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

WCPFC-SC15-AR/CCM-27

UNITED STATES OF AMERICA

2019 Annual Report to the Western and Central Pacific Fisheries Commission

United States of America

PART I. INFORMATION ON FISHERIES, RESEARCH, AND STATISTICS [1]

(Through 2018)

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 2016	**YES**
If no, please indicate the reason(s) and intended actions:	

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 the United States and U.S.-associated Participating Territory fisheries in the Western and Central Pacific Fisheries Commission (WCPFC) Statistical Area in 2018 are dominated by the catch of the purse seine fishery. Preliminary 2018 purse seine catch estimates total 167,202 t of skipjack, 20,558 t of yellowfin, and 6,958 t of bigeye tuna. The estimate of total U.S. purse-seine catch in 2017 has been revised to 166,561 t from last year's preliminary estimate. Longline retained catch decreased slightly in 2018. Total

[1] PIFSC Data Report DR-19-xx.
Issued xx February 2019.

longline catch in the North Pacific Ocean (NPO) in 2018 declined from a high of 13,147 t in 2017 to 12,433 t in 2018. Longline retained catch by American Samoa in the South Pacific Ocean (SPO) continued a decreasing trend and was 1,840 t in 2018 (the lowest level recorded during the 2014–2018 time period). Bigeye tuna longline catch by the United States and its Territories decreased to 5,230 t in 2018. Albacore longline catch by the United States and its Territories decreased slightly to 1,416 t in 2018. Excluding catch attributed to the U.S. Participating Territories (i.e., American Samoa, Commonwealth of the Northern Mariana Islands, and Guam), longline catch of bigeye tuna by U.S. longline vessels increased to 3,392 t in 2018. Total bigeye tuna catch estimates by the U.S. longline fishery were below the limit of 3,554 t for 2018. The annual bigeye catch limits were 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, CMM 2013-01 in 2014, CMM 2014-01 in 2015, CMM 2015-01 in 2016, CMM 2016-01 in 2017, and CMM 2017-01 in 2018.

The longline catch of swordfish by the United States and its Territories decreased to 631 t in 2018. 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 150 vessels in 2018, while there were 33 purse seine vessels in 2018.

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 2018, socio-economic studies addressed impacts of bigeye tuna catch limits on longline fishery, economics of Hawaii's small boat fishery, and social vulnerability indicators of fishing communities in the Pacific region. 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).

NOAA Fisheries biological and oceanographic research on tunas, billfishes, and sharks addressed use of observer data and the collection of biological samples to support stock assessments, the effects of biological, economic, and management factors on pelagic stocks, modelling age-based movement behavior, and migratory patterns of Pacific bluefin tuna (*Thunnus orientalis*). Oceanographic studies in the central North Pacific focused on climate change impacts and ocean acidification. Bycatch mitigation studies focused on the longline fishery and included research on sea turtles, pelagic sharks, and cetaceans.

Tabular Annual Fisheries Information

This report presents estimates of annual catches of tuna, billfish, and other highly migratory species (HMS), and vessel participation during 2014–2018 for fisheries of the United States and its Participating Territories operating in the western and central Pacific Ocean (WCPO). All statistics for 2018 are provisional. Statistics for 2017 have been updated from those reported provisionally in the submission of 2016–2017 U.S. fishery statistics for the WCPO (NOAA, NMFS 2017). Statistics for 2014–2016 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. 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.

The purse seine fishery remains the largest U.S. fishery in terms of total catch. It accounts for about 94% of the total catch of HMS by the United States and its Participating Territories in the WCPO. The longline, tropical troll, handline and albacore troll fisheries account for 5.1%, 0.3%, 0.8%, and 0.2% of the total catch, respectively.

Fisheries of the United States and its Participating Territories for tunas, billfishes and other HMS produced an estimated catch of 209,977 t in 2018 (Table 1a), increasing from 182,540 t in 2017 (Table 1b). The catch consisted primarily of skipjack tuna (77%), yellowfin tuna (15%), bigeye tuna (5%), and albacore (1%). Catches of skipjack tuna decreased in 2018 due to lower purse seine catches, but bigeye and yellowfin tuna catch increased from the previous year due to higher purse seine catches.

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 2018 (preliminary). Totals may not match sums of values due to rounding to the nearest metric ton (< 0.5 t = 0). Purse seine species composition estimates have not been adjusted for 2018.

	Purse seine	Longline	Albacore troll	Tropical troll	Handline	Total
Albacore (ALB), North Pacific		70	16	1	20	107
Albacore (ALB), South Pacific		1,416	459			1,875
Bigeye tuna (BET)	6,958	5,230		27	124	12,339
Pacific bluefin tuna (PBF)		1				1
Skipjack tuna (SKJ)	167,202	187		495	5	167,889
Yellowfin tuna (YFT)	20,558	2,324		587	337	23,806
Other tuna (TUN KAW FRI)				4	1	5
TOTAL TUNAS	194,719	9,227	475	1,114	487	206,022
Black marlin (BLM)	3			2		5
Blue marlin (BUM)	5	598		165	3	771
Sailfish (SFA)		11		4		15
Spearfish (SSP)		187		10		197
Striped marlin (MLS), North Pacific	0	375		11		386
Striped marlin (MLS), South Pacific	0	0				1
Other marlins (BIL)		1				1
Swordfish (SWO), North Pacific		631		1	3	635
Swordfish (SWO), South Pacific		6				6
TOTAL BILLFISHES	8	1,810		193	6	2,017
Blue shark (BSH)		3				3
Mako shark (MAK)		42				42
Thresher sharks (THR)		2				2
Other sharks (SKH OCS FAL SPN TIG CCL)						
TOTAL SHARKS		47				47
Mahimahi (DOL)	2	172		316	9	498
Moonfish (LAP)		449				449
Oilfish (GEP)		112		0		112
Pomfrets (BRZ)		298		0	9	307
Wahoo (WAH)	5	314		183	6	507
Other fish (PEL PLS MOP TRX GBA ALX GES RRU DOT)	5	4		7		17
TOTAL OTHER	12	1,349		506	24	1,890
TOTAL	**194,739**	**12,433**	**475**	**1,813**	**517**	**209,977**

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 2017 (preliminary). Totals may not match sums of values due to rounding to the nearest metric ton (< 0.5 t = 0). Purse seine species composition estimates have not been adjusted for 2017.

Species and FAO code	Purse seine	Longline	Albacore troll	Tropical troll	Handline	Total
Albacore (ALB), North Pacific		90	336		35	462
Albacore (ALB), South Pacific	0	1,411	468			1,880
Bigeye tuna (BET)	3,267	5,357		38	106	8,768
Pacific bluefin tuna (PBF)		2	0			2
Skipjack tuna (SKJ)	140,081	255		392	6	140,735
Yellowfin tuna (YFT)	23,197	2,600		473	400	26,669
Other tuna (TUN KAW FRI)				16	2	18
TOTAL TUNAS	166,545	9,717	805	918	549	178,533
Black marlin (BLM)	2	1		2		5
Blue marlin (BUM)	4	612		155	4	774
Sailfish (SFA)		12		2		14
Spearfish (SSP)		234		9		243
Striped marlin (MLS), North Pacific		330		6		336
Striped marlin (MLS), South Pacific	0	2				2
Other marlins (BIL)		1				1
Swordfish (SWO), North Pacific		967			6	973
Swordfish (SWO), South Pacific		6				6
TOTAL BILLFISHES	6	2,164		174	10	2,354
Blue shark (BSH)		1				1
Mako shark (MAK)		36				36
Thresher sharks (THR)		5				5
Other sharks (SKH OCS FAL SPN TIG CCL)		0		1		1
TOTAL SHARKS		42		1		43
Mahimahi (DOL)	1	180		228	9	418
Moonfish (LAP)		322				322
Oilfish (GEP)		116				116
Pomfrets (BRZ)		300		0	15	315
Wahoo (WAH)	5	304		110	4	422
Other fish (PEL PLS MOP TRX GBA ALX GES RRU DOT)	4	3		9		16
TOTAL OTHER	10	1,225		347	28	1,610
TOTAL	**166,561**	**13,147**	**805**	**1,441**	**587**	**182,540**

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 2016 (preliminary). Totals may not match sums of values due to rounding to the nearest metric ton (< 0.5 t = 0). Purse seine species composition estimates have not been adjusted for 2016.

Species and FAO code	Purse seine	Longline	Albacore troll	Tropical troll	Handline	Total
Albacore (ALB), North Pacific		243		1	24	268
Albacore (ALB), South Pacific		1,517	145			1,662
Bigeye tuna (BET)	4,711	6,216		34	183	11,144
Pacific bluefin tuna (PBF)		1	0			1
Skipjack tuna (SKJ)	178,284	306		406	5	179,001
Yellowfin tuna (YFT)	18,162	1,654		535	269	20,620
Other tuna (TUN KAW FRI)		0		6	2	8
TOTAL TUNAS	201,156	9,936	145	983	483	212,703
Black marlin (BLM)	2	1		2		5
Blue marlin (BUM)	3	506		161	2	672
Sailfish (SFA)		19		2		21
Spearfish (SSP)		281		16		297
Striped marlin (MLS), North Pacific		327		12		339
Striped marlin (MLS), South Pacific		2				2
Other marlins (BIL)		1				1
Swordfish (SWO), North Pacific		639			4	643
Swordfish (SWO), South Pacific		6				6
TOTAL BILLFISHES	5	1,782		193	6	1,986
Blue shark (BSH)		1				1
Mako shark (MAK)		46			1	47
Thresher sharks (THR)		4				4
Other sharks (SKH OCS FAL SPN TIG CCL)		0		1		1
TOTAL SHARKS		51		1	1	53
Mahimahi (DOL)	1	234		369	9	613
Moonfish (LAP)		380				380
Oilfish (GEP)		191		0		191
Pomfrets (BRZ)	0	386		1	16	402
Wahoo (WAH)	2	403		145	5	555
Other fish (PEL PLS MOP TRX GBA ALX GES RRU DOT)	5	9		2		15
TOTAL OTHER	7	1,602		516	30	2,156
TOTAL	**201,168**	**13,371**	**145**	**1,693**	**520**	**216,898**

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 2015 (updated). Totals may not match sums of values due to rounding to the nearest metric ton (< 0.5 t = 0). Purse seine species composition estimates have not been adjusted for 2015.

Species and FAO code	Purse seine	Longline	Albacore troll	Tropical troll	Handline	Total
Albacore (ALB), North Pacific		217	0	2	62	281
Albacore (ALB), South Pacific		1,855	156			2,011
Bigeye tuna (BET)	1,595	5,840		59	202	7,696
Pacific bluefin tuna (PBF)		6				6
Skipjack tuna (SKJ)	219,550	254		401	5	220,210
Yellowfin tuna (YFT)	17,019	1,041		558	401	19,019
Other tuna (TUN KAW FRI)		0		15	1	16
TOTAL TUNAS	238,164	9,213	156	1,035	671	249,239
Black marlin (BLM)	3	0		4		7
Blue marlin (BUM)	6	526		197	3	732
Sailfish (SFA)		15		3		18
Spearfish (SSP)		204		11		215
Striped marlin (MLS), North Pacific		414		11		425
Striped marlin (MLS), South Pacific		3				3
Other marlins (BIL)	1	1				2
Swordfish (SWO), North Pacific		690		1	5	696
Swordfish (SWO), South Pacific		8				8
TOTAL BILLFISHES	10	1,862		227	8	2,107
Blue shark (BSH)		1				1
Mako shark (MAK)		39				39
Thresher sharks (THR)		6			1	7
Other sharks (SKH OCS FAL SPN TIG CCL)				1		1
TOTAL SHARKS		45		1	1	47
Mahimahi (DOL)	1	226		404	13	644
Moonfish (LAP)		336				336
Oilfish (GEP)		185				185
Pomfrets (BRZ)		419			13	432
Wahoo (WAH)	1	340		203	9	554
Other fish (PEL PLS MOP TRX GBA ALX GES RRU DOT)	4	9		1		14
TOTAL OTHER	6	1,515		608	35	2,164
TOTAL	**238,180**	**12,635**	**156**	**1,871**	**715**	**253,557**

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 2014. Totals may not match sums of values due to rounding to the nearest metric ton (< 0.5 t = 0). Purse seine species composition estimates have not been adjusted for 2014.

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		1,430	445			1,875
Bigeye tuna (BET)	2,802	5,141		143	206	8,292
Pacific bluefin tuna (PBF)		3				3
Skipjack tuna (SKJ)	269,243	291		370	8	269,912
Yellowfin tuna (YFT)	40,959	1,021		582	385	42,947
Other tuna (TUN KAW FRI)				14	2	16
TOTAL TUNAS	313,004	8,072	445	1,112	650	323,283
Black marlin (BLM)	5	1		3		9
Blue marlin (BUM)	4	486		160	4	654
Sailfish (SFA)		17		1		18
Spearfish (SSP)		175		8		183
Striped marlin (MLS), North Pacific		357		12		369
Striped marlin (MLS), South Pacific	1	7				8
Other marlins (BIL)	1					1
Swordfish (SWO), North Pacific		880		1	7	888
Swordfish (SWO), South Pacific		10				10
TOTAL BILLFISHES	11	1,932		185	11	2,139
Blue shark (BSH)		1				1
Mako shark (MAK)		37				37
Thresher sharks (THR)		6		1		7
Other sharks (SKH OCS FAL SPN TIG CCL)				1		1
TOTAL SHARKS		43		2		45
Mahimahi (DOL)	2	263		535	26	827
Moonfish (LAP)		408				408
Oilfish (GEP)		182				182
Pomfrets (BRZ)		392		0	19	411
Wahoo (WAH)	3	336		259	10	608
Other fish (PEL PLS MOP TRX GBA ALX GES RRU DOT)	2	6		1		10
TOTAL OTHER	7	1,587		796	55	2,445
TOTAL	**313,022**	**11,635**	**445**	**2,095**	**716**	**327,913**

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 2014–2018. Totals may not match sums of values due to rounding to the nearest metric ton (< 0.5 t = 0). Catch in North Pacific Ocean = NPO and catch in South Pacific Ocean = SPO.

	U.S. in NPO					CNMI in NPO					Guam in NPO		American Samoa in NPO					American Samoa in SPO					Total		
	2018	2017	2016	2015	2014	2018	2017	2016	2015	2014	2016	2015	2018	2017	2016	2015	2014	2018	2017	2016	2015	2014	2018	2017	2016
Vessels	136	136	133	135	140	121	119	117	117	109	118	112	113	118	23	22	17	13	15	20	21	23	150	150	151
Species																									
Albacore, NPO	59	74	208	197	178								11	17	34	19	8						70	90	243
Albacore, SPO																		1,416	1,411	1,517	1,855	1,430	1,416	1,411	1,517
Bigeye tuna	3,392	2,948	3,747	3,427	3,823	993	999	879	999	1,000	932	856	798	1,346	586	441	236	47	65	72	116	82	5,230	5,357	6,216
Pacific bluefin tuna	0	1	0										0	0				1	2	0	6	3	1	2	1
Skipjack tuna	105	156	186	176	167								15	36	26	11	9	67	64	94	67	116	187	255	306
Yellowfin tuna	1,868	1,750	1,093	681	567								209	312	175	105	30	246	538	386	255	424	2,324	2,600	1,654
Other tuna			0	0											0										0
TOTAL TUNA	**5,424**	**4,928**	**5,234**	**4,482**	**4,734**	**993**	**999**	**879**	**999**	**1,000**	**932**	**856**	**1,034**	**1,710**	**821**	**577**	**283**	**1,776**	**2,079**	**2,069**	**2,299**	**2,055**	**9,227**	**9,717**	**9,936**
																									0
Black marlin		0	1	0	1									0		0	0		0					1	1
Blue marlin	529	485	419	445	428								38	87	57	55	31	32	39	30	25	28	598	612	506
Sailfish	9	9	15	11	15								1	2	2	2	0	1	1	2	2	2	11	12	19
Spearfish	171	205	251	188	163								15	27	28	15	11	1	2	2	1	1	187	234	281
Striped marlin, NPO	332	280	280	378	343								44	50	48	36	14						375	330	327
Striped marlin, SPO																		1	2	2	3	7	0	2	2
Other marlins	1	1	1	1										0		0							1	1	1
Swordfish, NPO	590	918	596	665	865								41	49	43	24	15						631	967	639
Swordfish, SPO																		6	6	6	8	10	6	6	6
TOTAL BILLFISH	**1,631**	**1,899**	**1,562**	**1,688**	**1,813**								**138**	**215**	**179**	**133**	**72**	**41**	**50**	**41**	**40**	**47**	**1,810**	**2,164**	**1,782**
Blue shark															0			3	1	1	1	1	3	1	1
Mako shark	36	30	37	35	35								5	5	9	4	2	0	0	0			42	36	46
Thresher	2	2	3	5	5									0	0	1	1	1	2	0			2	5	4
Other sharks		0	0																0	0				0	0
Oceanic whitetip shark																				0					
Silky shark		0																0					0	0	
Hammerhead shark			0																						0
Tiger shark																									
Porbeagle																									
TOTAL SHARKS	**38**	**32**	**40**	**40**	**40**								**5**	**6**	**10**	**5**	**2**	**4**	**3**	**1**	**1**	**1**	**47**	**42**	**51**
Mahimahi	155	143	202	199	236								14	23	28	21	15	2	14	4	6	12	172	180	234
Moonfish	390	257	304	279	385								58	63	74	55	22	1	1	2	2	1	449	322	380
Oilfish	98	94	160	165	169								14	22	29	20	13	0	0	2	0	0	112	116	191
Pomfret	265	260	339	380	373								32	40	46	39	18	0	0	0	0	0	298	300	386
Wahoo	264	217	309	256	243								34	37	47	27	18	16	49	47	58	75	314	304	403
Other fish	4	2	7	7	6								0	0	1	1	0	0	0	1	1	0	4	3	9
TOTAL OTHER	**1,178**	**975**	**1,322**	**1,285**	**1,411**								**153**	**185**	**224**	**164**	**87**	**19**	**66**	**55**	**66**	**89**	**1,349**	**1,225**	**1,602**
GEAR TOTAL	**8,271**	**7,834**	**8,158**	**7,495**	**7,999**	**993**	**999**	**879**	**999**	**1,000**	**932**	**856**	**1,330**	**2,116**	**1,235**	**878**	**445**	**1,840**	**2,198**	**2,167**	**2,405**	**2,192**	**12,433**	**13,147**	**13,371**

* Pacific bluefin tuna catches are reported for American Samoa (NPO), however the species may be misidentified. There were no catch attributions to Guam in 2014, 2017, and 2018.

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 2014–2018. Totals may not match sums of values due to rounding to the nearest metric ton (< 0.5 t = 0). NPO = North Pacific Ocean and SPO = South Pacific Ocean.

	Hawaii					Guam					CNMI					American Samoa					Total Tropical Troll				
	2018	2017	2016	2015	2014	2018	2017	2016	2015	2014	2018	2017	2016	2015	2014	2018	2017	2016	2015	2014	2018	2017	2016	2015	2014
Vessels	1,380	1,410	1,478	1,576	1,649	398	408	428	372	447	8	8	9	9	19	7	8	12	11	22	1,793	1,834	1,927	1,968	2,137
Species																									
Albacore, North Pacific	1	-	1	2	3																1		1	2	3
Albacore, South Pacific																									
Bigeye tuna	27	37	34	59	143												1				27	38	34	59	143
Pacific bluefin tuna																									
Skipjack tuna	82	97	117	96	78	277	185	198	273	177	132	107	87	29	109	4	3	4	3	6	495	392	406	401	370
Yellowfin tuna	554	431	464	492	555	24	27	58	51	15	4	8	9	13	8	5	6	4	2	3	587	473	535	558	582
Other tunas	3	3	4	15	12	0	0	0		0	1	13	1		2	0	0	1			4	16	6	15	14
TOTAL TUNAS	**667**	**568**	**620**	**664**	**791**	**301**	**213**	**256**	**324**	**192**	**138**	**127**	**97**	**42**	**120**	**9**	**10**	**10**	**5**	**9**	1,114	918	983	1,035	1,112
Black marlin	2	2	2	4	3											0					2	2	2	4	3
Blue marlin	152	139	141	179	144	11	14	20	17	13	1	1			3	1	0		1	1	165	155	161	197	160
Sailfish	2	2	2	2	1	2				0					0				1	0	4	2	2	3	1
Spearfish	10	9	16	11	8																10	9	16	11	8
Striped marlin, N. Pacific	11	6	12	11	12																11	6	12	11	12
Striped marlin, S. Pacific																									
Other billfish																									
Swordfish, North Pacific	1			1	1																1			1	1
Swordfish, South Pacific																									
TOTAL BILLFISHES	**178**	**158**	**173**	**208**	**169**	**13**	**14**	**20**	**17**	**13**	**1**	**1**			**3**	**1**	**0**		**2**	**1**	193	174	193	227	185
Blue shark																									
Mako shark																									
Thresher sharks					1																				1
Other sharks		1	1	1	1																	1	1	1	1
TOTAL SHARKS		**1**	**1**	**1**	**2**																	**1**	**1**	**1**	**2**
Mahimahi	250	189	253	329	408	40	18	79	72	87	25	20	36	3	39	0	1	1		1	316	228	369	404	535
Moonfish																									
Oilfish						0												0			0		0		
Pomfrets						0	0	1					0		0			0			0	0	1		0
Wahoo	136	84	122	189	211	44	21	15	14	42	3	4	2		5	1	0	6	0	0	183	110	145	203	259
Other pelagics		1		1	1	6	6			0	0	1				0	1	2			7	9	2	1	1
TOTAL OTHER	**386**	**274**	**375**	**519**	**620**	**90**	**46**	**95**	**86**	**130**	**28**	**26**	**38**	**3**	**44**	**1**	**2**	**8**	**0**	**1**	**506**	**347**	**516**	**608**	**796**
GEAR TOTAL	**1,231**	**1,001**	**1,169**	**1,392**	**1,582**	**404**	**273**	**371**	**427**	**335**	**167**	**155**	**135**	**45**	**167**	**11**	**12**	**18**	**7**	**11**	**1,813**	**1,441**	**1,693**	**1,871**	**2,095**

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 2014–2018, to fulfill the reporting requirements of WCPFC CMM 2009-03.

	U.S.-flagged Vessels South of 20° S	
Year	Catch (t) by all	Number of vessels fishing for swordfish
2018	0	0
2017	0	1
2016	0	0
2015	< 1	0
2014	0	0

Note: The catch is only reported for years when 3 or more vessels fished in the area, although the number of vessels fishing for swordfish may be less than the number that fished. The United States 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 2014 to 2018. Data for 2018 are preliminary.

	2018	2017	2016	2015	2014
Purse seine	33	34	37	39	40
Longline (N Pac-based) [1]	136	136	133	135	140
Longline (American Samoa-based)	113	118	23	22	17
Total U.S. Longline [2]	150	150	151	156	162
Albacore troll (N Pac) [3]	4	14		4	3
Albacore troll (S Pac) [3]	12	15	6	7	13
Tropical troll	1,793	1,834	1,907	1,968	2,137
Handline	431	487	475	478	499
Tropical Troll and Handline (combined)[4]	1,910	1,960	2,046	2,057	2,212
TOTAL	**2,105**	**2,159**	**2,263**	**2,259**	**2,427**

[1] Includes Hawaii- and California-based vessels that fished west of 150 W.
[2] Some longline vessels fished in both Hawaii and American Samoa and are counted only once in the Total U.S. Longline.
[3] Some vessels fished on both sides of the equator, and are counted only once in the TOTAL.
[4] Some vessels used both tropical troll and handline gear, but are counted only once in the combined total.

Table 2b. Estimated number of United States and Participating Territories vessels operating in the WCPFC Statistical Area, by gear type, from 2014 to 2017. Data for 2018 are preliminary.

Gear and year	0-50	51-200	201-500	501-1000	1001-1500	1500+
2014 Purse seine					19	21
2015 Purse seine					17	22
2016 Purse seine					15	22
2017 Purse seine					14	20
2018 Purse seine					14	19
2014 Longline	13	149				
2015 Longline	13	143				
2016 Longline	12	139				
2017 Longline	8	142				
2018 Longline	7	143				

	0-50	51-150	150+
2014 Pole and line	1	1	
2015 Pole and line	1	1	
2016 Pole and line	1	1	
2017 Pole and line	1	1	
2018 Pole and line	1	1	
2014 Albacore Troll		9	7
2015 Albacore Troll		6	4
2016 Albacore Troll		5	4
2017 Albacore Troll		11	8
2018 Albacore Troll		10	4

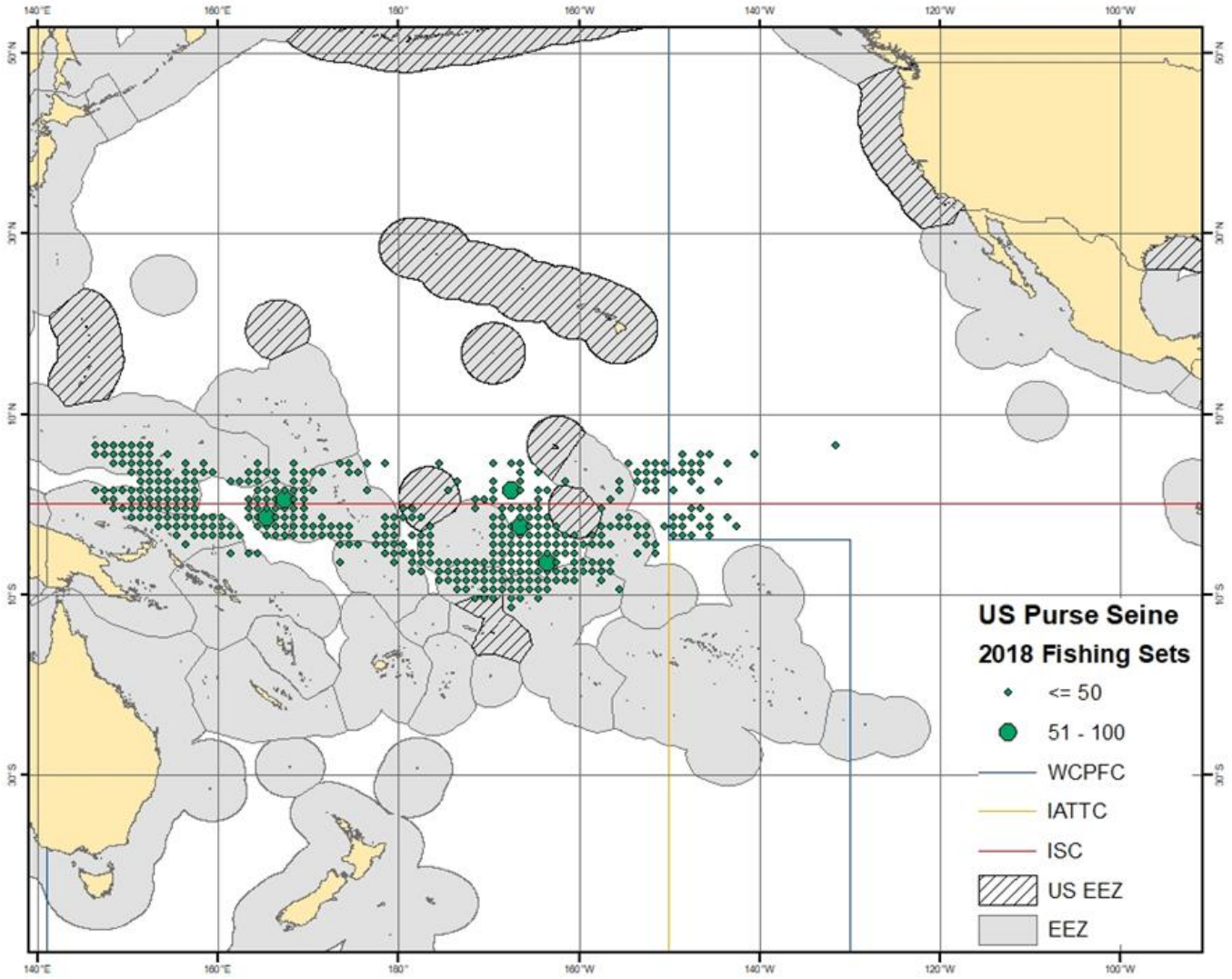

Figure 1. Spatial distribution of fishing effort (fishing sets) reported in logbooks by U.S.-flagged purse seine vessels the Pacific Ocean in 2018 (preliminary data). Effort in some areas is not shown to preserve data confidentiality.

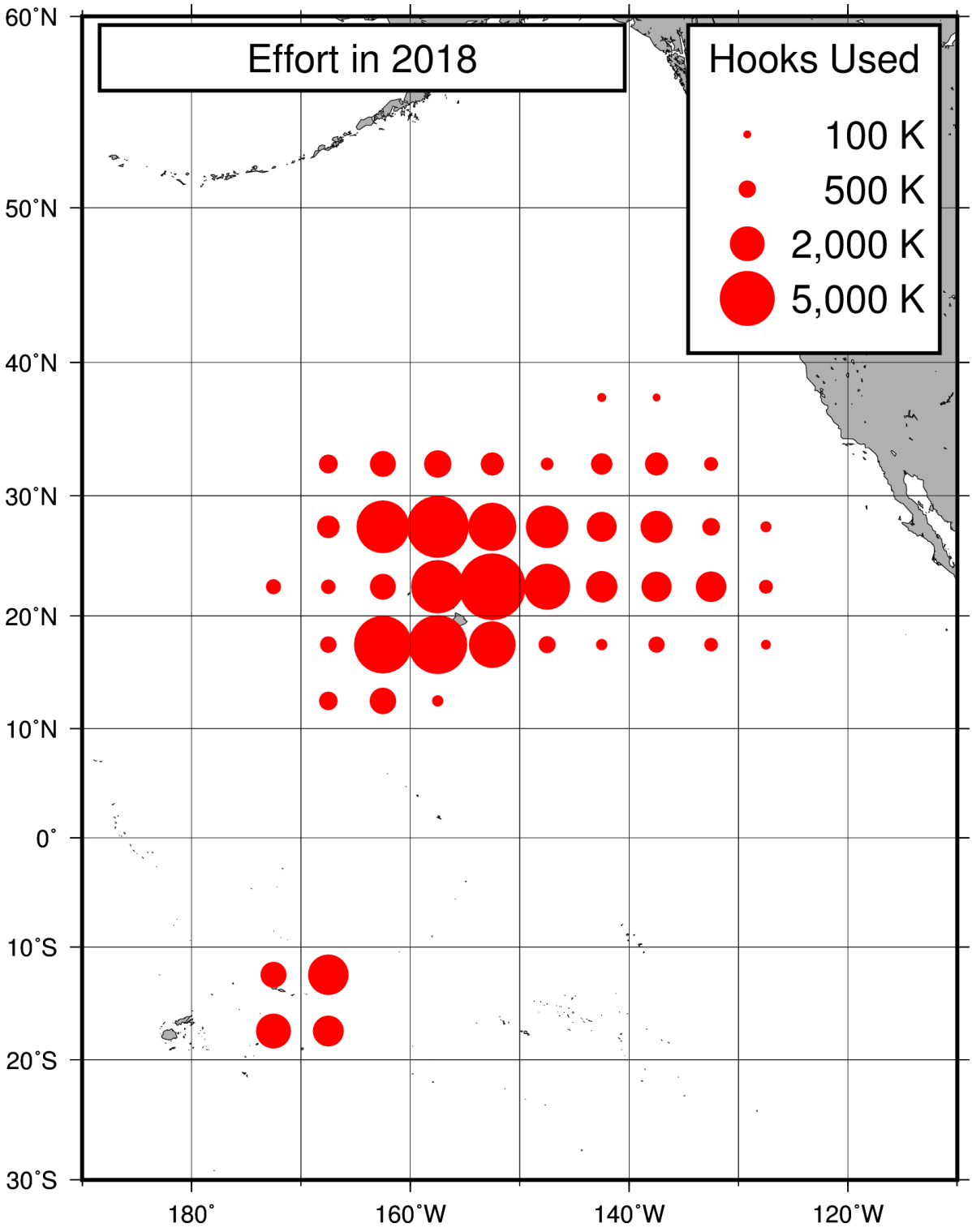

Figure 2a. Spatial distribution of fishing effort (K=1,000 hooks) reported by U.S.-flagged longline vessels in 2018 proportional to effort (preliminary data). Effort in some areas is not shown to preserve data confidentiality.

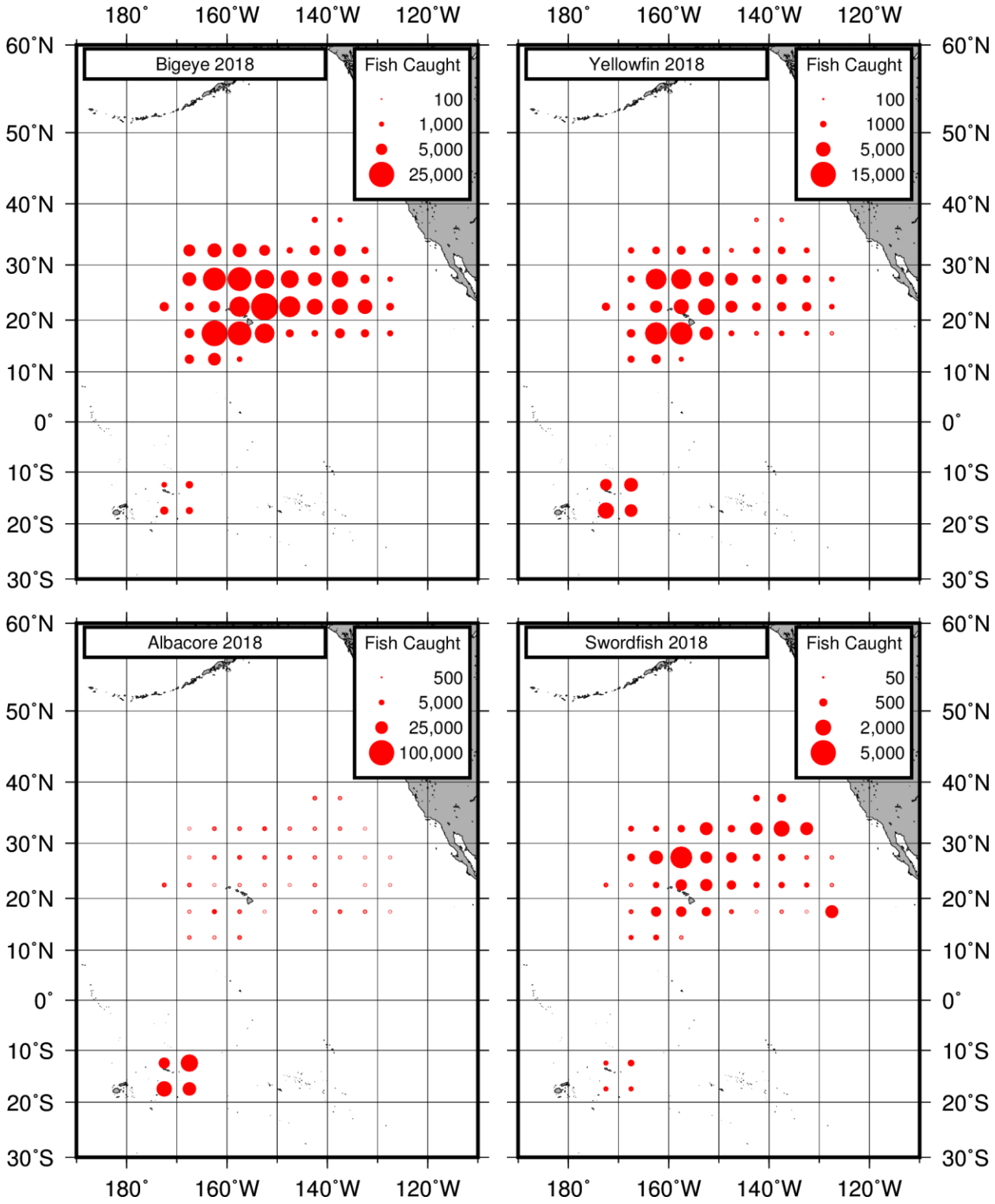

Figure 2b. Spatial distribution of catch by U.S.-flagged longline vessels, in numbers of fish (includes retained and released catch), in 2018 (preliminary data). Catches in some areas are not shown to preserve data confidentiality.

Background

[n/a]

Flag State Reporting of National Fisheries

U.S. Purse seine Fishery

The U.S. purse seine catch of tunas in the WCPO was 194,719 t in 2018 compared to 166,545 t in 2017, 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 5 years (Tables 1a-1e). The number of vessels in 2018 was 33 vessels, 4 less than in 2016 (Table 2a). The fishery continued to operate further eastward, and not as far northward as in the prior years, mainly in areas between 5° N and 15° S latitude and 155° E and 135°W longitude (Figure 1).

U.S. Longline Fisheries

The longline fisheries of the United States 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 2014–2018 ranged from 150 vessels in 2018 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 136 in 2018. Participation in the American Samoa-permitted fleet operating in the South Pacific declined from 23 vessels in 2014 to 13 vessels in 2018. A few vessels occasionally operated in both the Hawaii-permitted and American Samoa-permitted longline fisheries during 2014–2018. Longline catches made outside of the U.S. EEZ in NPO by vessels operating with both American Samoa and Hawaii longline permits and landing their fish in Hawaii belong 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 entries for American Samoa (Table 1f) include 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 in the NPO attributed to American Samoa. Pursuant to the Consolidated and Further Continuing Appropriations Act (CFCAA) of 2011 (Pub. L. 112-55, 125 Stat. 552 et seq.) 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 or Amendment 7 of the Pelagics Fishery Ecosystem Plan, its catch during those periods was attributed to the fishery of American Samoa in the NPO from 2011 to 2012 and 2017 to 2018, to CNMI during 2013 through 2018, and to Guam in 2015 and 2016. Under the Amendment 7 arrangements (2014 through 2018 only bigeye tuna were attributed to the participating territory and all other incidental catch was attributed to the Hawaii-based fishery).

The U.S. longline fishery in the NPO operated mainly from the equator to 40° N latitude and from 120° W to 175° W in 2018 (Figure 2a). The American Samoa-based longline fishery operated mostly from 10° S to 20° S latitude and 165° W to 175° W longitude in 2018 (Figure

2a). 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 longline fishery in the SPO targeted albacore, but also produced a noteworthy amount of yellowfin tuna. Pacific bluefin tuna catches are reported on longline log sheets for the American Samoa fishery, however the species may be misidentified (Tables 1a-1f). The dominant components of the longline catch by the United States and its Territories in 2018 were bigeye tuna, albacore, yellowfin tuna, and swordfish (Table 1a, Figure 2b). The total catch of all species during the past 5 years ranged from a high of 13,371 t in 2016 which decreased to 13,102 t in 2017 and then decreased to a low of 12,433 t in 2018(Tables 1a-1e).

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 (including Territories) varied substantially and fell from a high of 967 t in 2017 to a low of 631 t in 2018. 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 12 out of 15 years since its reopening in 2004.

U.S. Albacore Troll Fisheries

In recent years, participation in the U.S. troll fisheries for albacore in the WCPO has fluctuated greatly. Twelve vessels participated in the South Pacific albacore troll fishery in 2018 compared to 15 vessels in 2017 and nine vessels in 2016 (Table 2). The South Pacific albacore troll fishery operates mostly between 30° S and 45° S latitude and 145° W and 175° W longitude. The catch in this fishery is composed almost exclusively of albacore. The albacore troll catches in the WCPO by both the U.S. North Pacific and South Pacific albacore troll fisheries decreased from 805 t in 2017 to 475 t in 2018 (Tables 1a-1e).

Other Fisheries of the United States and Participating Territories

Other fisheries of the United States 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 United States 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 2,330 t in 2018. The catch was composed primarily of yellowfin tuna, skipjack tuna, bigeye tuna, and mahimahi.

Coastal State Reporting

[n/a]

Socioeconomic Factors and Trends in the Fisheries

Socio-economic Surveys and Analyses

NMFS staff and colleagues have conducted 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.

The Commonwealth of the Northern Mariana Islands fishing community profile. This NOAA Technical Memorandum represents a 2017 update to the Commonwealth of the Northern Mariana Islands as a Fishing Community published by Allen and Amesbury in 2012. This fishing community profile update aspires to provide a comprehensive view of the Commonwealth of the Northern Mariana Islands (CNMI) as a fishing community. The report begins by presenting recent social, economic, and tourism information gathered by the Government Accountability Office (GAO) and the Marianas Visitors Authority in the CNMI. These data are followed by data on four key topics that emerged from interviews conducted by the author in 2016 with the CNMI fishing community. Next, findings from low income fish consumption in 2015 are presented, aggregated at the island level. These data provide the only current estimates of fish consumption on Tinian and Rota. The report concludes by presenting some additional empirical information that supplements the primary data gathered in the profile (Ayers 2018).

Vessel level annual cost-earnings study of the Hawaii offshore handline fishery and the Hawaii small boat commercial fishery .This NOAA report presents an assessment of the annual economic performance of the Hawaii offshore handline fishery and the Hawaii small boat commercial fishery using data collected from the cost-earnings survey of Hawaii small boats in 2014, which was comprised of 1,796 small boat and offshore handline fishermen. Response to the survey was voluntary. Three types of fishermen are included in the analysis; offshore handline fishermen, full-time small boat commercial fishermen, and part-time small boat commercial fishermen. Offshore handline fishermen are defined based on their fishing location and gear usage as described in fishing reports submitted to the State of Hawaii Division of Aquatic Resources (HDAR). Full-time commercial and part-time commercial fishermen are defined based on their self-identified motivations as reported in the 2014 Hawaii Small Boat Economic Survey (Chan and Pan[A] 2019).

Tracking economic performance indicators for small boat fisheries in America Samoa, Guam, and the Commonwealth of the Northern Mariana Islands. This NOAA report presents trends in economic performance indicators for small boat fisheries in American Samoa, Guam, and the Commonwealth of the Northern Mariana Islands (CNMI) from 2009 to 2017. The primary data sources of the economic performance indicators were collected through the Pacific Islands Fisheries Science Center (PIFSC) economic data collection programs' add-on to the boat-based

creel surveys, implemented through collaborative efforts ofthe PIFSC Ocean Synthesis and Human Dimensions Program, the Western Pacific Fisheries Information Network (WPacFIN), and local fisheries agencies in the three island areas that regularly collect fishing catch and effort data through creel surveys. We established the trip-level cost data collection programs in collaboration with existing data collection vehicles that were already gathering fisheries-related data on a continuous basis. The trip cost survey is an add-on to the boat-based creel survey with a voluntary, in-person intercept interview, following the same sampling methodology as the creel survey (Chan and Pan[B] 2019).

Charter fishing in Hawaii: A multi-region analysis of the economic linkages and contributions within and outside Hawaii. This study develops several single- and multi-region input-output models in IMPLAN using the annual expenditure data from a 2012 survey of charter fishing operations in the state of Hawaii. The survey reached out to 207 charter vessel operators, with a response rate of 36%, and collected demographic, trip, catch, and economic information across islands and vessel sizes. Four separate county models are built to observe regional effects, and one state model to observe total state effects. The state model is linked to secondary regions (the mainland west coast made up of Oregon, California, and Washington, as well as the rest of the mainland U.S.) to observe the economic effects occurring outside the state of Hawaii. This is especially relevant to Hawaii because of its dependence on the mainland to supply many of its raw materials and finished products. The multi-region approach allows us to observe spillover effects (effects occurring in the secondary regions in response to a demand in the study region) and feedback effects (further effects that occur in the study region as a result of purchasing goods and services by the secondary regions). The results from this multi-region model method are more informative and broad reaching as they capture the spillover and feedback effects that would otherwise be lost as leakages (Rollins and Levell, 2018).

Tracking changes on fishery economic performance -- continuous economic data collection programs for the Hawaii and American Samoa longline fisheries 2005-2016. The purpose of this report is twofold. First, it provides a first-time comprehensive review of the establishment and implementation of continuous economic data collection programs of two important fisheries, the Hawaii longline fishery and the American Samoa longline fishery, managed under the Western Pacific Regional Fishery Management Council's fishery management plans. Second, this report presents trends of the economic performance indicators from the beginning of the continuous economic data collection programs, 2005 being the first full year for the Hawaii longline fishery, and 2006 for the American Samoa longline fishery, through 2016. The economic performance indicators presented in this report include not only fishing cost data collected through the data collection programs, but also net revenue information resulting from the integration of primary data (from the economic data collection programs) and secondary economic data. In addition, since database development and management are necessary to ensure data quality and timely products, this report illustrates the database system designs and management associated with products of these economic data collection programs (Pan 2018).

Relevant Publications

Ayers AL. 2018. The commonwealth of the Northern Mariana Islands fishing community profile: 2017 update. U.S. Dept. of Commerce, NOAA Technical Memorandum NOAA-TM-NMFS-PIFSC-66, 57 p. https://doi.org/10.7289/V5/TM-PIFSC-66.

Chan HL, Pan M[A]. 2019. Vessel level annual cost-earnings study of the Hawaii offshore handline fishery and the Hawaii small boat commercial fishery, 2014. U.S. Dept. of Commerce, NOAA Technical Memorandum NOAA-TM-NMFS-PIFSC-80, 50 p. https://doi.org/10.25923/zffy-5a13.

Chan HL, Pan M[B]. 2019. Tracking economic performance indicators for small boat fisheries in America Samoa, Guam, and the Commonwealth of the Northern Mariana Islands. U.S. Dept. of Commerce, NOAA Technical Memorandum NOAA-TM-NMFS-PIFSC-79, 76 p. https://doi.org/10.25923/8etp-x479.

Kleiber D, Leong K. 2018. Cultural fishing in American Samoa. Pacific Islands Fisheries Science Center, PIFSC Administrative Report, H-18-03, 21 p. https://doi.org/10.25923/fr4m-wm95.

Rollins E, Lovell S. 2018. Charter fishing in Hawaii: A multi-region analysis of the economic linkages and contributions within and outside Hawaii. Marine Policy. 100:277-287. https://doi.org/10.1016/j.marpol.2018.11.032.

Oram R, Talamoa G. 2018. Pacific Islands Fisheries Science Center protocols and tips for working in American Samoa. Pacific Islands Fisheries Science Center, PIFSC Special Publication, SP-18-001, 36 p. https://doi.org/10.7289/V5/SP-PIFSC-18-001.

Pan M. 2018. Tracking changes on fishery economic performance -- continuous economic data collection programs for the Hawaii and American Samoa longline fisheries 2005-2016 . U.S. Dept. of Commerce, NOAA Technical Memorandum NOAA-TM-NMFS-PIFSC-73, 48 p. https://doi.org/10.25923/hqhf-d906.

Disposition of Catch

The purse seine catch is stored onboard 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. Most vessels transport their catches to Vancouver, Canada, for sale. The other fisheries store their catch in ice. Large tunas 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.

Onshore Developments

[n/a]

Future Prospects of the Fisheries

As a result of the high demand for fresh tuna in Hawaii and the U.S. mainland, the future prospect for the U.S. longline fishery in the NPO is likely to continue to have a greater proportion of effort in the deep-set sector targeting tunas. This sector of the longline fishery is constrained by catch limits for bigeye tuna in the WCPO & EPO. The U.S. longline fishery bigeye tuna limit in the WCPO was 3,554 t in 2015 and 2016 decreased to 3,138 t in 2017 and increased back to 3,554 t in 2018. In 2018, the bigeye tuna catch limit in the eastern Pacific Ocean (EPO) established pursuant to decisions of the Inter-American Tropical Tuna Commission (IATTC) was increased from 500 t to 750 t for vessels >24 m in length. About 27 Hawaii-permitted and California longline vessels >24 m were active in the EPO in 2018. Bigeye tuna catch in the EPO by longline vessels >24 m was 517 t in 2018, well below the 750 t limit.

The effort by the shallow-set sector targeting swordfish declined during 2013–2018 despite the removal of the effort restriction in 2006 and revised sea turtle interaction limits in 2012 (26 leatherback and 34 loggerhead sea turtles). The shallow-set longline fishery was closed on May 4, 2018, as a result of a Court Order that reset the take limits to pre-2012 levels (16 leatherback and 17 loggerhead sea turtles). The bigeye tuna catch limits do not affect the shallow-set longline fishery as adversely as the deep- set sector since this species represents only a small proportion of its catch. The shallow-set longline fishery for swordfish is also highly seasonal.

Fuel costs increased slightly throughout 2018 while prices for supplies and goods remained constant or increased slightly. The price of fuel may continue to increase in 2019 which may hinder the economic performance of both sectors of the longline fishery. Other issues facing both sectors of the U.S. longline fishery in the NPO are exceeding false killer whale (*Pseudorca crassidens*) interaction limits in the main Hawaiian Islands EEZ and the expansion of the NWHI Monument out to the 200-mile EEZ. The U.S. longline fishery in the NPO is expected to continue targeting bigeye tuna and swordfish as well as catch of other associated pelagic species and deliver them fresh to service both local and mainland markets.

Catches by the American Samoa longline fishery in the South Pacific decreased from years 2014 to 2018 and were at a 5-year low in 2018 (Table 1 f). Despite declining catches, the American Samoa longline fishery in the South Pacific is expected to continue targeting albacore and delivering their catch frozen to the cannery in Pago Pago, American Samoa.

The prospect of participation and catch from the U.S. small-scale troll and handline fisheries is

expected to be fairly stable although these fisheries are challenged by a shortage of crew due to an improving economy, low unemployment rate and the uncertainty of fish prices. Fuel prices dropped dramatically in 2015, remained low in 2016 into 2017 which helped with operational costs for this fishery, but the price of fuel began increasing in 2018 and this may make fishing ventures more expensive in 2019. The main Hawaiian Island troll and handline 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.

Status of Fisheries Data Collection Systems

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, California, and American Samoa-based longline fisheries are monitored using the NOAA Fisheries Western Pacific Daily Longline Fishing Logs for effort and resulting catch. The coverage of logbook data is assumed to be complete (100%); 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 has been published, 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.

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%. Data collected under this arrangement by FFA-deployed observers are currently provided directly to the WCPFC.

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, fishing operations, 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 326 trips out of a total of 1,577 deep-set trips, as well as on all 22 shallow-set trips, resulting in coverage rates of 20.4% and 100%, respectively in 2018. For the American Samoa-based longline fishery, 2018 was the twelfth year monitored by observers. The coverage rate was 17.5% for a total of 11 trips out of 63 trips. These coverage statistics are from 2018 reports of the NOAA Pacific Islands Regional Observer Program (PIROP) and are based on longline trips that departed with observers in calendar year 2018.[2]

Per reporting requirements agreed to at WCPFC 11, Table 3 contains estimates on observer coverage in U.S. longline fisheries for 2018 in the WCPFC Area exclusive of the U.S. EEZ.

[2] Detailed information on the U.S. Pacific Islands Regional Observer Program can be found at http://www.fpir.noaa.gov/OBS/obs_qrtrly_annual_rprts.html.

Table 3. Observer coverage in 2018 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	27,896,350	6,585,865	24	10,192	2,519	25	1,108	254	23
American Samoa	22,988	0	0	7	0	0	1	0	0

Fishery Interactions with Protected Species

Information on estimated fishery interactions with non-fish species by the Hawaii-based longline fishery during 2014–2018 is provided in Tables 4a-4c. 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 2018, purse seine vessels reported 12 instances of interactions with 59 individual marine mammals. This included 29 false killer whales (19 released alive and 10 dead), 15 pantropical spotted dolphins (5 dead and 10 released alive), 7 unidentified dolphins (all released alive), 4 Minke whales (*Balaenoptera acutorostrata* -all released alive), 2 sei whales (both released alive), and one baleen whale (released alive).

CMM 2011-04 requires CCMs to estimate the number of releases of oceanic whitetip sharks (*Carcharhinus longimanus*) including their status upon release. For the U.S. purse seine fishery observer data indicates that there were 171 oceanic whitetip sharks released in 2018 (92 alive and 79 dead). In the longline fishery, data indicate that 329 oceanic whitetip sharks were released (321 alive and 8 dead) in the Hawaii-based deep set fishery and 525 oceanic whitetip sharks were released (512 alive and 13 dead) in the American Samoa-based fishery.

CMM 2012-04 requires CCMs to report instances in which whale sharks (*Rhincodon typus*) have been encircled by purse seine nets of their flagged vessels. In 2018, purse seine vessels reported 10 instances of interactions with 26 individual whale sharks, all released alive.

CMM 2013-08 requires CCMs to estimate the number of releases of silky sharks (*Carcharhinus falciformis*) including their status upon release. For the U.S. purse seine fishery, information available indicate that there were 7,217 silky sharks released in 2018 (2,885 alive and 4,327 dead). In the longline fishery, data indicate that 198 silky sharks were released (191 alive and 7 dead) in the Hawaii-based fishery and 444 silky sharks were released (433 alive and 11 dead) in the American Samoa-based fishery.

Table 4a. 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 2014–2018[2].

Species	2018	2017	2016	2015	2014
Marine Mammals					
Striped dolphin (*Stenella coeruleoalba*)		1	1	4	2
Common dolphin (*Delphinus delphis, D. capensis)*					1
Bottlenose dolphin (*Tursiops truncatus*)	4	7	6	2	4
Risso's dolphin (*Grampus griseus*)	2	7	2	13	6
Blainville's beaked whale (*Mesoplodon blainvillei*)					
Bryde's whale (*Balaenoptera edeni*)					
False killer whale (*Pseudorca crassidens*)	49	45	39	21	56
Ginkgo-toothed beaked whale (*Mesoplodon ginkgodens)*				1	
Shortfinned pilot whale (*Globicephala macrorhynchus)*				4	
Rough-toothed dolphin (*Steno bradenensis*)			5		
Northern elephant seal (*Mirounga angustirostris*)					1
Humpback whale (*Megaptera novangliae*)				1	5
Pygmy sperm whale (*Kogia Breviceps*)					10
Fin whale (*Balaenoptera physalus)*				1	
Guadalupe fur seal (*Arctocephalus townsendi*)		3	1		
Unspecified false killer or shortfinned pilot whale	4			6	
Unidentified Cetacean (*Cetacea*)	15	18	5		10
Unidentified Pinniped *(Pinnipedia*)				3	
Unspecified member of beaked whales (*Ziphiidae*)			6		
Unspecified eared seal (*Otariidae*)					1
Total Marine Mammals	**74**	**81**	**65**	**58**	**96**
Sea Turtles					
Loggerhead turtle (*Caretta caretta*)	42	28	23	24	13
Leatherback turtle (*Dermochelys coriacea*)	28	4	20	24	57
Olive Ridley turtle (*Lepidochelys olivacea*)	97	123	162	70	51
Green turtle (*Chelonia mydas*)	18	20	5	4	17
Unidentified hardshell turtle (Cheloniidae)		5			1
Total Sea Turtles	**185**	**175**	**215**	**122**	**139**

[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 4b. Effort and observed seabird captures 2014-2018 for Hawaii-based longline fishery for North of 23° N and 23° N – 30° S areas combined. Rate is observed captures per 1,000 hooks.

	Fishing Effort				Observed Seabird Captures	
Year	**Number of Vessels**	**Number of Hooks**	**Observed Hooks**	**% Hooks Observed**	**Number**	**Rate**
2014	149	47,262,156	11,117,964	23.52	112	0.01
2015	143	48,925,850	12,121,568	24.78	228	0.02
2016	139	51,924,659	10,722,120	20.65	213	0.02
2017	142	54,630,336	11,199,621	20.50	192	0.02
2018	142	54,482,420	11,114,413	20.40	249	0.02

Table 4c. Total number of observed seabird captures by species in Hawaii-based longline fishery 2014-2018 for North of 23° N and 23° N – 30° S areas combined. Observed capture numbers for 2018 by area are preliminary.

	2018	**2018**	**2018**	**2017**	**2017**	**2017**	**2016**	**2015**	**2014**
Species	**>23° N**	**23° N – 30° S**	**Total**	**>23° N**	**23° N – 30° S**	**Total**	**Total**	**Total**	**Total**
Blackfooted albatross (*Phoebastria nigripes*)	192	10	202	137	11	148	144	148	61
Laysan albatross (*Phoebastria diomedia*)	35	0	35	44	0	44	60	69	49
Unidentified albatross (*Diomedeidae*)							1		
Red-footed booby (*Sula sula*)	1		1				2	1	
Brown booby (*Sula leucogaster*)		1	1						
Sooty shearwater (*Ardenna grisea*)							2	5	
Unidentified shearwater (*Procellariidae*)	10		10				4	5	2
	238	**11**	**249**	**181**	**11**	**192**	**213**	**228**	**112**

Table 4d. Mitigation types mandated for use in Hawaii based longline fishery are regulated by type of set, location of set, and method employed to set (side setting or stern setting). NS = night setting, WB = weighted branch lines, SS = side setting, BC = bird curtain, BDB = blue dyed bait, DSLS = deep setting line shooter, MOD = management of offal discharge.

Fishery type/location	Combination of Mitigation Measures mandated	Proportion of observed effort using mitigation measures 2012-2018
When setting from stern:		
Shallow set (anywhere)	**BDB + WB + MOD + NS**	100%
Deep set (North of 23° N)	**BDB + WB + MOD + DSLS**	100%
When setting from side:		
Shallow set (anywhere)	**SS + DSLS + BC + WB + NS**	100%
Deep set (North of 23° N)	**SS + DSLS + BC + WB**	100%

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.

Unloading / Transshipment

Information on the quantities transshipped and the number of transshipments by the U.S. longline and purse-seine fisheries in 2018 is provided in Table 5.

For the U.S. purse-seine fishery in the WCPFC Statistical Area in 2016, approximately 60% of the total landings of yellowfin, skipjack, and bigeye were transshipped to foreign ports for processing in 2018. There were an estimated 152 transshipments of purse-seine-caught fish in port in 2018.

There was no available information on transshipments for the longline fishery, albacore troll fishery, or any other HMS gear type in 2018.

Table 5a. Information on quantities transshipped of HMS species by U.S. purse seine fisheries in 2018 to satisfy reporting requirements of CMM 2009-06. * = cannot be displayed due to confidentiality protocols.

a) offloaded and received;	b) transhipped in port, transhipped at sea in areas of national jurisdiction, and transhipped beyond areas of national jurisdiction	c) transhipped inside the Convention Area and transhipped outside the Convention Area;	d) caught inside the Convention Area and caught outside the Convention Area;	e) Species	f) Product Form	g) Fishing gear
offloaded	1,556	0	*	BET	Frozen	Purse seine
	87,683	0	*	SKJ	Frozen	Purse seine
	7,505	0	*	YFT	Frozen	Purse seine
received						

Table 5b. Information on number of transshipments of HMS species by U.S. purse seine fisheries in 2018 to satisfy reporting requirements of CMM 2009-06. * = cannot be displayed due to confidentiality protocols.

a) offloaded and received	b) transhipped in port, transhipped at sea in areas of national jurisdiction, and transhipped beyond areas of national jurisdiction	c) transhipped inside the Convention Area and transhipped outside the Convention Area	d) caught inside the Convention Area and caught outside the Convention Area	e) fishing gear
offloaded	152	0	*	Purse seine
received				

Scientific Survey Data

Cooperative Data Collection Program for North Pacific Albacore. NOAA Fisheries collaborates with the American Fishermen's Research Foundation (AFRF) and the American Albacore Fishing Association (AAFA) on research and monitoring programs for North Pacific albacore. Since 1961, a port sampling program has employed state fishery personnel to collect size data from albacore landings made by the U.S. troll fleet along the U.S. Pacific coast. Since 2001, NOAA Fisheries and American Fishermen's Research Foundation (AFRF) have collaborated on an archival tagging program to study migration patterns and stock structure of

juvenile (3–5 year old) albacore in the North Pacific. As of December, 2017, 1,086, archival tags have been deployed on albacore off the west coast of North America and 37 tags have been recovered. Times at liberty ranged from 25 days to 2.8 years. Detailed daily location estimates, diving behavior, and physiological information is available from the tag data (Childers-SWFSC unpublished data).

North Pacific Albacore Electronic Logbook Project. In 2005, a computer program was developed to allow albacore troll fishermen to enter their logbook data into a computer program rather than completing the traditional paper forms. The advantages of recording the data through a computer program include implementing validation rules at the point of entry thus limiting data entry errors, saving time and money on data entry costs, and making the data available in a timelier manner. Since 2006, the program has been used by 5–10 fishermen annually. The program has received positive feedback on its functionalities and ease of use. During the 2016 season, logs for 31 trips were submitted electronically. In 2015, NOAA Fisheries began developing a new, alternative electronic logbook in PDF format to upgrade the existing version and increase the use of electronic logbooks. Development is nearly complete and distribution of the new electronic logbooks began in 2018 with 17 vessels participating by December of 2018..

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, and Commonwealth of the Northern Mariana Islands). This includes longline, skipjack pole-and-line, tropical troll, and tropical handline fisheries.

Statistical framework use and estimation performance of multistage recruitment functions in stock assessments. This NOAA study investigates how multiple processes act at different stages and different intensities within the timeline between spawning and the age designated as "recruitment". However, common practice is to model only a single step between spawning stock and recruits. Reasons for this practice include lack of data on the intermediate stages, lack of understanding of the mechanisms and functional form governing intermediate stages, and lack of computational resources to model a multistage process in the appropriate statistical framework. NOAA scientists developed a state-space framework and, using a simulation study, explored the estimation of multistage stock-recruit functions. They evaluated four different functions (Ricker, Beverton-Holt, Shepherd, and Generalized), and examined the effects on estimation of several factors, including the form of density dependence, the magnitude of measurement error associated with each stage, type of prior on measurement error, and the magnitude of process error between stages (Brooks et al., 2018).

Cetacean and seabird data collected during the Hawaiian Islands Cetacean and Ecosystem Assessment Survey. The Hawaiian Islands Cetacean and Ecosystem Assessment Survey

(HICEAS) of 2017 was a large-scale ship survey for cetaceans and seabirds within U.S. waters surrounding the Hawaiian Islands. HICEAS 2017 was the third of its kind using many of the same methods and encompassing the same study area as surveys which occurred in 2002 and 2010. The 2017 survey represented the first Cetacean and Ecosystem Assessment Survey conducted as part of the Pacific Marine Assessment Program for Protected Species. This program includes rotational ship surveys in regions of joint interest throughout the Pacific designed to estimate the abundance of cetaceans and seabirds and to assess the ecosystems supporting these species. HICEAS 2017 was a collaborative survey between the Pacific Islands and Southwest Fisheries Science Centers (PIFSC and SWFSC). The survey took place from 6 July to 1 December 2017, spanned 7 survey "legs", and tallied 179 days-at-sea (Yano et al., 2018).

Relevant Publications

Brooks EN, Thorson JT, Shertzer KW, Nash RDM, Brodziak JKT, Johnson KF, Klibansky N, Wells BK, White J. 2018. Paulik revisited: Statistical framework and estimation performance of multistage recruitment functions. Fisheries Research. Available online (In Press, Corrected Proof). https://doi.org/10.1016/j.fishres.2018.06.018.

Crone, P., Maunder, M.N., Lee, H.H., Piner, K.R. 2019. Good practices for including environmental data to inform spawner-recruit dynamics in integrated stock assessments: small pelagic species case study. Fish. Res.. DOI: https://doi.org/10.1016/j.fishres.2018.12.026

Fisheries Research and Monitoring Division, Pacific Islands Fisheries Science Center, NOAA Fisheries. 2019. 2018 annual report to the Western and Central Pacific Fisheries Commission. Part I. Information on fisheries, research, and statistics. Pacific Islands Fisheries Science Center, PIFSC Data Report, DR-19-009, 43 p. https://doi.org/10.25923/7k61-rg33.

Fisheries Research and Monitoring Division, Pacific Islands Fisheries Science Center, NOAA Fisheries. 2018. PIFSC report on the American Samoa limited-access longline fishery from 1 January to 31 December 2017. Pacific Islands Fisheries Science Center, PIFSC Data Report, DR-18-015, 16 p. https://doi.org/10.25923/akhh-yr72.

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Piner, K.R., Lee, H.H., Thomas, L.R. 2018. Bias in estimates of growth when selectivity in models includes effects of gear and availability of fish. Fish. B-NOAA. 116(1): 75-80. http://dx.doi.org/10.7755/FB.116.1.8.

Yano KM, Oleson EM, Keating JL, Ballance LT, Hill MC, Bradford AL, Allen AN, Joyce TW, Moore JE, Henry A. 2018. Cetacean and seabird data collected during the Hawaiian Islands Cetacean and Ecosystem Assessment Survey (HICEAS), July-December 2017. U.S. Dept. of Commerce, NOAA Technical Memorandum NOAA-TM-NMFS-PIFSC-72, 110 p. https://doi.org/10.25923/7avn-gw82.

Research Activities

Biological and Oceanographic Research – TUNAS

Nocturnal visual census of pelagic fauna using scuba near Kona, Hawaii. Plankton and micronekton occupy the base and intermediate levels of oceanic food webs and are generally regarded as difficult to quantify. Gelatinous plankton are the most abundant functional group of macroplankton, yet they remain largely unstudied. What little is known of plankton communities has been largely deduced from plankton samplers, optical counters, nets, and towed cameras. This NOAA research introduces a survey methodology that used recreational scuba divers to evaluate pelagic community structure observed on popular "blackwater" dives. The most abundant organisms encountered were salps, siphonophores, and ctenophores. Over a 19-month period, environmental data were compared against nightly observed diversity to build a generalized additive model that accounted for 43% of the total observed deviation in biodiversity. The three most important predictors of pelagic diversity were water temperature, bathymetry, and El Niño–Southern Oscillation (ENSO) index (Milisen et al., 2018).

Biological Research – PELAGIC SHARKS

Can the status of pelagic shark populations be determined using simple fishery indicators? Calls to develop alternative methods of assessing the population status of pelagic shark populations have increased substantially in recent years. An interim solution has been the development of more subjective evaluation of data series (indicator-based analysis) rather than predictions from complex stock assessment models. In this paper, NOAA researchers examine the reliability of indicators for predicting population status (i.e. whether a stock has been overfished) and the fishing pressure (i.e. whether overfishing is occurring) of large pelagic sharks, based on these fishery indicator trends alone. This research simulates a variety of large pelagic shark populations under different exploitation scenarios using life history parameters, and measurable fishery indicators information (catch-per-unit of effort - CPUE; and average length - AL). The results are designed to be generalized (via sampling of realistic distributions), but are based loosely on the shortfin mako shark and show that the reliability of fishery indicators for establishing population status is dependent upon the length of the time series analyzed. These insights are critical to the proper evaluation of population trajectories that underlie the most important conservation decisions being made for sharks today (Carvalho et al., 2019).

Basking shark (Cetorhinus maximus) movements in the eastern North Pacific determined using satellite telemetry. To fill data gaps on movements, behaviors and habitat use, both near- and offshore, NOAA developed two programs to deploy satellite tags on basking sharks off the coast of California. Basking sharks are large filter-feeding sharks that are second in size only to whale sharks. Similar to many megafauna populations, available data suggest that populations are below historic levels. In the eastern North Pacific (ENP) Ocean, the limited information on basking sharks comes from nearshore habitats where they forage. From 2010 to 2011, four sharks were tagged with pop-off satellite archival tags with deployments ranging from 9 to 240 days. The tags provided both transmitted and archived data on habitat use and geographic movement patterns. Nearshore, sharks tended to move north in the summer and prefer shelf and slope habitat around San Diego, Point Conception and Monterey Bay. The two sharks with 180

and 240 days deployments left the coast in the summer and fall. Offshore their paths diverged and by January one shark had moved to near the tip of the Baja Peninsula, Mexico and the other to the waters near Hawaii, USA. Vertical habitat use was variable both within and among individuals and changed as sharks moved offshore. Nearshore, most time was spent in the mixed layer but sharks did spend hours in cold waters below the mixed layer. Offshore vertical movements depended on location. The shark that went to Hawaii had a distinct diel pattern, with days spent at ~450–470 m and nights at ~250–300 m and almost no time in surface waters, corresponding with the diel migration of a specific portion of the deep scattering layer. The shark that moved south along the Baja Peninsula spent progressively more time in deep water but came to the surface daily. Movement patterns and shifts in vertical habitat and use are likely linked to shifts in prey availability and oceanography. Data collected indicate the potential for large-scale movements and the need for international dialogue in any recovery efforts (Dewar et al. 2019).

Size compositions and sex ratios of oceanic whitetip sharks and giant manta rays for longline fisheries in the Pacific Islands region. This NOAA research document presents relevant life history, assessment, and summary plots of data available from Hawaii longline fishery observer data and the literature for oceanic whitetip shark (*Carcharhinus longimanus*) and giant manta ray (*Manta birostris*) catches by the longline (LL) fisheries in Hawaii and American Samoa from 2010 to 2016. This information is being provided as both species are currently proposed to be listed as threatened under the Endangered Species Act (ESA). The Hawaiian longline fishery is represented in two parts, the Shallow Set (SS) and Deep Set (DS). Deep sets are classified as containing 15 or more hooks per float and that fishery has a target of 20% observer coverage annually; shallow sets are any number of hooks below 15 and that fishery has mandated 100% observer coverage. The American Samoa longline fishery is presented as a single entity. For each fishery, scientists summarize the relevant life history and assessment information to aid the reader in interpreting the presented data. We provide summary tables and histograms describing the estimated (non-empirical) sex ratio and length composition of observed catch through the time period examined. There are far fewer observed catches of giant manta ray and thus those data are presented for each individual (Kapur and Yau, 2018).

Research on Bycatch and Fishing Technology – SEA TURTLES

Trace metals in green sea turtles (Chelonia mydas) inhabiting two southern California coastal estuaries. Foraging aggregations of east Pacific green sea turtles (*Chelonia mydas*) inhabit the Seal Beach National Wildlife Refuge (SBNWR) and San Diego Bay (SDB), two habitats in southern California, USA, located near urbanized areas. Both juvenile and adult green turtles forage in these areas and exhibit high site fidelity, which potentially exposes green turtles to anthropogenic contaminants. We assessed 21 trace metals (TM) bioaccumulated in green turtle scute and red blood cell (RBC) samples collected from SBNWR (n = 16 turtles) and SDB (n = 20 turtles) using acid digestion and inductively coupled plasma mass spectrometry. Principal component analyses of TM composition indicate that SBNWR and SDB turtles have location-specific contaminant signatures, characterized by differences in cadmium and selenium concentrations: SBNWR turtles had significantly more cadmium and selenium in RBC and more selenium in scute samples, than SDB turtles. Cadmium and selenium concentrations in RBC had a strong positive relationship, regardless of location. SBNWR turtles had higher selenium in RBCs than previously measured in other green turtle populations globally. Due to different

retention times in blood vs. scute, these results suggest that SBNWR turtles have high long- and short-term selenium exposure. Turtles from SBNWR and SDB had higher trace metal concentrations than documented in green turtle populations that inhabit non-urbanized areas, supporting the hypothesis that coastal cities can increase trace metal exposure to local green turtles. Our study finds evidence that green turtle TM concentrations can differ between urbanized habitats and that long-term monitoring of these green turtles may be necessary (Barraza et al., 2019).

Densities and drivers of sea turtle populations across Pacific coral reef ecosystems. Sea turtle populations are often assessed at the regional to sub-basin scale from discrete indices of nesting abundance. While this may be practical and sometimes effective, widespread in-water surveys may enhance assessments by including additional demographics, locations, and revealing emerging population trends. Here, we describe sea turtle observations from 13 years of towed-diver surveys across 53 coral islands, atolls, and reefs in the Central, West, and South Pacific. These surveys covered more than 7,300 linear km, and observed more than 3,400 green (*Chelonia mydas*) and hawksbill (*Eretmochelys imbricata*) sea turtles. From these data, we estimated sea turtle densities, described trends across space and time, and modelled the influence of environmental and anthropogenic drivers. Both species were patchily distributed across spatial scales, and green turtles were 11 times more abundant than hawksbills. The Pacific Remote Island Areas had the highest densities of greens (3.62 turtles km-1, Jarvis Island), while American Samoa had the most hawksbills (0.12 turtles km-1, Ta'u Island). The Hawaiian Islands had the lowest turtle densities (island ave = 0.07 turtles km-1) yet the highest annual population growth ($\mu = 0.08$, $\sigma = 0.22$), suggesting extensive management protections can yield positive conservation results. Densities peaked at 27.5°C SST, in areas of high productivity and low human impact, and were consistent with patterns of historic overexploitation. Though such intensive surveys have great value, they are logistically demanding and therefore have an uncertain budget and programmatic future (Becker et al., 2019).

Hawaii permitted deep-set longline fishery estimated anticipated take levels for Endangered Species Act listed species. In this NOAA report, the Hawaii permitted deep-set longline (DSLL) fishery estimated anticipated take levels of nine protected species and four unidentified classifications are provided. The nine species are (1) loggerhead sea turtle (2) leatherback sea turtle (3) olive Ridley sea turtle (4) green sea turtle (5) giant manta ray (6) oceanic whitetip shark (7) Indo-west Pacific (IWP) scalloped hammerhead shark (8) sperm whale, and (9) main Hawaiian Islands false killer whale stock (MHIFKW). The four unidentified classifications are (1) hardshell sea turtle (2) unidentified ray (3) manta/mobula (identified as a member of the Mobulidae family), and (4) IWP unidentified hammerhead shark (an unidentified hammerhead shark caught within the IWP region). Additionally, the anticipated dead or serious injury classification levels are provided for the two cetacean populations (McCracken 2019).

Prevalence of polygyny in a critically endangered marine turtle population. Genetic analyses of nuclear DNA (e.g., microsatellites) are a primary tool for investigating mating systems in reptiles, particularly marine turtles. Whereas studies over the past two decades have demonstrated that polyandry (i.e., females mating with multiple males) is common in marine turtles, polygyny (i.e., males mating with multiple females) has rarely been reported. In this study, NOAA and other scientific agencies investigated the mating structure of Critically Endangered hawksbill turtles (*Eretmochelys imbricata*) at Bahía de Jiquilisco in El Salvador, one

of the largest rookeries in the eastern Pacific Ocean. They collected genetic samples from 34 nesting females and hatchlings from 41 clutches during the 2015 nesting season, including one nest from each of 27 females and two nests from seven additional females. Using six highly polymorphic microsatellite loci, they reconstructed the paternal genotypes for 22 known male turtles and discovered that seven (31.8%) sired nests from multiple females, which represents the highest polygyny level reported to date for marine turtles and suggests that this is a common mating structure for this population. Scientists also detected multiple paternity in four (11.8%) clutches from the 34 females analyzed, confirming polyandrous mating strategies are also employed. The high level of polygyny documented suggests there may be a limited number of sexually mature males at Bahía de Jiquilisco; a scenario supported by multiple lines of empirical evidence. These findings highlight key management uncertainties, including whether polygynous mating strategies can compensate for potential ongoing feminization and the low number of adult males found for this and possibly other marine turtle populations (Gaos et al., 2018).

Impact of exceptional growth rates on estimations of life-stage duration in Hawaiian green sea turtles. The Hawaiian green sea turtle *Chelonia mydas* population has steadily increased since its protection under the US Endangered Species Act of 1978. However, an understanding of their recovery status is stymied by lack of certainty regarding the population age structure. Based on the observed slow growth rates of juveniles, current assessments place age at first reproduction in Hawaiian green sea turtles at 35-40 yr, although a recent study suggests 23 yr for this population. It is possible that somatic growth dynamics such as growth spurts have been missed by traditional mark-recapture studies. Skeletochronology provides annual longitudinal data on growth rates of marine turtles, allowing for the detection of rare but potentially important growth spurts. This NOAA study uses skeletochronology to estimate growth rates and detect the frequency of growth spurts in 30-90 cm straight carapace length (SCL) Hawaiian green sea turtles. We found that growth spurts occurred throughout the life span, but peaked for males from 50 to 59.9 cm SCL and for females from 70 to 79.9 cm SCL. The growth rates were binned into 10 cm SCL size class bins, and 4 methods were used to estimate the mean growth rate for each bin. We found that mean growth rates overestimated life-stage durations for each of the methods, although the expectation of the lognormal distribution gave the least biased results. This study suggests that infrequent growth spurts are not represented in mean growth rate statistics but that these spurts likely result in faster lifetime growth rates and lower age at first reproduction than has been estimated using traditional methods (Murakawa et al., 2018).

Research on Bycatch and Fishing Technology – CETACEANS

Monitoring long-term soundscape trends in U.S. Waters. NOAA/National Park Service (NPS) Ocean Noise Reference Station (NRS) Network is an array of currently twelve calibrated autonomous passive acoustic recorders. The first NRS was deployed in June 2014, and eleven additional stations were added to the network during the following two years. The twelve stations record data that can be used to quantify baseline levels and multi-year trends in ocean ambient sound across the continental United States, Alaska, Hawaii, and island territories within and near to the United States Exclusive Economic Zone (U.S. EEZ). The network provides multi-year, continuous observations of low-frequency underwater sound between 10 Hz and 2000 Hz to capture anthropogenic, biological, and geophysical contributions to the marine soundscape at each location. Comparisons over time and among recording sites will provide information on the presence of calling animals and the prevalence of abiotic and anthropogenic

activities that contribute to each soundscape. Implementation of the NRS Network advances broad-scale passive acoustic sensing capabilities within NOAA and the NPS and is an important tool for monitoring protected areas and marine species and assessing potential environmental impacts of anthropogenic noise sources. This analysis focuses on the first year of recordings and captures the wide variability of low-frequency sound levels among and within individual NRS sites over time. Continued data collection will provide information on long-term, low-frequency sound level trends within or near the U.S. EEZ and will be used to explore the value of using soundscape analysis to inform management and mitigation strategies (Haver et al., 2018).

Injury determinations for marine mammals observed interacting with Hawaii and American Samoa longline fisheries during 2017. Data on marine mammal interactions (i.e., hookings and entanglements) with the Hawaii and American Samoa longline fisheries observed during 2017 were compiled, and the number of marine mammal deaths, serious injuries, and non-serious injuries by fishery, species, and management area were assessed. These values are used to compute the mortality and serious injury estimates included in the stock assessment reports of stocks impacted by these fisheries. Injury determinations were made using a nationally standardized process and established criteria for distinguishing serious from non-serious injuries (National Marine Fisheries Service, 2012). In the Hawaii deep-set fishery, 14 marine mammal interactions were observed in 2017; most involved false killer whales (57.1%), resulted in death or serious injury (64.3%), and occurred outside the U.S. exclusive economic zone (EEZ) (85.7%). In the Hawaii shallow-set fishery, 6 marine mammal interactions were observed in 2017; 3 involved Guadalupe fur seals (50.0%), while most resulted in death or serious injury (66.7%) and occurred outside the U.S. EEZ (100.0%). In the American Samoa deep-set fishery, 2 marine mammal interactions were observed in 2017; one involving a seriously injured false killer whale and the other a non-seriously injured rough-toothed dolphin, both within the U.S. EEZ (Bradford[A] 2018).

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