and 2 dead) in the Hawaii-based shallow set fishery (100% observer coverage), and 20 oceanic whitetip sharks were released (15 alive and 5 dead) in the American Samoa-based fishery (19% observer coverage).

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 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. 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	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 3. (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 2013 is provided in Table 4.

For the U.S. purse seine fishery in the WCPFC Statistical Area in 2013, approximately 80% of the total landings of yellowfin, skipjack, and bigeye were transshipped to foreign ports for processing in 2013. There were an estimated 274 transshipments of purse seine-caught fish in port in 2013, as compared to 277 transshipments in 2012.

For the U.S. longline fishery in the WCPFC Statistical Area in 2013, 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 2013.

Table 4. Information on quantities transshipped and numbers of transshipments of HMS species by U.S. longline and purse seine fisheries in 2013 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	202,276	274	*	*
	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		202,276	274	*	*
Transshipped outside the Convention Area		0	0	*	*
Caught inside the convention area		202,276	274	*	*
Caught outside the convention area		0	0	*	*
Species	BET	3,490		*	
	SKJ	185,069		*	
	YFT	13,717		*	
Product Form	Fresh	0		*	
	Frozen	202,276		*	

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 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, 2013, 878 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 recaptured in 2013 near the coast of 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 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 2013, WPacFIN completed and published the 28th edition of Fishery Statistics of the Western Pacific (Lowe et al., 2013). Annual reports for the Hawaii-based longline fishery and the American Samoa longline fishery were also published (PIFSC FRMD, 2013; PIFSC FRMD, 2014).

10.6 Relevant Publications

Brodziak J, Walsh WA. 2013. Model selection and multimodel inference for standardizing catch rates of bycatch species: a case study of oceanic whitetip shark in the Hawaii-based longline fishery. Canadian Journal of Fisheries and Aquatic Sciences 70(12): 1723-1740. DOI: 10.1139/cjfas-2013-0111.

Chang SK, DiNardo G, Farley J, Brodziak J, Yuan ZL. 2013a. Possible stock structure of dolphinfish (Coryphaena hippurus) in Taiwan coastal waters and globally based on reviews of growth parameters. Fisheries Research 147: 127-136. DOI: 10.1016/j.fishres.2013.05.003.

Chang YJ, Sun CL, Chen Y, Yeh SZ, DiNardo G, Su NJ. 2013b. Modelling the impacts of environmental variation on the habitat suitability of swordfish, Xiphias gladius, in the equatorial Atlantic Ocean. ICES Journal of Marine Science. DOI: 10.1093/icesjms/fss190.

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. 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. 2013. The Hawaii-based Longline Logbook Summary Report, January-December 2012. Pacific Islands Fisheries Science Center, PIFSC Data Report, DR-13-004, 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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Mangel M, MacCall AD, Brodziak J, Dick EJ, Forrest RE, Pourzand R, Ralston S. 2013. A perspective on steepness, reference points, and stock assessment. Canadian Journal of Fisheries and Aquatic Sciences 70:930-940. DOI: 10.1139/cjfas-2012-0372.

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.

Pacific Islands Fisheries Science Center, National Marine Fisheries Service, National Oceanic and Atmospheric Administration. 2013. Submission of 2011-2012 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-13-010, 10 p.

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.

Soykan, C. U., Eguchi, T., Kohin, S., & Dewar, H. 2014. Prediction of fishing effort distributions using boosted regression trees. Ecological Applications, 24(1), 71-83.

Su NJ, Sun CL, Punt AE, Yeh SZ, DiNardo G, Chang YJ. 2013. An ensemble analysis to predict future habitats of striped marlin (*Kajikia audax*) in the North Pacific Ocean. ICES Journal of Marine Science 70(5): 1013-1022. DOI: 10.1093/icesjms/fss191.

11. Research Activities

11.1 Biological and Oceanographic Research - TUNAS

Albacore Age and Growth – A number of lines of evidence support the hypothesis that there are two different substocks of albacore tuna in the California Current with 40°N as the dividing line between them. NOAA Fisheries scientists in collaboration with the University of San Diego and Texas A&M University examined the daily rings in otoliths of 126 albacore from both regions to determine, age, growth rates and hatching dates. Overall, fish from the southern region were larger than those in the north as reported in other studies. Calculated age data reveal that the size differences were primarily due to differences in age, although albacore from the southern population were significantly larger than fish from the north at the same age indicating a faster growth rate over some time period. Results also showed that fish from both regions had protracted hatch dates from February-September with a peak from April-July and no significant difference between the two purported substocks.

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). Mean otolith $\delta^{13}C$ and $\delta^{15}N$ values from the south showed enrichment compared to northern samples. The $\delta^{13}C$ values show distinct carbon sources being utilized by two potentially separate substocks with limited mixing, while $\delta^{15}N$ values are different but fall short of indicating distinct trophic levels. These preliminary findings support previous studies that have shown limited regional mixing of albacore in the EPO.

Albacore distribution and environmental effects – NOAA Fisheries scientists, in collaboration with scientists of Canada's Department of Fisheries and Oceans (DFO) are examining the influence of the North Pacific Current on the spatial distribution and availability of North Pacific albacore in order to improve the development of abundance indices for albacore in the Northeast Pacific Ocean. One study examines the influence of subtropical fronts on the spatial distribution of albacore in the Northeast Pacific over the past 30 years by relating albacore catch-per-unit-effort (CPUE) from U.S. and Canadian logbooks with subtropical fronts derived from an analysis of SST gradients using an improved version of the Cayula-Cornillion frontal detection algorithm. The results suggest that areas with high albacore catch-per-unit-effort (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 interannual scale, with the exception of several years with limited fishery data in the NPTZ due to changes in fishery operations.

Another study examines coastal upwelling fronts as key habitat for albacore in the Northeast Pacific Ocean. 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 interannual 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.

Fishery-induced changes in the subtropical Pacific pelagic ecosystem size structure – NOAA Fisheries analyzed a 16-year (1996–2011) time series of catch and effort data for 23 species with mean weights ranging from 0.8 kg to 224 kg, recorded by observers in the Hawaii-based deep-set longline fishery. Over this time period, domestic fishing effort, as numbers of hooks set in the core Hawaii-based fishing ground, has increased fourfold. The standardized aggregated annual catch rate for 9 small (<15 kg) species increased about 25% while for 14 large species (>15 kg) it decreased about 50% over the 16-year period. A size-based ecosystem model for the subtropical Pacific captures this pattern well as a response to increased fishing effort. Further, the model projects a decline in the abundance of fishes larger than 15 kg results in an increase in abundance of animals from 0.1 to 15 kg but with minimal subsequent cascade to sizes smaller than 0.1 kg. These results suggest that size-based predation plays a key role in structuring the subtropical ecosystem. These changes in ecosystem size structure show up in the fishery in various ways. The non-commercial species lancetfish (mean weight 7 kg) has now surpassed the target species, bigeye tuna, as the species with the highest annual catch rate. Based on the increase in snake mackerel (mean weight 0.8 kg) and lancetfish catches, the discards in the fishery are estimated to have increased from 30 to 40% of the total catch (Polovina and Woodworth, 2013).

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. To minimize interactions with species of concern, the deep-set gear was designed to fish below the thermocline (270 to 350m) during daylight hours. 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 were conducted in 2013 to investigate alternative configurations (i.e., gear modification, bait presentation) and reduce the probability of lost gear. These data will be used in 2014 on trials with cooperative fisher platforms to assess the domestic market niche for buoy caught swordfish.

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 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.

Growth and Maximum Size of Tiger Sharks in Hawaii – Tiger sharks (*Galecerdo cuvier*) are apex predators characterized by their broad diet, large size and rapid growth. Tiger shark maximum size is typically between 380 & 450 cm Total Length (TL), with a few individuals reaching 550 cm TL, but the maximum size of tiger sharks in Hawaii waters remains uncertain. A previous study suggested tiger sharks grow rather slowly in Hawaii compared to other regions, but this may have been an artifact of the method used to estimate growth (unvalidated vertebral ring counts) compounded by small sample size and narrow size range. Since 1993, the University of Hawaii and NOAA has conducted a research program aimed at elucidating tiger shark biology, and to date 420 tiger sharks have been tagged and 50 recaptured (Meyer et al., 2014). All recaptures were from Hawaii except a single shark recaptured off Isla Jacques Cousteau (24° 13’17”N 109°52’14”W), in the southern Gulf of California (minimum distance between tag and recapture sites = approximately 5,000 km), after 366 days at liberty (DAL). These empirical mark-recapture data were used to estimate growth rates and maximum size for tiger sharks in Hawaii. Tiger sharks in Hawaii were found to grow twice as fast as previously thought, on average reaching 340 cm TL by age 5, and attaining a maximum size of 403 cm TL. The model indicates the fastest growing individuals attain 400 cm TL by age 5, and the largest reach a maximum size of 444 cm TL. The largest shark captured during the study was 464 cm TL but individuals >450 cm TL were extremely rare (0.005% of sharks captured). It was concluded that tiger shark growth rates and maximum sizes in Hawaii are generally consistent with those in other regions, and hypothesized that a broad diet may help them to achieve this rapid growth by maximizing prey consumption rates.

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 conducted a study to examine the effectiveness of illuminating gillnets with ultraviolet (UV) light-emitting diodes for reducing green sea turtle (*Chelonia mydas*) interactions (Wang et al., 2013). The mean sea turtle capture rate was found to be reduced by 39.7% in UV-illuminated nets compared with nets without illumination. In collaboration with commercial, fishermen, UV net illumination in a bottom-set gillnet fishery in Baja California, Mexico was tested. No difference was found in overall target fish catch rate or market value between net types. These findings suggest that UV net illumination may have applications in coastal and pelagic gillnet fisheries to reduce sea turtle bycatch.

Work has expanded to other gillnet fisheries in Peru, Brazil, Chile, and Indonesia. Preliminary results from Northern Peru 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. 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.

In a NOAA study in the North Pacific, the likelihood of sea turtle mortality as a result of interactions with longline fishing gear was estimated based on satellite telemetry data, such as the number of days an animal was successfully tracked, or days at liberty (DAL) and dive depth data, as well as anatomical hooking locations (Swimmer et al., 2013).

Pop-up satellite archival tags were deployed on 29 loggerhead sea turtles (*Caretta caretta*) caught by the North Pacific US-based pelagic longline fishery operating from California and

Hawaii between 2002 and 2006. Loggerhead turtles were categorized by observers as shallow-hooked (55%) if the animal was entangled in the line or the hook was in the flipper, jaw or mouth and could be removed, or deep-hooked (45%) if the hook was ingested and could not be removed. The vertical movements of turtles were used to infer potential mortalities. Of the 25 tags that reported data, the DAL ranged from 3 to 243 days (mean =68 days). The DAL was shorter (by nearly 50%) for shallow-hooked (mean=48 days, range: 3 to 127) compared to deep-hooked turtles (mean=94 days, range: 5 to 243), but these changes were not statistically significant (P =0.0658).

Although aspects of these analyses may be considered speculative, these data provide empirical evidence to indicate that deep-hooking is not linked to shorter DAL. DAL, anatomical hooking location, and gear removal were evaluated with inferences about the extent of injuries and rates of infection to estimate an overall post-release mortality rate of 28% (95% bootstrap CI: 16–52%). This range of estimates is consistent with those used to shape some US 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.

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). In this study, satellite transmitters (PTT) were deployed on juvenile loggerheads 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 are in the southwestern Atlantic Ocean.

A model of loggerhead turtle habitat and movement in the North Pacific – Habitat preferences for juvenile loggerhead turtles (*Caretta caretta*) in the North Pacific were investigated with data from two several-year long tagging programs, using 224 satellite transmitters deployed on wild and captive-reared turtles (Abecassis et al., 2013). Animals ranged between 23 and 81 cm in straight carapace length. Tracks were used to investigate changes in temperature preferences and speed of the animals with size. Average sea surface temperatures along the tracks ranged from 18 to 23°C. Bigger turtles generally experienced larger temperature ranges and were encountered in warmer surface waters. Seasonal differences between small and big turtles suggest that the larger ones dive deeper than the mixed layer and subsequently target warmer surface waters to rewarm. Average swimming speeds were under 1 km/h and increased with size for turtles bigger than 30 cm. However, when expressed in body lengths per second (bl s^{-1}), smaller turtles showed much higher swimming speeds (>1 bl s^{-1}) than bigger ones (0.5 bl s^{-1}). Temperature and speed values at size estimated from the tracks were used to parameterize a habitat-based Eulerian model to predict areas of highest probability of presence in the North Pacific. The model-generated habitat index generally matched the tracks closely, capturing the north-south movements of tracked animals, but the model failed to replicate observed east-west movements, suggesting temperature and foraging preferences are not the only factors driving large-scale loggerhead movements. Model outputs could inform potential bycatch reduction strategies.

11.5 Research on Bycatch and Fishing Technology – PELAGIC SHARKS

Redistribution of longline hooks to reduce shark bycatch – The interspecific preferences of fishes for different depths and habitats suggest fishers could avoid unwanted catches of some species while still effectively targeting other species. In pelagic longline fisheries, albacore (*Thunnus alalunga*) are often caught in relatively cooler, deeper water (>100 m) than many species of conservation concern (e.g., sea turtles, billfishes, and some sharks) that are caught in shallower water (<100 m). From 2007 to 2011, this study examined the depth distributions of hooks for 1154 longline sets (3,406,946 hooks) and recorded captures by hook position on 2642 sets (7,829,498 hooks) in the American Samoa longline fishery (Watson and Bigelow, 2014). Twenty-three percent of hooks had a settled depth <100 m. Individuals captured in the 3 shallowest hook positions accounted for 18.3% of all bycatch. The study analyzed hypothetical impacts for 25 of the most abundant species caught in the fishery by eliminating the 3 shallowest hook positions under scenarios with and without redistribution of these hooks to deeper depths. Distributions varied by species: 45.5% (n = 10) of green sea turtle (*Chelonia mydas*), 59.5% (n = 626) of shortbill spearfish (*Tetrapturus angustirostris*), 37.3% (n = 435) of silky shark (*Carcharhinus falciformis*), and 42.6% (n = 150) of oceanic whitetip shark (*C. longimanus*) were caught on the 3 shallowest hooks. Eleven percent (n = 20,435) of all tuna and 8.5% (n = 10,374) of albacore were caught on the 3 shallowest hooks. Hook elimination reduced landed value by 1.6–9.2%, and redistribution of hooks increased average annual landed value relative to the status quo by 5–11.7%. Based on these scenarios, redistribution of hooks to deeper depths may provide an economically feasible modification to longline gear that could substantially reduce bycatch for a suite of vulnerable species. The results suggest that this method may be applicable to deep-set pelagic longline fisheries worldwide.

11.6 Research on Bycatch and Fishing Technology – CETACEAN

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 2007-2011 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, 50 cetacean interactions were observed from 2007 to 2011; most involved false killer whales (48.0%), resulted in death or serious injury (73.5%), and occurred outside the U.S. exclusive economic zone, or EEZ (54.0%). In the Hawaii shallow-set fishery, 46 cetacean interactions were observed from 2007 to 2011; most involved Risso's dolphins (45.7%), resulted in death or serious injury (77.2%), and occurred outside the U.S. EEZ (91.3%). In the American Samoa deep-set fishery, 14 cetacean interactions were observed from 2007 to 2011; most involved rough-toothed dolphins (42.9%), resulted in death or serious injury (92.9%), and occurred within the U.S. EEZ (85.7%).

11.7 Relevant Publications

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