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

WCPFC-SC17-AR/CCM-27

UNITED STATES OF AMERICA

2021 Annual Report to the Western and Central Pacific Fisheries Commission

United States of America

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

(Through 2020)

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 2021	**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 2020 are dominated by the catch of the purse seine fishery. Preliminary 2020 purse seine catch estimates total 115,719 t of skipjack, 10,989 t of yellowfin, and 9,451 t of bigeye tuna. Longline retained catch decreased in 2020 partly from a global Coronavirus

[1] PIFSC Data Report DR-20-xx.
Issued xx July 2021.

pandemic. Total longline catch in the North Pacific Ocean (NPO) in 2020 was 10,483 t compared to 12,957 t in 2019. Longline retained catch by American Samoa in the South Pacific Ocean (SPO) continued a decreasing trend and was 852 t in 2020 (the lowest level recorded during the 2016–2020 time period). Bigeye tuna longline catch by the United States and its Territories remained stable at 6,058 t in 2020 compared to a revised estimate of 6,005 t in 2019. Albacore longline catch by the United States and its Territories continued a decreasing trend to 564 t in 2020. 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 is estimated to be 3,548 t in 2020 which is below the limit of 3,554 t for 2020. 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) CMM 2015-01 in 2016, CMM 2016-01 in 2017, CMM 2017-01 in 2018 CMM 2018-01 in 2019 and 2020.

The longline catch of swordfish by the United States and its Territories decreased to 308 t in 2020. 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 146 vessels in 2020, while the purse seine fleet continued a decreasing trend with 23 vessels in 2020 compared to 31 vessels in 2019, and 34 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 addresses animals caught as bycatch in those fisheries. In 2020, socio-economic studies investigated impacts of bigeye tuna catch rates from protected area closures in the Hawaii-based longline 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) and included an update on striped marlin and swordfish distribution trends in Pacific longline fisheries.

NOAA Fisheries biological and oceanographic research on tunas, billfishes, and sharks included environmental predictors of tuna recruitment, taking an ecosystem approach through a ground up view of pelagic fisheries from smaller pelagic fish species, the effects of biological, economic, and management factors on pelagic stocks, and ecosystem modelling. 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 2016–2020 for fisheries of the United States and its Participating Territories operating in the western and central Pacific Ocean (WCPO). All statistics for 2020 are provisional. Statistics for 2019 have been updated from those reported provisionally in the submission of 2018–2019 U.S. fishery statistics for the WCPO (NOAA, NMFS 2019). Statistics for 2016–2018 have also been updated using an automated reporting process that contains minor rounding differences from previous reports. 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 91% 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 7%, 1%, 0.8%, and 0.3% 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 150,253 t in 2020 (Table 1a), decreasing from 182,018 t in 2019 (Table 1b). The catch consisted primarily of skipjack tuna (77%), bigeye tuna (10%), yellowfin tuna (9%), and albacore (2%). Catches of skipjack and yellowfin tuna decreased in 2020 due to lower purse seine catches, but bigeye 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 2020 (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 2020.

Species and FAO Code	Purse Seine	Longline	Albacore Troll	Tropical Troll	Handline	Total
Albacore (ALB), North Pacific	0	57	19	0	3	79
Albacore (ALB), South Pacific	0	507	1894	0	-	2401
Bigeye tuna (BET)	9451	6058	-	19	144	15671
Pacific bluefin tuna (PBF)	0	1	-	0	-	1
Skipjack tuna (SKJ)	115719	198	-	482	5	116404
Yellowfin tuna (YFT)	10989	1576	-	342	241	13148
Other tuna (TUN KAW FRI)	0	0	-	1	1	2
TOTAL TUNAS	136159	8395	1913	845	394	147706
Black marlin (BLM)	1	0	-	1	-	3
Blue marlin (BUM)	9	510	-	111	3	632
Sailfish (SFA)	0	7	-	1	-	7
Spearfish (SSP)	0	105	-	3	-	108
Striped marlin (MLS), North Pacific	0	288	-	10	-	298
Striped marlin (MLS), South Pacific	1	2	-	-	-	2
Other marlins (BIL)	0	1	-	0	-	1
Swordfish (SWO), North Pacific	0	306	-	0	2	307
Swordfish (SWO), South Pacific	0	2	-	-	-	2
TOTAL BILLFISHES	11	1220	-	125	5	1360
Blue shark (BSH)	0	0	-	0	-	0
Mako shark (MAK)	0	2	-	0	-	2
Thresher sharks (THR)	0	1	-	0	-	1
Other sharks (SKH OCS FAL SPN TIG CCL)	0	0	-	0	-	0
TOTAL SHARKS	0	3	-	0	-	4
Mahimahi (DOL)	3	91	-	212	6	312
Moonfish (LAP)	0	238	-	0	-	238
Oilfish (GEP)	0	63	-	1	-	65
Pomfrets (BRZ)	0	181	-	0	1	182
Wahoo (WAH)	2	290	-	71	3	366
Other fish (PEL PLS MOP TRX GBA ALX GES RRU DOT)	1	2	-	16	0	19
TOTAL OTHER	7	865	-	300	11	1183
TOTAL	136177	10483	1913	1270	410	150253

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 2019 (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 2019.

Species and FAO Code	Purse Seine	Longline	Albacore Troll	Tropical Troll	Handline	Total
Albacore (ALB), North Pacific	0	101	1	1	10	112
Albacore (ALB), South Pacific	0	1050	872	0	-	1923
Bigeye tuna (BET)	3014	6005	-	35	226	9280
Pacific bluefin tuna (PBF)	0	2	-	0	-	2
Skipjack tuna (SKJ)	144839	295	-	482	10	145627
Yellowfin tuna (YFT)	18102	1965	-	456	249	20771
Other tuna (TUN KAW FRI)	0	0	-	3	1	4
TOTAL TUNAS	165955	9417	873	978	496	177719
Black marlin (BLM)	3	0	-	2	-	6
Blue marlin (BUM)	3	860	-	176	5	1045
Sailfish (SFA)	0	16	-	1	-	17
Spearfish (SSP)	0	173	-	7	-	179
Striped marlin (MLS), North Pacific	0	458	-	13	-	472
Striped marlin (MLS), South Pacific	0	2	-	-	-	2
Other marlins (BIL)	0	0	-	0	-	0
Swordfish (SWO), North Pacific	0	555	-	0	3	558
Swordfish (SWO), South Pacific	0	4	-	-	-	4
TOTAL BILLFISHES	7	2068	-	200	8	2282
Blue shark (BSH)	0	0	-	0	-	0
Mako shark (MAK)	0	35	-	0	-	35
Thresher sharks (THR)	0	5	-	0	-	5
Other sharks (SKH OCS FAL SPN TIG CCL)	0	0	-	0	-	0
TOTAL SHARKS	0	40	-	0	-	40
Mahimahi (DOL)	3	145	-	344	8	500
Moonfish (LAP)	0	428	-	0	-	428
Oilfish (GEP)	0	103	-	0	-	103
Pomfrets (BRZ)	0	275	-	0	8	283
Wahoo (WAH)	5	479	-	158	7	649
Other fish (PEL PLS MOP TRX GBA ALX GES RRU DOT)	1	2	-	9	0	13
TOTAL OTHER	9	1433	-	511	24	1977
TOTAL	165971	12957	873	1689	528	182018

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 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.

Species and FAO Code	Purse Seine	Longline	Albacore Troll	Tropical Troll	Handline	Total
Albacore (ALB), North Pacific	0	70	12	1	20	103
Albacore (ALB), South Pacific	0	1542	429	0	-	1971
Bigeye tuna (BET)	6958	5236	-	27	117	12338
Pacific bluefin tuna (PBF)	0	1	-	0	-	1
Skipjack tuna (SKJ)	167235	196	-	535	5	167971
Yellowfin tuna (YFT)	20565	2339	-	598	340	23843
Other tuna (TUN KAW FRI)	0	0	-	5	1	6
TOTAL TUNAS	194759	9384	441	1166	484	206234
Black marlin (BLM)	3	0	-	2	0	5
Blue marlin (BUM)	5	598	-	167	3	773
Sailfish (SFA)	0	11	-	4	-	14
Spearfish (SSP)	0	187	-	10	0	197
Striped marlin (MLS), North Pacific	0	375	-	12	-	387
Striped marlin (MLS), South Pacific	0	1	-	-	-	2
Other marlins (BIL)	0	1	-	0	-	1
Swordfish (SWO), North Pacific	0	631	-	1	3	634
Swordfish (SWO), South Pacific	0	6	-	-	-	6
TOTAL BILLFISHES	8	1811	-	195	6	2020
Blue shark (BSH)	0	3	-	0	-	3
Mako shark (MAK)	0	42	-	0	-	42
Thresher sharks (THR)	0	2	-	0	-	2
Other sharks (SKH OCS FAL SPN TIG CCL)	0	0	-	1	-	1
TOTAL SHARKS	0	47	-	1	-	48
Mahimahi (DOL)	2	174	-	323	9	508
Moonfish (LAP)	0	449	-	0	-	449
Oilfish (GEP)	0	112	-	0	-	112
Pomfrets (BRZ)	0	298	-	0	7	305
Wahoo (WAH)	5	329	-	184	6	524
Other fish (PEL PLS MOP TRX GBA ALX GES RRU DOT)	5	5	-	8	0	18
TOTAL OTHER	12	1367	-	515	23	1917
TOTAL	194779	12610	441	1876	513	210219

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 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	0	90	335	0	35	461
Albacore (ALB), South Pacific	0	1495	465	0	-	1960
Bigeye tuna (BET)	3267	5356	-	41	106	8769
Pacific bluefin tuna (PBF)	0	2	-	0	-	2
Skipjack tuna (SKJ)	140081	262	-	392	6	140741
Yellowfin tuna (YFT)	23197	2621	-	477	406	26700
Other tuna (TUN KAW FRI)	0	0	-	16	2	18
TOTAL TUNAS	166545	9827	800	926	555	178653
Black marlin (BLM)	2	1	-	2	-	5
Blue marlin (BUM)	4	612	-	156	3	775
Sailfish (SFA)	0	12	-	2	0	14
Spearfish (SSP)	0	234	-	9	0	243
Striped marlin (MLS), North Pacific	0	330	-	6	-	336
Striped marlin (MLS), South Pacific	0	2	-	-	-	2
Other marlins (BIL)	0	1	-	0	-	1
Swordfish (SWO), North Pacific	0	967	-	0	6	974
Swordfish (SWO), South Pacific	0	6	-	-	-	6
TOTAL BILLFISHES	6	2165	-	175	9	2356
Blue shark (BSH)	0	1	-	0	-	1
Mako shark (MAK)	0	35	-	0	0	36
Thresher sharks (THR)	0	5	-	0	0	5
Other sharks (SKH OCS FAL SPN TIG CCL)	0	0	-	0	0	0
TOTAL SHARKS	0	41	-	0	1	43
Mahimahi (DOL)	1	180	-	230	9	420
Moonfish (LAP)	0	322	-	0	-	322
Oilfish (GEP)	0	116	-	0	0	116
Pomfrets (BRZ)	0	300	-	0	12	313
Wahoo (WAH)	5	304	-	111	4	424
Other fish (PEL PLS MOP TRX GBA ALX GES RRU DOT)	4	3	-	9	1	17
TOTAL OTHER	10	1226	-	350	27	1612
TOTAL	166561	13259	800	1452	592	182664

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 2016 (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 2016.

Species and FAO Code	Purse Seine	Longline	Albacore Troll	Tropical Troll	Handline	Total
Albacore (ALB), North Pacific	0	243	-	1	24	268
Albacore (ALB), South Pacific	0	1527	168	0	-	1696
Bigeye tuna (BET)	4711	6216	-	34	190	11151
Pacific bluefin tuna (PBF)	0	1	-	0	-	1
Skipjack tuna (SKJ)	178284	307	-	417	5	179013
Yellowfin tuna (YFT)	18162	1653	-	542	275	20632
Other tuna (TUN KAW FRI)	0	0	-	6	2	7
TOTAL TUNAS	201156	9947	168	1000	497	212768
Black marlin (BLM)	2	1	-	2	0	5
Blue marlin (BUM)	3	514	-	163	2	683
Sailfish (SFA)	0	19	-	2	-	21
Spearfish (SSP)	0	281	-	16	0	297
Striped marlin (MLS), North Pacific	0	328	-	12	0	340
Striped marlin (MLS), South Pacific	0	2	-	-	-	2
Other marlins (BIL)	0	1	-	0	-	1
Swordfish (SWO), North Pacific	0	639	-	0	4	643
Swordfish (SWO), South Pacific	0	6	-	-	-	6
TOTAL BILLFISHES	5	1791	-	195	7	1998
Blue shark (BSH)	0	1	-	0	-	1
Mako shark (MAK)	0	46	-	0	1	47
Thresher sharks (THR)	0	4	-	0	0	4
Other sharks (SKH OCS FAL SPN TIG CCL)	0	0	-	1	0	2
TOTAL SHARKS	0	51	-	2	1	54
Mahimahi (DOL)	1	234	-	378	9	622
Moonfish (LAP)	0	380	-	0	-	380
Oilfish (GEP)	0	190	-	0	0	191
Pomfrets (BRZ)	0	386	-	1	16	402
Wahoo (WAH)	2	402	-	141	5	550
Other fish (PEL PLS MOP TRX GBA ALX GES RRU DOT)	5	9	-	14	1	28
TOTAL OTHER	7	1601	-	534	31	2173
TOTAL	201169	13390	168	1731	535	216993

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 2016–2020. 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. (NPO)					CNMI (NPO)					Guam (NPO)	American Samoa (NPO)					American Samoa (SPO)					Total				
Species	**2020**	**2019**	**2018**	**2017**	**2016**	**2020**	**2019**	**2018**	**2017**	**2016**	**2016**	**2020**	**2019**	**2018**	**2017**	**2016**	**2020**	**2019**	**2018**	**2017**	**2016**	**2020**	**2019**	**2018**	**2017**	**2016**
Vessels	135	138	136	136	133	119	128	121	119	117	118	122	127	113	118	23	11	18	14	15	20	146	156	151	150	151
Albacore, NPO	48	88	59	74	208							8	12	11	17	34						57	101	70	90	243
Albacore, SPO																	507	1050	1542	1495	1527	507	1050	1542	1495	1527
Bigeye tuna	3548	3460	3393	2948	3748	925	999	993	999	879	932	1563	1514	798	1346	586	21	31	53	63	71	6058	6005	5236	5356	6216
Pacific bluefin tuna	0	1	0	1	0							0	0	0	0	0	0	0	1	2	0	1	2	1	2	1
Skipjack tuna	125	198	105	155	186							16	28	15	36	26	57	69	76	71	95	198	295	196	262	307
Yellowfin tuna	1198	1556	1868	1751	1093							160	220	209	311	175	217	189	261	559	385	1576	1965	2339	2621	1653
Other tuna	0	0	0	0	0																					
TOTAL TUNAS	4920	5304	5425	4928	5236	925	999	993	999	879	932	1747	1774	1034	1709	821	802	1339	1934	2190	2079	8395	9417	9384	9827	9947
	-	-	-	-	-																					
Black marlin	0	0	0	0	1							0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
Blue marlin	440	747	529	485	427							44	83	38	87	57	25	29	32	40	30	510	860	598	612	514
Sailfish	5	12	9	9	14							1	2	1	2	2	1	2	1	1	2	7	16	11	12	19
Spearfish	94	154	171	205	251							11	16	15	27	28	0	2	1	2	2	105	173	187	234	281
Striped Marlin, NPO	241	397	332	280	280							47	62	44	50	48	0	0	0	0	0	288	458	375	330	328
Striped Marlin, SPO	0	0	0	0	0							0	0	0	0	0	2	2	1	2	2	2	2	1	2	2
Other marlins	1	0	1	1	1							0	0	0	0	0	0	0	0	0	0	1	0	1	1	1
Swordfish, NPO	265	510	590	918	596							40	44	41	49	43	0	0	0	0	0	306	555	631	967	639
Swordfish, SPO	0	0	0	0	0							0	0	0	0	0	2	4	6	6	6	2	4	6	6	6
TOTAL BILLFISH	1047	1821	1631	1899	1570							143	208	138	215	179	29	39	41	51	41	1220	2068	1811	2165	1791
Blue shark												0	0	0	0	0	0	0	3	1	1	0	0	3	1	1
Mako shark	2	32	36	30	37							0	3	5	5	9	0	0	0	0	0	2	35	42	35	46
Thresher	1	4	2	2	3							0	1	0	0	0	0	1	1	2	0	1	5	2	5	4
Sharks nei																										
Oceanic whitetip shark																										
Silky shark																										
Hammerhead shark																										
Tiger shark																										
Blacktip shark																										
TOTAL SHARKS	3	36	38	32	40							0	3	5	6	10	0	1	4	3	1	3	40	47	41	51
	-	-	-	-	-																					
Mahimahi	76	123	155	143	202							11	20	14	23	28	4	2	5	14	4	91	145	174	180	234
Moonfish	198	368	390	257	304							40	59	58	63	74	1	1	1	1	2	238	428	449	322	380
Oilfish	55	89	98	94	160							8	15	14	22	29	0	0	0	0	2	63	103	112	116	190
Pomfret	157	246	265	260	339							23	29	32	40	46	0	0	0	0	0	181	275	298	300	386
Wahoo	239	401	264	217	310							35	60	34	37	47	16	18	31	50	46	290	479	329	304	402
Other fish	1	1	4	2	7							0	1	0	0	1	0	0	0	1	1	2	2	5	3	9
TOTAL OTHER	726	1228	1177	975	1322							118	184	153	184	224	21	21	37	67	55	865	1433	1367	1226	1601
TOTAL	6696	8388	8272	7834	8168	925	999	993	999	879	932	2009	2169	1329	2115	1235	852	1400	2016	2311	2176	10483	12957	12610	13259	13390

* Pacific bluefin tuna catches are reported for American Samoa (NPO); however, the species may be misidentified. There were no catch attributions to Guam 2017-2020.

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 2016–2020. 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				
	2020	2019	2018	2017	2016	2020	2019	2018	2017	2016	2020	2019	2018	2017	2016	2020	2019	2018	2017	2016	2020	2019	2018	2017	2016
Vessels	1122	1293	1386	1417	1485	459	465	398	408	428	26	49	56	48	73	8	5	7	8	12	1615	1812	1847	1881	1998
Albacore, NPO	0	1	1	1	1																0	1	1	1	1
Albacore, SPO																		0							
Bigeye tuna	18	35	27	40	34											0	0	0	1	0	19	35	27	41	34
Pacific bluefin tuna																									
Skipjack tuna	78	105	84	97	117	158	215	277	185	208	244	157	170	107	88	3	6	4	3	4	482	482	535	392	417
Yellowfin tuna	290	410	564	435	469	25	29	24	27	60	25	17	5	8	8	2	1	5	6	4	342	456	598	477	542
Other tunas	1	3	3	3	5	0	0	0	0	0	0	0	1	13	1	0	0	0	0	0	1	3	5	16	6
TOTAL TUNAS	388	554	680	576	625	183	244	301	213	268	269	173	177	127	97	5	7	9	10	9	845	978	1166	926	1000
Black marlin	1	2	2	2	2																1	2	2	2	2
Blue marlin	88	152	154	140	143	23	23	11	14	20	0	2	1	1	0			1	0	0	111	176	167	156	163
Sailfish	1	1	2	2	2	0	0	2	0	0	0	0	0	0	0						1	1	4	2	2
Spearfish	3	7	10	9	16																3	7	10	9	16
Striped marlin, NPO	10	13	12	6	12																10	13	12	6	12
Striped marlin, SPO																									
Other billfish																									
Swordfish, NPO		0	1	0	0																		1		
Swordfish, SPO																									
TOTAL BILLFISHES	102	175	179	159	174	23	23	13	14	20	0	2	1	1	0			1	0	0	125	200	195	175	195
Blue shark																									
Mako shark			0	0	0																				
Thresher sharks																									
Other sharks			1		1																		1	0	1
TOTAL SHARKS			1	0	2																		1	0	2
					-																				
Mahimahi	137	249	253	191	254	42	62	40	18	87	32	33	30	20	36	0	0	0	1	0	212	344	323	230	378
Moonfish																									
Oilfish						1	0	0	0	0	-	-	-	-	-	0	0	0	0	0	1	0	0	0	0
Pomfrets		0		0		0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Wahoo	47	146	137	85	122	21	11	44	21	16	3	1	3	4	2	0	0	1	0	1	71	158	184	111	141
Other pelagics	0	0	0	1	0	8	5	6	6	8	8	3	1	1	5	0	0	0	1	1	16	9	8	9	14
TOTAL OTHER	184	396	390	277	377	73	78	90	46	112	43	37	33	26	43	1	1	1	2	2	300	511	515	350	534
GEAR TOTAL	674	1124	1250	1012	1178	279	345	404	273	401	313	212	211	155	140	5	9	11	12	11	1270	1689	1876	1452	1731

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 2016–2020, 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**
2020	0	0
2019	0	0
2018	0	0
2017	0	1
2016	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 2016 to 2020. Data for 2020 are preliminary.

	2020	2019	2018	2017	2016
Purse seine	23	31	34	34	37
Longline (N Pac-based) [1]	135	138	136	136	133
Longline (American Samoa-based)	122	127	113	118	23
Total U.S. Longline [2]	146	156	151	150	151
Albacore troll (N Pac) [3]	3	3	4	14	-
Albacore troll (S Pac) [3]	18	9	11	13	6
Tropical troll	1615	1812	1847	1881	1998
Handline	394	444	429	494	473
Tropical Troll and Handline (combined)[4]	1742	1931	1963	2018	2137
TOTAL	1929	2127	2159	2215	2331

[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 2016 to 2020. Data for 2020 are preliminary.

Gear and year	0-50	51-200	201-500	501-1000	1001-1500	1500+
2016 Purse Seine					15	22
2017 Purse Seine					14	20
2018 Purse Seine					15	19
2019 Purse Seine					14	17
2020 Purse Seine					10	13
2016 Longline	12	139				
2017 Longline	8	142				
2018 Longline	7	144				
2019 Longline	10	146				
2020 Longline	6	140				
	0-50	**51-150**	**150+**			
2016 Pole and Line	1	1				
2017 Pole and Line	1	1				
2018 Pole and Line	1	1				
2019 Pole and Line	1	1				
2020 Pole and Line	1	1				
2016 Albacore Troll		4	2			
2017 Albacore Troll		9	8			
2018 Albacore Troll		8	5			
2019 Albacore Troll	2	7	3			
2020 Albacore Troll	2	9	9			

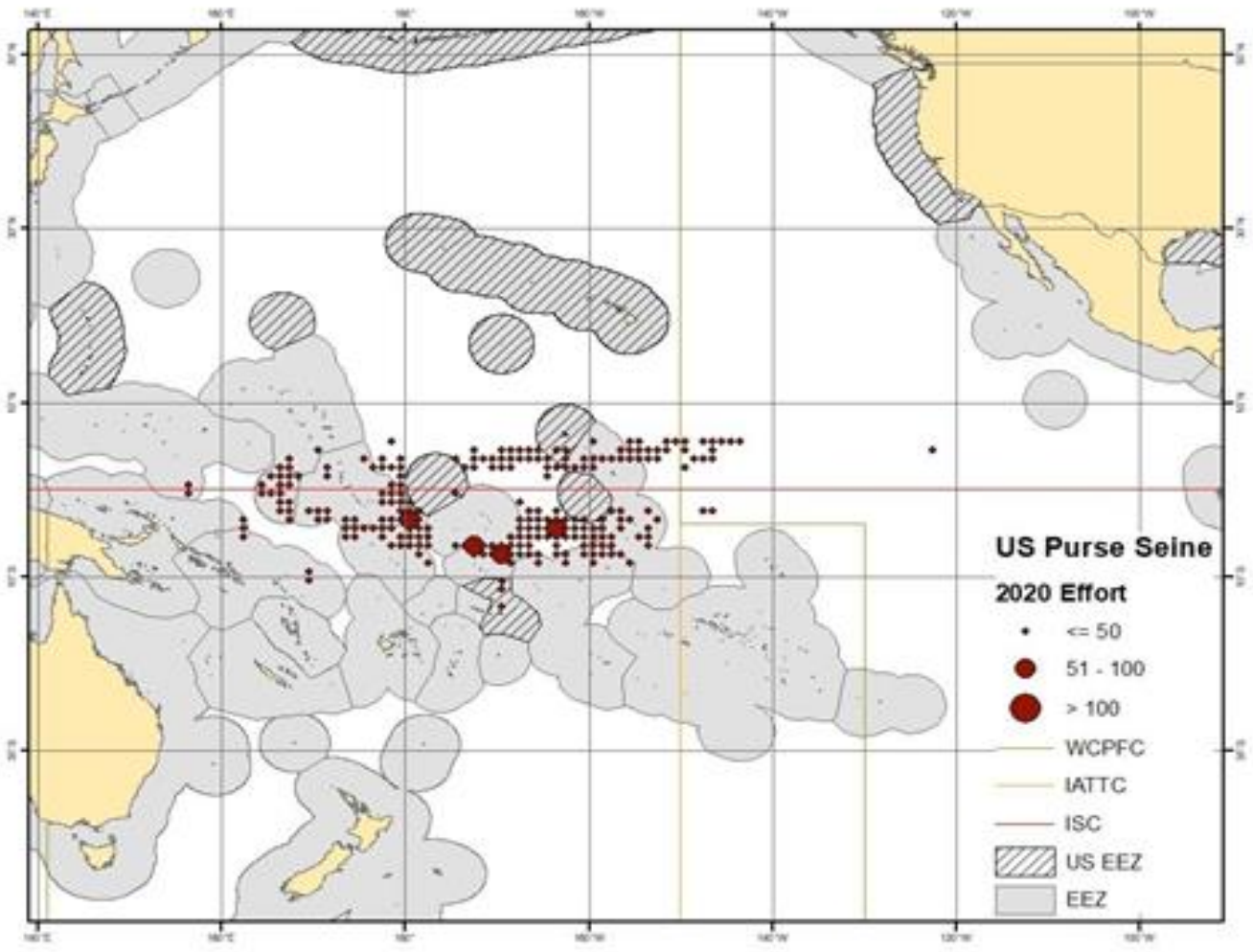

Figure 1. Spatial distribution of fishing effort (fishing sets) reported in logbooks by U.S.-flagged purse seine vessels the Pacific Ocean in 2020 (preliminary data). Effort in some areas is not shown to preserve data confidentiality.

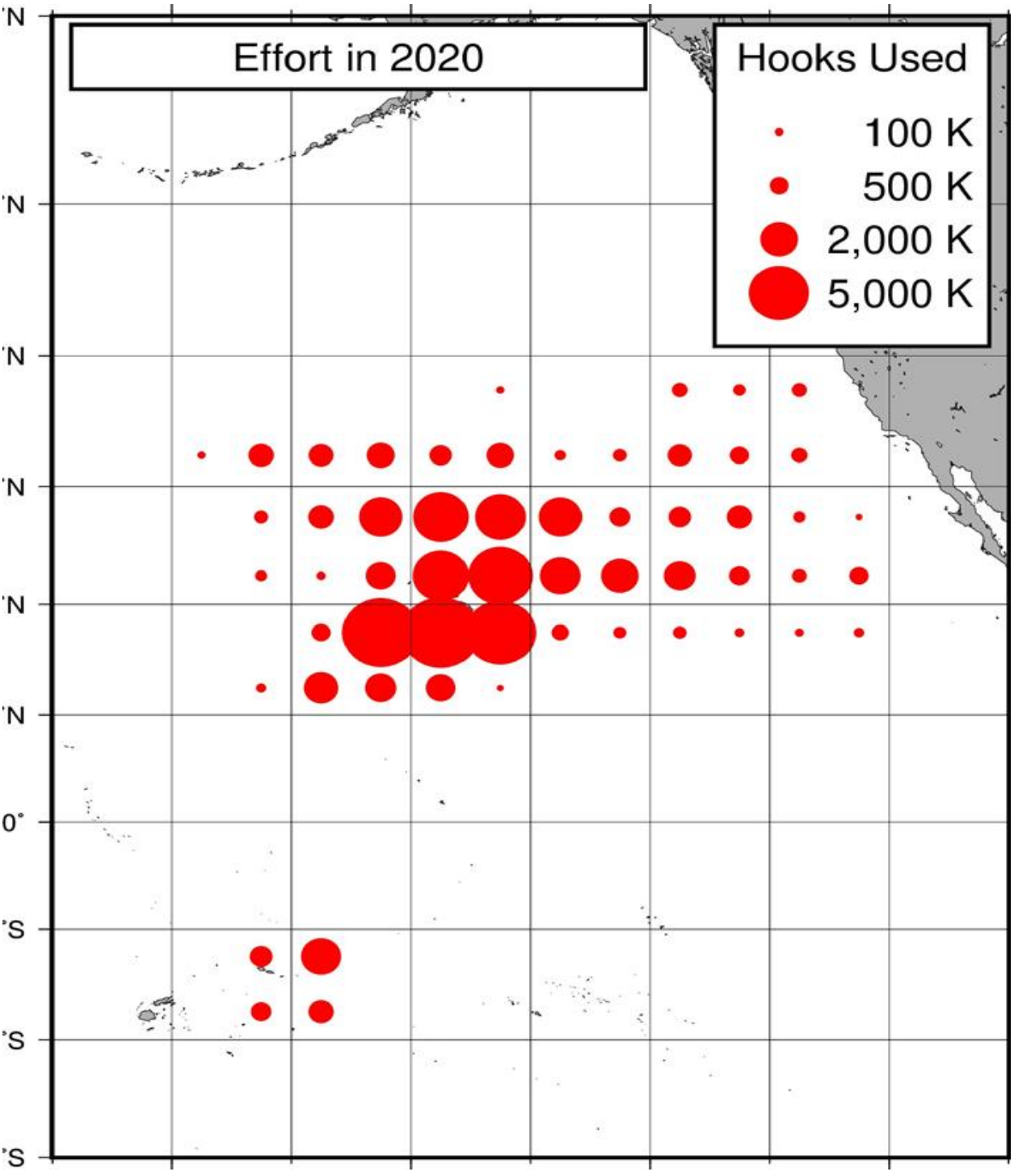

Figure 2a. Spatial distribution of fishing effort (K=1,000 hooks) reported by U.S.-flagged longline vessels in 2020 proportional to effort (preliminary data). Effort in some areas is not shown to preserve data confidentiality.

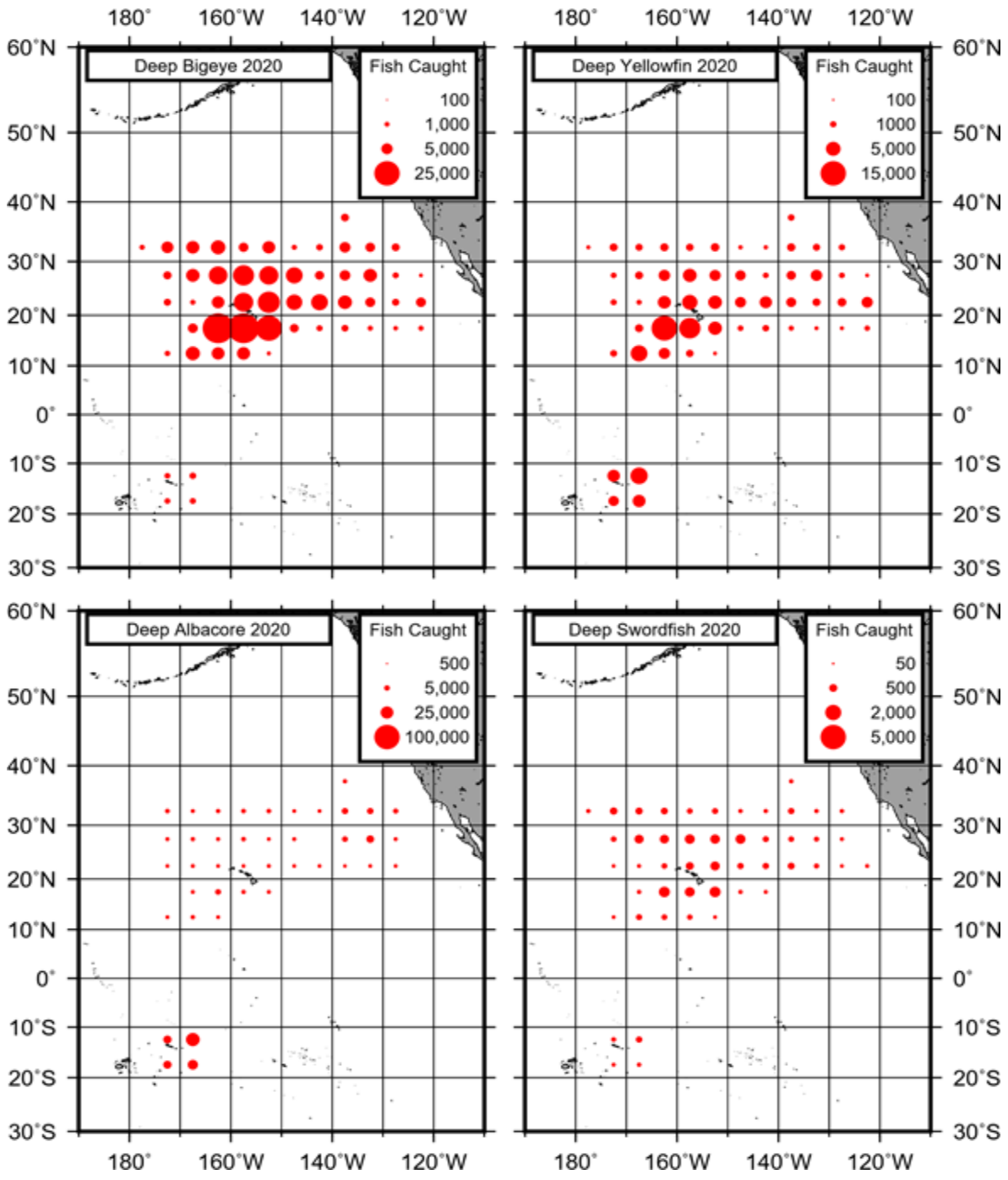

Figure 2b. Spatial distribution of catch by U.S.-flagged longline vessels, in numbers of fish (includes retained and released catch), in 2020 (preliminary data). Catches in some areas are not shown to preserve data confidentiality.

Background

Flag State Reporting of National Fisheries

U.S. Purse seine Fishery

The U.S. purse seine catch of tunas in the WCPO was 136,177 t in 2020, decreasing from 165,971 t in 2019. Total catch 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 2020 was 23 vessels, continuing a decreasing trend over the past five years (Table 2a). The fishery continued to operate further eastward, and not as far northward as in 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 has remained relatively consistent over the past five years with 146 participating vessels in 2020 (Table 2a). The U.S. longline fishery in the NPO consistently had the highest number of vessels in operation with 135 vessels in 2020. Participation in the American Samoa-permitted fleet operating in the South Pacific declined to 11 vessels in 2020. A few vessels occasionally operated in both the Hawaii-permitted and American Samoa-permitted longline fisheries during 2016–2020. 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 2020, to CNMI during 2013 through 2020, and to Guam in 2015 and 2016. Under the Amendment 7 arrangements (2014 through 2020 only bigeye tuna was 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 2020 (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 2020 (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 sometimes 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 13,390 t in 2016 to a low of 10,483 t in 2020 (Tables 1a-1e).

Most of the U.S. longline fishery in the NPO involved deep set longline effort directed towards tunas. Despite an ongoing global Covid-19 pandemic, 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 306 t in 2020. 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 17 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. Eighteen vessels participated in the South Pacific albacore troll fishery in 2020 compared to 9 vessels in 2019 (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 increased from 873 t in 2019 to 1,919 t in 2020 (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 1,680 t in 2020. The catch was composed primarily of yellowfin tuna, skipjack tuna, bigeye tuna, and mahimahi.

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.

Relevant Publications

Ayers A, Leong K. 2020. Stories of Conservation Success: Results of Interviews with Hawai`i Longline Fishers. Pacific Islands Fisheries Science Center, PIFSC Administrative Report, H-20-11, 43 p. https://doi.org/10.25923/6bnn-m598

Ayers AL, Chan HL. 2020. Rights-Based Management, Competition, and Distributional Equity in Hawaii's Largest Commercial Fishery. International Journal of the Commons. 14(1):262-277. https://doi.org/10.5334/ijc.996

Cardenosa D, Fields AT, Babcock E, Shea SKH, Feldheim KA, Kraft DW, Hutchinson M, Herrera MA, Caballero S, Chapman DD. 2020. Indo-Pacific origins of silky shark fins in major shark fin markets highlights supply chains and management bodies key for conservation. Conservation Letters. e12780. https://doi.org/10.1111/conl.12780

Iwane MA, Leong KM, Vaughan M, Oleson KL. 2021. When a shark is more than a shark: A sociopolitical problem-solving approach to fisher-shark interactions. Frontiers in Conservation Science. 2:10. https://doi.org/10.3389/fcosc.2021.669105

Iwane MA, Leong KM, Vaughan M, Oleson KLL. 2020. Engaging Hawai'i small boat fishers to mitigate pelagic shark mortality. Pacific Islands Fisheries Science Center, PIFSC Administrative Report, H-20-10, 113 p. https://doi.org/10.25923/54tf-kh65

Iwane MA, Leong KM. 2020. Socioeconomic context for fisher-shark interactions in the Marianas. Pacific Islands Fisheries Science Center, PIFSC Administrative Report, H-20-13, 48 p. https://doi.org/10.25923/9wat-a254

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, some vessels 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.

Future Prospects of the Fisheries

Participation in the U.S. purse seine fishery has declined from 37 vessels in 2016 to 23 vessels in 2020. The remaining vessels in the fleet are almost exclusively based in American Samoa, and the fishery will be characterized as the American Samoa-based fishery in future years.

As a result of the global Covid-19 related pandemic in 2020 resulting in a lower demand for fresh tuna in Hawaii and the U.S. mainland, the future prospect for the U.S. longline fishery in the NPO is uncertain. This sector of the longline fishery is already constrained by catch limits for bigeye tuna in the WCPO and 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 from 2018 to 2020. In 2018 to 2020, 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 30 Hawaii-permitted and California longline vessels >24 m were active in the EPO in 2020. Bigeye tuna catch in the EPO by longline vessels >24 m was 351 t in 2020, down from 508 t in 2019, and well below the 750 t catch limit.

The effort by the shallow set sector targeting swordfish declined during 2013–2020 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 early in 2018, 2019, and again in 2020, as a result of reaching a turtle take limit that a Court Order reset to the pre-2012 take limits to pre-2012 (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 and coincides with a seasonal abundance in sea turtles in the same areas that the swordfish fishery targets, but not in an area that the deep set sector usually targets.

Fuel costs increased slightly throughout 2019, but decreased in response to the Covid-19 pandemic in 2020, whilst prices for supplies and goods remained constant or increased slightly. The future price of fuel is also highly uncertain for 2021 and this uncertainty 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 2016 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 2016 to 2020 and were at a 5-year low in 2020 (Table1f). 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 an uncertain economy and the uncertainty of fish prices. 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. Data collected under this arrangement by FFA-deployed observers are currently provided directly to the WCPFC.

Starting on January 1, 2010, the observer coverage rate in the U.S. purse seine fishery in the Convention Area has been 100%. However, in 2020, the observer coverage minimum requirements were waived in response to a global pandemic (COVID-19), and observer coverage rates were below 100% from March-December of 2020.

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). In 2020, observer coverage minimum requirements were waived in response to a global pandemic (Covid-19) and observer coverage rates were below 20% from March-December of 2020.

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 fishing operations, fish catch, and on the biology of target and non-target species. Fish catch data collection now includes measurement of a systematic subsample of 33% of all fish brought on deck, including bycatch species. Prior to 2006, observers attempted to measure 100% of tunas, billfishes and sharks brought on deck, but not other species. Researchers use observer-collected protected species data to estimate the total number of interactions with those species.

For the U.S. longline fishery in the NPO, there were observers on 242 trips out of a total of 1,587 trips, resulting in a coverage rate of 15.2%. These coverage statistics are from 2020 reports of the NOAA Pacific Islands Regional Observer Program (PIROP) and are based on longline trips that departed with observers in calendar year 2020.[2]

Per reporting requirements agreed to at WCPFC 11, Table 3 contains estimates on observer coverage in U.S. longline fisheries for 2020 in the WCPFC Area exclusive of the U.S. EEZ.

Table 3. Observer coverage in 2020 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	33,593,690	5,341,862	16	11,845	2,011	17	1,182	193	16
American Samoa	40,176	0	0	12	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 2016–2020 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 2020, purse seine vessels reported 5 instances of interactions with 21 individual marine mammals. This included 16 false killer whales (*Globocephala Macroprhyncus* -13 released alive and 3 dead), 4 rough toothed dolphins (*Steno Bredanensis* - 4 dead), and 1 sei whale (*Balaenoptera borealis*) 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 72 oceanic whitetip sharks released in 2020 (58 alive and 30 dead). In the longline fishery updated 2020 data are still pending, but 2019 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 2020, purse seine vessels reported interactions with 4 individual whale sharks, all released alive.

[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.

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 5,995 silky sharks released in 2020 (1,239 alive and 4,756 dead). In the longline fishery updated 2020 data are not yet available, but 2019 data indicate that 304 silky sharks were released (293 alive and 11 dead) in the Hawaii-based fishery and 714 silky sharks were released (696 alive and 18 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 2016–2020[2].

Species	2020	2019	2018	2017	2016
Marine Mammals					
Striped dolphin (*Stenella coeruleoalba*)			1	1	1
Common dolphin (*Delphinus delphis, D. capensis)*					
Bottlenose dolphin (*Tursiops truncatus*)	1		4	7	6
Risso's dolphin (*Grampus griseus*)	2	7	2	7	2
Blainville's beaked whale (*Mesoplodon blainvillei*)					
Bryde's whale (*Balaenoptera edeni*)					
False killer whale (*Pseudorca crassidens*)	5	75	49	45	39
Ginkgo-toothed beaked whale (*Mesoplodon*					
Shortfinned pilot whale (*Globicephala*					
Rough-toothed dolphin (*Steno bradenensis*)	5	4			5
Northern elephant seal (*Mirounga angustirostris*)					
Humpback whale (*Megaptera novangliae*)					
Pygmy sperm whale (*Kogia Breviceps*)					
Fin whale (*Balaenoptera physalus)*					
Guadalupe fur seal (*Arctocephalus townsendi*)	7			3	1
Unspecified false killer or shortfinned pilot whale		6	4		
Unidentified Cetacean (*Cetacea*)	4	10	15	18	5
Unidentified Pinniped *(Pinnipedia*)					
Unspecified member of beaked whales (*Ziphiidae*)	1	7			6
Unspecified eared seal (*Otariidae*)	2	1			
Unidentified Kogia Whale	1				
Total Marine Mammals	**28**	**110**	**74**	**81**	**65**
Sea Turtles					
Loggerhead turtle (*Caretta caretta*)	34	20	42	28	23
Leatherback turtle (*Dermochelys coriacea*)	32	14	28	4	20
Olive Ridley turtle (*Lepidochelys olivacea*)	79	140	97	123	162
Green turtle (*Chelonia mydas*)	13	12	18	20	5
Unidentified hardshell turtle (Cheloniidae)	0			5	
Total Sea Turtles	**158**	**186**	**185**	**175**	**215**

[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 counts for the 2020 marine mammals are the total observed. 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. 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 2016-2020 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
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
2019	146	63,349,796	13,322,564	21.03	226	0.02
2020	143	58,763,329	9,326,492	15.87	188	0.02

Table 4c. Total number of observed seabird captures by species in Hawaii-based longline fishery 2016-2020 for North of 23° N and 23° N – 30° S areas combined. Observed capture numbers for 2020 by area are preliminary.

	2020	2020	2019	2019	2018	2018	2017	2017	2016
Species	**>23° N**	**23° N – 30° S**	**>23° N**	**23° N – 30° S**	**>23° N**	**23° N – 30° S**	**>23° N**	**23° N – 30° S**	**Total**
Blackfooted albatross (*Phoebastria nigripes*)	395	204	137	28	192	10	137	148	144
Laysan albatross (*Phoebastria diomedia*)	285	58	57	3	35	0	44	44	60
Unidentified albatross (*Diomedeidae*)	0	0	0	0					1
Red-footed booby (*Sula sula*)	0	5	0	0	1				2
Brown booby (*Sula leucogaster*)	0	7	0	1		1			
Sooty shearwater (*Ardenna grisea*)	0	7	0	0					2
Unidentified shearwater (*Procellariidae*)	0	0	0	0	10				4
	680	**281**	**194**	**32**	**238**	**11**	**181**	**182**	**213**

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 2012-2020
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%

Unloading / Transshipment

Information on the quantities transshipped and the number of transshipments by the U.S. longline and purse-seine fisheries in 2020 is provided in Table 5.

For the U.S. purse-seine fishery in the WCPFC Statistical Area, about half of the total landings of yellowfin, skipjack, and bigeye were transshipped to foreign ports for processing in 2020. There were an estimated 75 transshipments of purse-seine-caught fish in port in 2020.

There was no available information on transshipments for the longline fishery, albacore troll fishery, or any other HMS gear type in 2020.

Table 5. Information on quantities (tons) transshipped and numbers of transshipments of HMS species by U.S. purse seine fisheries in 2020 to satisfy reporting requirements of CMM 2009-06.

Gear Type		Purse Seine	
	2020	Quantities Transshipped (t)	Number of Transshipments
Offloaded	Transshipped in port	50,744	75
	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		50,744	75
Transshipped outside the Convention Area		0	0
Caught inside the Convention Area		50,744	75
Caught outside the Convention Area		0	0
Species	BET	1,746	
	SKJ	43,371	
	YFT	5,627	
Product Form	Fresh	0	
	Frozen	50,744	

Scientific Survey Data

Relevant Publications

Berger AM, Deroba JJ, Bosley KM, Goethel DR, Langseth BJ, Schueller AM, Hanselman DH. 2021. Incoherent dimensionality in fisheries management: consequences of misaligned stock assessment and population boundaries. ICES Journal of Marine Science. https://doi.org/10.1093/icesjms/fsaa203

Bradford AL, Becker EA, Oleson EM, Forney KA, Moore JE, Barlow J. 2020. Abundance Estimates of False Killer Whales in Hawaiian Waters and the Broader Central Pacific. U.S. Dept. of Commerce, NOAA Technical Memorandum NOAA-TM-NMFS-PIFSC-104, 78 p. https://doi.org/10.25923/2jjg-p807

Bradford AL. 2020. Injury Determinations for Marine Mammals Observed Interacting with Hawaii and American Samoa Longline Fisheries During 2018. U.S. Dept. of Commerce, NOAA Technical Memorandum NOAA-TM-NMFS-PIFSC-99, 20 p. https://doi.org/10.25923/2prh-0z06

Brodziak J. 2020. On the Probable Distribution of Stock-Recruitment Steepness for Western and Central North Pacific Swordfish. Pacific Islands Fisheries Science Center, PIFSC Working Paper, WP-20-005, 24 p. https://doi.org/10.25923/xn6v-hg81

Brodziak J. 2021. Some Rebuilding Analyses for the Western and Central North Pacific Ocean Striped Marlin Stock. Pacific Islands Fisheries Science Center, PIFSC Working Paper, WP-20-003, 61 p. https://doi.org/10.25923/3jfy-7r42

Fisheries Research and Monitoring Division, Pacific Islands Fisheries Science Center, NOAA Fisheries. 2020. 2020 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-20-009, 43 p. https://doi.org/10.25923/7k61-rg33.

Fisheries Research and Monitoring Division, Pacific Islands Fisheries Science Center, NOAA Fisheries. 2020. Submission of 2018-2019 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-20-012, 10 p. https://doi.org/10.25923/ndq2-sz64

Fisheries Research and Monitoring Division, Pacific Islands Fisheries Science Center, NOAA Fisheries. 2020. The American Samoa Longline Limited-entry Fishery Annual Report 1 January-31 December 2019. Pacific Islands Fisheries Science Center, PIFSC Data Report, DR-20-019, 12 p. https://doi.org/10.25923/tzzk-tj10

Ito R. 2020. The Hawaii and California-based Pelagic Longline Vessels Annual Report for 1 January-31 December 2019. Pacific Islands Fisheries Science Center, PIFSC Data Report, DR-20-011, 21 p. https://doi.org/10.25923/sxxz-z763

Oleson E. 2020. Abundance, Potential Biological Removal, and Bycatch Estimates for the Hawaii Pelagic Stock of False Killer Whales for 2015-2019. Pacific Islands Fisheries Science Center, PIFSC Administrative Report, H-20-06, 13 p. https://doi.org/10.25923/wmg3-ps37

Research Activities

Highlights:

Quantitative estimates of post-release survival rates of sharks captured in Pacific tuna longline fisheries reveal handling and discard practices that improve survivorship

Shark catch rates are higher in pelagic longline fisheries than in any other fishery, and sharks are typically discarded (bycatch) at sea. The post-release fate of discarded sharks is largely unobserved and could pose a significant source of unquantified mortality that may change stock assessment outcomes and prevent sound conservation and management advice. This NOAA study (Hutchinson et al. 2021) assessed post-release mortality rates of blue (*Prionace glauca*), bigeye thresher (*Alopias superciliosus*), oceanic whitetip (*Carcharhinus longimanus*), silky (*C. falciformis*) and shortfin mako (*Isurus oxyrhincu*s) sharks discarded in the Hawaii deep-set and American Samoa longline fisheries targeting tuna in the central Pacific Ocean. The impacts on survival rates were examined considering species, fishery, fishing gear configuration, handling method, animal condition at capture and at release, and the amount of trailing fishing gear

remaining on discarded sharks. Bayesian survival analysis showed that the condition at release (good vs. injured), branchline leader material, and the amount of trailing fishing gear left on the animals were among the factors that had the largest effect on post-release fate—animals captured on monofilament branchline leaders and released in good condition without trailing fishing gear had the highest rates of survival. This study shows that fisher behavior can have a significant impact on pelagic shark post-release mortality. Ensuring that sharks are handled carefully and released with minimal amounts of trailing fishing gear may reduce fishing mortality on shark populations.

Review on the Effect of Hook Type on the Catchability, Hooking Location, and Post-Capture Mortality of the Shortfin Mako, Isurus oxyrinchus

Due to the assessed vulnerability for the North Atlantic shortfin mako (*Isurus oxyrinchus*) there is an identified need to better understand the use of circle hooks as a potential mitigation measure in longline fisheries. NOAA researchers conducted a literature review related to the effect of hook type on the catchability, anatomical hooking location, and post-capture mortality of this species (Keller et al. 2020). This research found twenty-eight papers related to these topics, yet many were limited in interpretation due to small sample sizes and lack of statistical analysis. Catchability results were inconclusive, suggesting no clear trend in catch rates by hook type. The use of circle hooks was shown to either decrease or have no effect on at-haulback mortality. Three papers documented post-release mortality, ranging from 23-31%. The use of circle hooks significantly increased the likelihood of mouth hooking, which is associated with lower rates of post-release mortality. This review suggests minimal differences in catchability of shortfin mako between hook types, but suggests that use of circle hooks likely results in higher post-release survival that may assist population recovery efforts.

Quantifying the distribution of swordfish (*Xiphias gladius*) density in the Hawaii-based longline fishery

The Hawaii-based longline fishery targeting bigeye tuna and swordfish is the most economically important fishery in Hawaii. Sculley and Brodziak (2020) improved understanding of the distribution of swordfish within this fishery and how it changes in response to environmental conditions is critical for predicting potential climate change impacts to the fishery. The multi-species Vector-Autoregressive Spatio-Temporal (VAST) model was used by NOAA researchers to estimate abundance and density of swordfish within the Hawaii-based longline fishing grounds (Sculley & Brodziak 2020). Swordfish and bigeye tuna catch per unit effort were used in a spatial dynamics factor analysis to help estimate swordfish density in time periods when the swordfish fishery was closed. Although the model was unable to account fully for the significant changes in fishery regulations in 2000, it provided quantified estimates of swordfish density and distribution and information on how those distributions may change in response to environmental variables. Swordfish density center of gravity was found to correlate with the Southern Oscillation Index (SOI) averaged during the swordfish spawning season (April – July), with densities centered further north and east during positive SOI (cooler sea temperatures) and further south and west during negative SOI (warmer sea temperatures).

Catch rate composition affects assessment of protected area impacts

This NOAA study (Sweeney 2021) examines the sources of discrepancy between previous research that disagreed on fishing impacts in response to the Papahānaumokuākea Marine National Monument expansion. One study found little to no negative impact and another determined 7-9 % reductions in fishing revenues. This new study found catch rate composition to critically affect the underlying trends in data with which models are fit and are likely the source of the conflicting findings. This analysis also suggests that aggregate commercial catch rate is a more robust measure of catch per unit effort (CPUE) for Hawaii's deep-set longline fishery, and recommends a reanalysis of a previous model using this measure.

Natal Origin of Pacific Bluefin Tuna from the California Current Large Marine Ecosystem

While the general pattern of PBF trans-Pacific migrations has been documented, questions remain about the origin of PBF in the California Current large marine ecosystem (CCLME) and the contribution rates of recruits from the two spawning areas. For this study (Wells et al. 2020) used natural chemical tags in PBF otoliths to identify natal origin of PBF after their trans-Pacific migration to the California Current. First, they examined chemical signatures of multiple cohorts of age-0 PBF from both the East China Sea and Sea of Japan spawning areas to obtain yearly baseline chemical signatures. Next, core material of the otolith from subadult PBF in the CCLME was analyzed to estimate the relative contribution of each spawning area. Here, they present the first predictions of the natal origin of PBF in the CCLME using otolith chemistry.

Toward an environmental predictor of tuna recruitment

Bigeye tuna are of global economic importance and are the primary target species of Hawaii's most valuable commercial fishery. Due to their high commercial value, bigeye tuna are relatively well studied and routinely assessed. Larval and adult bigeye surveys have been conducted for many years and are supported by ongoing research on their physiology and life history. Yet, modeling stock dynamics and estimating future catch rates remain challenging. This NOAA study (Woodworth et al. 2020) demonstrates that an appropriately lagged measure of phytoplankton size is a robust predictor of catch rates in Hawaii's bigeye tuna fishery with a forecast window of four years. This study provides a fishery-independent tool with the potential to improve stock assessments, aid dynamic fisheries management, and allow Hawaii's commercial longline fishing industry to better plan for the future.

Relevant Publications

Arostegui MC, Braun CD, Woodworth-Jefcoats PA, Kobayashi DR, Gaube P. 2020. Spatiotemporal segregation of ocean sunfish species (Molidae) in the eastern North Pacific. Marine Ecology Progress Series. 654:109-25. https://doi.org/10.3354/meps13514

Bigelow K, Garvilles E, Garcia L, Barcoma S, Cecilio MA. 2020. Relative abundance of yellowfin tuna for the purse seine and handline fisheries operating in the Philippines Moro Gulf

(Region 12) and High Seas Pocket #1. Pacific Islands Fisheries Science Center, PIFSC Working Paper, WP-20-004, 13 p. https://doi.org/10.25923/p0j9-3v54

Heberer, LN, Wraith, J, Kohin, S, Gu, Y, Nasby-Lucas, ND, Dewar, H. 2021. The NOAA Southwest Fisheries Science Center Cooperative Billfish Tagging Program Operations and Database. NOAA Tech. Memo. NMFS-SWFSC-640. https://swfsc-publications.fisheries.noaa.gov/publications/CR/2021/2021Heberer.pdf

Hutchinson M, Siders Z, Stahl J, Bigelow K. 2021. Quantitative estimates of post-release survival rates of sharks captured in Pacific tuna longline fisheries reveal handling and discard practices that improve survivorship. Pacific Islands Fisheries Science Center, PIFSC Data Report, DR-21-001, 61 p. https://doi.org/10.25923/0m3c-2577

Jardim E, Azevedo M, Brodziak J, Brooks EN, Johnson KF, Klibansky N, Millar CP, Minto C, Mosqueira I, Nash RD, et al. 2021. Operationalizing ensemble models for scientific advice to fisheries management. ICES Journal of Marine Science. https://doi.org/10.1093/icesjms/fsab010

Kasperski S, DePiper GS, Blake S, Colburn LL, Jepson M, Haynie1 AC, Karnauskas M, Leong KM, Lipton D, Masi M, et al. 2021. Assessing the State of Coupled Social-Ecological Modeling in Support of Ecosystem Based Fisheries Management in the U.S. Front. Mar. Sci. https://doi.org/10.3389/fmars.2021.631400

Keller B, Swimmer Y, Brown C. 2020. Review on the Effect of Hook Type on the Catchability, Hooking Location, and Post-Capture Mortality of the Shortfin Mako, Isurus Oxyrinchus. Pacific Islands Fisheries Science Center, PIFSC Working Paper, WP-20-003, 10 p. https://doi.org/10.25923/gx1p-m838

Kinney MJ, O'Malley J. 2020. Collaborative biological sampling of highly migratory species. Pacific Islands Fisheries Science Center, PIFSC Working Paper, WP-20-001, 5 p. https://doi.org/10.25923/wx4n-q655

Kraft DW, Conklin EE, Barba EW, Hutchinson M, Toonen RJ, Forsman ZH, Bowen BW. 2020. Genomics versus mtDNA for resolving stock structure in the silky shark (Carcharhinus falciformis) Peer J. 8:e10186. https://doi.org/10.7717/peerj.10186

Martin S, Siders Z, Eguchi I, Langseth B, Yau A, Baker J, Ahrens R, Jones TT. 2020. Update to Assessing the Population-level Impacts of North Pacific Loggerhead and Western Pacific Leatherback Turtle Interactions, inclusion of the Hawaii-based Deep-set and American Samoa-based Longline Fisheries. U.S. Dept. of Commerce, NOAA Technical Memorandum NOAA-TM-NMFS-PIFSC-101, 62 p. https://doi.org/10.25923/pnf2-2q77

McCracken M, Cooper B. 2020. Assessment of Incidental Interactions with Marine Mammals in the Hawaii Longline Deep and Shallow Set Fisheries from 2015 through 2019. Pacific Islands Fisheries Science Center, PIFSC Data Report, DR-20-024, 2 p. https://doi.org/10.25923/m55s-ea18

McCracken M, Cooper B. 2020. Estimation of Bycatch with Bony Fish, Sharks, and Rays in the 2017, 2018, and 2019 Hawaii Permitted Deep-Set Longline Fishery. Pacific Islands Fisheries Science Center, PIFSC Data Report, DR-20-023, 1 p. https://doi.org/10.25923/n97k-wh55

McCracken M, Cooper B. 2020. Hawaii Longline Fishery 2019 Seabird and Sea Turtle Bycatch for the Entire Fishing Grounds, Within the IATTC Convention Area, and Seabird Bycatch for above 23° N and 23° N 30° S. Pacific Islands Fisheries Science Center, PIFSC Data Report, DR-20-004, 4 p. https://doi.org/10.25923/ckxr-vw68.

McCracken M. 2020. Assessment of Incidental Interactions with Marine Mammals in the American Samoa Permitted Longline Fishery from 2015 through 2019. Pacific Islands Fisheries Science Center, PIFSC Data Report, DR-20-022, 1 p. https://doi.org/10.25923/pabs-5e49

McCracken M. 2020. Estimation of Bycatch with Sea Turtles, Seabirds, Bony Fish, Sharks, and Rays in the American Samoa Permitted Longline Fishery for years 2016-2019. Pacific Islands Fisheries Science Center, PIFSC Data Report, DR-20-021, 1 p. https://doi.org/10.25923/8cxm-9j54

Papastamatiou YP, Verbeck D, Hutchinson M, Bracken-Grissom HD, Chapman D. 2020. An encounter between a pelagic shark and giant cephalopod. J Fish Biol. 97(2):588-589. https://doi.org/10.1111/jfb.14415

Peck MA, Alheit J, Bertrand A, Catalan IA, Garrido S, Moyano M, Rykaczewski R, Takasuka A, Van Der Lingen CD. 2021. Small pelagic fish in the new millennium: A bottom-up view of global research effort. Progress in Oceanography. 191:102494. https://doi.org/10.1016/j.pocean.2020.102494

Sculley M. 2021. Correction to the US Hawaii Longline Striped Marlin Catch from 2010-2017. Pacific Islands Fisheries Science Center, PIFSC Working Paper, WP-20-001, 8 p. https://doi.org/10.25923/s3z1-qt02

Sculley M. 2021. Update to the 2019 Western and Central North Pacific Ocean Striped Marlin Stock Assessment. Pacific Islands Fisheries Science Center, PIFSC Working Paper, WP-20-002, 24 p. https://doi.org/10.25923/kj66-qk79

Sculley ML, Brodziak j. 2020. Quantifying the distribution of swordfish (Xiphias gladius) density in the Hawaii-based longline fishery. Fisheries Research. 230:105638. https://doi.org/10.1016/j.fishres.2020.105638

Siders ZA, Ducharme-Barth ND, Carvalho F, Kobayashi D, Martin S, Raynor J, Jones TT, Ahrens RNM. 2020. Ensemble Random Forests as a Tool for Modeling Rare Occurrences. Endangered Species Research. 43:183-197. https://doi.org/10.3354/esr01060

Smith JA, Tommasi D, Welch H, Hazen EL, Sweeney J, Brodie S, Muhling B, Stohs SM, Jacox MG. 2021. Comparing Dynamic and Static Time-Area Closures for Bycatch Mitigation: A Management Strategy Evaluation of a Swordfish Fishery. Frontiers in Marine Science. 8:272. https://doi.org/10.3389/fmars.2021.630607

Stahl JP, Carnes MJ. 2020. Detection Accuracy in the Hawai'i Longline Electronic Monitoring Program with Comparisons between Three Video Review Speeds. Pacific Islands Fisheries Science Center, PIFSC Data Report, DR-20-012, 24 p. https://doi.org/10.25923/n1gq-m468

Sweeney JR. 2021. Catch rate composition affects assessment of protected area impacts. Nature Communications. 12:1-3. https://doi.org/10.1038/s41467-021-21607-4

Tanaka KR, Van Houtan KS, Mailander E, Dias BS, Galginaitis C, O'Sullivan J, Lowe CG, Jorgensen SJ. 2021. North Pacific warming shifts the juvenile range of a marine apex predator. Scientific Reports. 11:3373. https://doi.org/10.1038/s41598-021-82424-9

Uhrin AV, Walsh WA, Brodziak J. 2020. Relative abundance of derelict fishing gear in the Hawaii-based pelagic longline fishery grounds as estimated from fishery observer data. Scientific Reports. 10(1):1-10. https://doi.org/10.1038/s41598-020-64771-1

Weijerman M. 2021. Development of an Atlantis model for Hawaii to support ecosystem-based management. U.S. Dept. of Commerce, NOAA Technical Memorandum NOAA-TM-NMFS-PIFSC-113, 140 p. https://doi.org/10.25923/cwqb-1z04

Wells RD, Mohan J, Dewar H, Rooker J, Tanaka Y, Snodgrass, O, Kohin S, Miller, N, Ohshimo, S. 2020. Natal origin of Pacific bluefin tuna from the California Current Large Marine Ecosystem. Biology Letters. https://doi.org/10.1098/rsbl.2019.0878

Whitney JL, Gove JM, McManus MA, Smith KA, Lecky J, Neubauer P, Phipps JE, Contreras EA, Kobayashi DR, Asner GP. 2021. Surface slicks are pelagic nurseries for diverse ocean fauna. Scientific Reports. 11(1):1-8. https://doi.org/10.1038/s41598-021-81407-0

Williams GD, Andrews KS, Brown JA, Gove JM, Hazen EL, Leong KM, Montenero KA, Moss JH, Rosellon-Druker JM, Schroeder ID, Siddon E. 2021. Place-Based Ecosystem Management: Adapting Integrated Ecosystem Assessment Processes for Developing Scientifically and Socially Relevant Indicator Portfolios. Coastal Management. 49(1):46-71. https://doi.org/10.1080/08920753.2021.1846154

Wood C, Balazs GH, Rice M, Work TM, Jones TT, Sterling E, Summers TM, Brooker J, Kurpita L, King CS, et al. 2021. Sea turtles across the North Pacific are exposed to perfluoroalkyl substances. Environmental Pollution. 279:116875. https://doi.org/10.1016/j.envpol.2021.116875

Woodworth-Jefcoats PA, Ellgen S, Lumsden B, Jacobs A, Marra J, Mooney A, Sabater M. 2021. Summary Report from the 4th Annual Collaborative Climate Science Workshop, 13-15 October 2020. Pacific Islands Fisheries Science Center, PIFSC Administrative Report, H-21-03, 34 p. https://doi.org/10.25923/ezac-hk23

Woodworth-Jefcoats PA, Wren JLK. 2020. Toward an environmental predictor of tuna recruitment. Fish Oceanogr. 29(5):436-441. https://doi.org/10.1111/fog.12487