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

WCPFC-SC19-AR/CCM-27

UNITED STATES OF AMERICA

2023 Annual Report to the
Western and Central Pacific Fisheries Commission

United States of America

PART I. INFORMATION ON FISHERIES, RESEARCH, AND STATISTICS

(Through 2022)

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 2023	**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 targeting skipjack tuna (*Katsuwonus pelamis*) and yellowfin tuna (*Thunnus albacares*); longline fisheries targeting bigeye tuna (*Thunnus obesus*), swordfish (*Xiphias gladius*), or albacore (*Thunnus alalunga*); and a troll fishery targeting albacore. Small-scale fisheries include troll fisheries targeting a wide variety of tropical tunas and associated pelagic species, handline fisheries targeting yellowfin and bigeye tuna, a pole-and-line fishery targeting skipjack tuna, and as well as other miscellaneous-gear fisheries.

In these large- and small-scale fisheries, other pelagic species are captured incidentally or targeted (e.g. small-scale troll fisheries) including 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, Guam, and the Commonwealth of the Northern Mariana Islands (CNMI).

This report presents estimates of annual catches of tuna, billfish, and other highly migratory species (HMS), and vessel participation during 2018–2022 for fisheries of the United States and its Participating Territories operating in the Western and Central Pacific Fisheries Commission (WCPFC) Statistical Area. All statistics for 2022 are provisional. Statistics for 2021 have been updated from those reported provisionally in the submission of 2017–2021 (NOAA, NMFS 2021).

Overall trends in total retained catch by the United States and U.S.-associated Participating Territory fisheries in the (WCPFC) Statistical Area are dominated by the catches of the purse seine fishery. Total purse seine catches in 2021 (50,479 t) and 2022 (55,708 t) declined to less than half of the total catches for each of the three previous years (2018, 194,779 t; 2019, 165,971 t; 2020, 137,406 t; Table 1a-e) Preliminary 2022 purse seine estimates of retained catch are 42,793 t of skipjack tuna, 4,449 t of yellowfin tuna, and 8,457 t of bigeye tuna.

U.S. and Participating Territory longline annual retained catch of all pelagic species in the WCPFC statistical area ranged between 10,535 t to 12,610 t during the 5-year period of 2018 to 2022 with catches lowest in the last three years (2020 to 2022); the 2022 catch of 11,278 t was around the 5-year average catch (11,783 t; Table 1a-e). On average, about 12% of this annual total catch in the WCPFC statistical area is from American Samoa vessels fishing in the South Pacific Ocean (SPO). Retained annual catch in the SPO ranged from 908 t to 2,016 t during the 5-year period of 2018 to 2022 with the 2022 catch (1,350 t) similar to the 5-year average (1,373 t, Table 1f). Bigeye tuna longline retained catch in the WCPFC statistical area by the United States and its Territories remained stable over the last 5 years (2018 to 2022) with an average of 5,665 t and a range of 5,236 t to 6,058 t with a 2022 catch of 5,346 t (Table 1a-e). Longline catch of bigeye tuna in the north Pacific Ocean within the WCPFC statistical area by only U.S. longline vessels (excluding any bigeye tuna caught by the Territories or by U.S. vessels that was attributed to a U.S. Territory as part of an arrangement[1]) was 3,237 t in 2022, which is below the annual bigeye catch limit[2] of 3,554 t for 2022. Albacore longline retained catch by the United States and its Territories ranged from 599 t to 1,612 t during 2018 to 2022 with the 2022 catch (1,202 t) above the 5-year average (1,107 t, Table 1a-e). Yellowfin longline retained annual catch in the WCPFC statistical area by the United States and its territories ranged from 1,581 t to 2,509 t from 2018 to 2022 with the 2022 catch (2,301 t) above the 5-year average of (2,139 t; Table 1a-e). Swordfish longline retained catch by the United States and its territories in the WCPFC statistical area ranged from 309 t to 763 t during 2018 to 2022 with the 2022 catch (763 t) above the average (568 t) and the 2022 catch was the highest annual catch for the 5-year period (Table 1 a-e).

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 with an annual average from 2018 to 2022 of 1,886 vessels using troll, handline or both gear types. While the purse seine fleet is small comparatively, with an average of only 24 vessels from 2018 to 2022, this fleet has the largest catch. As mentioned above, participation in the purse seine fleet declined with only 13 vessels operating in 2022. The second largest fleet is the longline fleet with an average of 151 vessels operating from 2018 to 2022. The albacore troll fleet in the WCPFC statistical area had on average 19 vessels

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[1] Agreements allowing bigeye tuna catch from the Hawaii-permitted longline vessels that fished in the high seas or the Hawaii EEZ to be attributed to U.S territories of American Samoa, Guam, or CNM: 1) Consolidated and Further Continuing Appropriations Act, Sec. 113(a), 2012, Pub. L. 112-55, 125 Stat. 552 et seq., 2) of the Pelagics Fishery Ecosystem Plan, Amendment 7).

[2] The annual bigeye catch limits were established in U.S. fishery regulations (50 CFR Part 300) pursuant to the provisions in the following WCPFC Conservation and Management Measures (CMM): for 2009 through 2011 2008-01, for 2012 CMM 2011-01, for 2013 CMM 2012-01, for 2014 CMM 2013-01, for 2015 CMM 2014-01, for 2016 CMM 2015-01, for 2017 CMM 2016-01, for 2018 CMM 2017-01, for 2019 CMM 2018-01, for 2020 CMM 2019-01, for 2021 CMM 2020-01, and for 2022 CMM 2021-01.

operating annually from 2018 to 2022.

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 on targeted and bycatch species, including biological and oceanographic research, fish stock assessment research, studies to reduce bycatch, and socio-cultural studies. In 2022 and 2023, socio-economic studies were conducted to include fisher observations from Hawaii and U.S. Territories in Stock Assessment and Fishery Evaluation (SAFE) reports, to examine human dimensions to reduce protected species bycatch, to study the economics and social characteristics of Hawaii's small boat fisheries, and to investigate the market trends in Hawaii's fisheries. Stock assessment research was conducted with collaborations 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 research on oceanic whitetip sharks. NOAA Fisheries biological and oceanographic research included movement and habitat studies and research on climate change, eddies, El Niño-Southern Oscillation, and biogeochemistry.

Tabular Annual Fisheries Information

The purse seine fishery remains the largest U.S. fishery in terms of total catch. It accounts for about 79% of the total catch of HMS by the United States and its Participating Territories in the WCPFC statistical area. The longline, tropical troll, handline and albacore troll fisheries account for 16%, 2%, 1%, and 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 70,213 t in 2022 (Table 1a) similar to the 2021 catch (64,503 t); however, this annual catch is less than half of the annual catch during the previous three years (2018–2020) due to a decline in purse seine catch and vessel participation (Tables 1a-e, Table 2a). The catch consisted primarily of skipjack tuna (62%), bigeye tuna (20%), yellowfin tuna (11%), and albacore (4%). Catches of skipjack and yellowfin tuna were similar to 2021 catches however were much lower than the previous three years (2018–2020) due to the decreased catch and participation in the purse seine fishery (Tables 1a-e, Table 2a).

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 CNMI) by species and fishing gear in the WCPFC Statistical Area for 2022 (preliminary). Totals may not match sums of values due to rounding to the nearest metric ton. Catch less than 0.5 t is indicated by 0 while no catch by a "-".

Species and FAO Code	Purse Seine	Longline	Albacore Troll	Tropical Troll	Handline	Total
Albacore (ALB), North Pacific	-	129	-	1	5	135
Albacore (ALB), South Pacific	-	1073	1400	0	-	2473
Bigeye tuna (BET)	8457	5346	-	13	201	14016
Pacific bluefin tuna (PBF)	-	1	-	0	-	1
Skipjack tuna (SKJ)	42793	133	-	353	5	43284
Yellowfin tuna (YFT)	4449	2301	-	367	405	7522
Other tuna (TUN KAW FRI)	-	-	-	2	1	3
TOTAL TUNAS	55699	8984	1400	735	616	67434
Black marlin (BLM)	0	0	-	1	-	2
Blue marlin (BUM)	3	450	-	116	3	572
Sailfish (SFA)	-	9	-	3	-	12
Spearfish (SSP)	-	-	-	4	0	124
Striped marlin (MLS), North Pacific	-	255	-	9	-	264
Striped marlin (MLS), South Pacific	-	2	-	-	-	2
Other marlins (BIL)	-	0	-	0	-	0
Swordfish (SWO), North Pacific	-	760	-	0	1	762
Swordfish (SWO), South Pacific	-	3	-	-	-	3
TOTAL BILLFISHES	3	1600	-	134	4	1741
Blue shark (BSH)	-	-	-	0	-	0
Mako shark (MAK)	-	1	-	0	-	1
Thresher sharks (THR)	-	2	-	0	-	2
Other sharks (SKH OCS FAL SPN TIG CCL)	0	0	-	0	-	0
TOTAL SHARKS	0	3	-	0	-	3
Mahimahi (DOL)	1	149	-	231	8	389
Moonfish (LAP)	-	92	-	0	-	92
Oilfish (GEP)	-	64	-	0	0	64
Pomfrets (BRZ)	-	155	-	2	2	159
Wahoo (WAH)	2	231	-	85	2	320
Other fish (PEL PLS MOP TRX GBA ALX GES RRU DOT)	2	2	-	8	0	12
TOTAL OTHER	5	692	-	326	13	1035
TOTAL	55708	11278	1400	1195	632	70213

Table 1b. Estimated weight (in metric tons) of catch by vessels of the United States and its Participating Territories (American Samoa, Guam, and CNMI) by species and fishing gear in the WCPFC Statistical Area for 2021. Totals may not match sums of values due to rounding to the nearest metric ton. Catch less than 0.5 t is indicated by 0 while no catch by a "-".

Species and FAO Code	Purse Seine	Longline	Albacore Troll	Tropical Troll	Handline	Total
Albacore (ALB), North Pacific	-	135	-	1	5	141
Albacore (ALB), South Pacific	0	835	654	0	-	1490
Bigeye tuna (BET)	6145	5683	-	13	123	11964
Pacific bluefin tuna (PBF)	-	1	-	0	-	1
Skipjack tuna (SKJ)	39507	198	-	516	4	40225
Yellowfin tuna (YFT)	4820	2509	-	387	276	7992
Other tuna (TUN KAW FRI)	-	-	-	3	1	4
TOTAL TUNAS	50472	9362	654	919	409	61816
Black marlin (BLM)	1	0	-	1	-	2
Blue marlin (BUM)	2	397	-	128	3	530
Sailfish (SFA)	-	11	-	1	-	12
Spearfish (SSP)	-	121	-	5	-	126
Striped marlin (MLS), North Pacific	-	226	-	8	-	234
Striped marlin (MLS), South Pacific	-	3	-	-	-	3
Other marlins (BIL)	-	1	-	0	-	1
Swordfish (SWO), North Pacific	-	567	-	0	1	569
Swordfish (SWO), South Pacific	-	3	-	-	-	3
TOTAL BILLFISHES	3	1329	-	143	4	1480
Blue shark (BSH)	-	-	-	0	-	0
Mako shark (MAK)	-	1	-	0	-	1
Thresher sharks (THR)	-	1	-	0	-	1
Other sharks (SKH OCS FAL SPN TIG CCL)	-	-	-	0	-	0
TOTAL SHARKS	-	2	-	0	-	2
Mahimahi (DOL)	2	128	-	194	7	330
Moonfish (LAP)	-	136	-	0	-	136
Oilfish (GEP)	-	58	-	1	0	60
Pomfrets (BRZ)	-	150	-	1	2	153
Wahoo (WAH)	2	371	-	134	4	511
Other fish (PEL PLS MOP TRX GBA ALX GES RRU DOT)	1	3	-	11	0	15
TOTAL OTHER	5	846	-	341	13	1205
TOTAL	50479	11539	654	1404	427	64503

Table 1c. Estimated weight (in metric tons) of catch by vessels of the United States and its Participating Territories (American Samoa, Guam, and CNMI) by species and fishing gear in the WCPFC Statistical Area for 2020. Totals may not match sums of values due to rounding to the nearest metric ton. Catch less than 0.5 t is indicated by 0 while no catch by a "-".

Species and FAO Code	Purse Seine	Longline	Albacore Troll	Tropical Troll	Handline	Total
Albacore (ALB), North Pacific	-	57	18	0	3	78
Albacore (ALB), South Pacific	-	542	1901	0	-	2443
Bigeye tuna (BET)	9487	6058	-	19	145	15709
Pacific bluefin tuna (PBF)	-	1	-	0	-	1
Skipjack tuna (SKJ)	116886	203	-	347	5	117440
Yellowfin tuna (YFT)	11015	1581	-	331	243	13170
Other tuna (TUN KAW FRI)	-	-	-	1	1	2
TOTAL TUNAS	137388	8442	1919	698	397	148844
Black marlin (BLM)	1	0	-	1	-	3
Blue marlin (BUM)	9	513	-	111	3	636
Sailfish (SFA)	-	7	-	1	-	7
Spearfish (SSP)	-	105	-	3	-	108
Striped marlin (MLS), North Pacific	0	288	-	10	-	298
Striped marlin (MLS), South Pacific	1	2	-	-	-	2
Other marlins (BIL)	-	1	-	0	-	1
Swordfish (SWO), North Pacific	-	306	-	0	2	307
Swordfish (SWO), South Pacific	-	3	-	-	-	3
TOTAL BILLFISHES	11	1223	-	125	5	1364
Blue shark (BSH)	-	-	-	0	-	0
Mako shark (MAK)	-	2	-	0	-	2
Thresher sharks (THR)	-	1	-	0	-	1
Other sharks (SKH OCS FAL SPN TIG CCL)	-	0	-	0	-	0
TOTAL SHARKS	-	3	-	0	-	3
Mahimahi (DOL)	3	92	-	195	6	296
Moonfish (LAP)	-	238	-	0	-	238
Oilfish (GEP)	-	63	-	1	-	65
Pomfrets (BRZ)	-	181	-	0	1	182
Wahoo (WAH)	2	292	-	69	3	367
Other fish (PEL PLS MOP TRX GBA ALX GES RRU DOT)	1	2	-	12	1	15
TOTAL OTHER	7	867	-	278	11	1162
TOTAL	137406	10535	1919	1101	413	151374

Table 1d. Estimated weight (in metric tons) of catch by vessels of the United States and its Participating Territories (American Samoa, Guam, and CNMI) by species and fishing gear in the WCPFC Statistical Area for 2019. Totals may not match sums of values due to rounding to the nearest metric ton. Catch less than 0.5 t is indicated by 0 while no catch by a "-".

Species and FAO Code	Purse Seine	Longline	Albacore Troll	Tropical Troll	Handline	Total
Albacore (ALB), North Pacific	-	101	-	1	10	111
Albacore (ALB), South Pacific	-	1050	872	0	-	1923
Bigeye tuna (BET)	3014	6003	-	35	226	9278
Pacific bluefin tuna (PBF)	-	2	-	0	-	2
Skipjack tuna (SKJ)	144839	295	-	482	9	145625
Yellowfin tuna (YFT)	18102	1965	-	456	249	20771
Other tuna (TUN KAW FRI)	-	-	-	3	1	4
TOTAL TUNAS	165955	9415	872	977	495	177715
Black marlin (BLM)	3	0	-	2	-	6
Blue marlin (BUM)	3	860	-	176	5	1045
Sailfish (SFA)	0	16	-	1	-	17
Spearfish (SSP)	-	-	-	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
Swordfish (SWO), North Pacific	-	555	-	0	3	558
Swordfish (SWO), South Pacific	-	4	-	-	-	4
TOTAL BILLFISHES	7	2068	-	200	8	2282
Blue shark (BSH)	-	0	-	0	-	0
Mako shark (MAK)	-	35	-	0	-	35
Thresher sharks (THR)	-	5	-	0	-	5
Other sharks (SKH OCS FAL SPN TIG CCL)	-	-	-	0	-	0
TOTAL SHARKS	-	40	-	0	-	40
Mahimahi (DOL)	3	145	-	344	8	500
Moonfish (LAP)	-	428	-	0	-	428
Oilfish (GEP)	-	103	-	0	-	103
Pomfrets (BRZ)	-	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	12955	872	1688	527	182014

Table 1e. Estimated weight (in metric tons) of catch by vessels of the United States and its Participating Territories (American Samoa, Guam, and CNMI) by species and fishing gear in the WCPFC Statistical Area for 2018. Totals may not match sums of values due to rounding to the nearest metric ton. Catch less than 0.5 t is indicated by 0 while no catch by a "-".

Species and FAO Code	Purse Seine	Longline	Albacore Troll	Tropical Troll	Handline	Total
Albacore (ALB), North Pacific	-	70	12	1	20	103
Albacore (ALB), South Pacific	-	1542	535	0	-	2077
Bigeye tuna (BET)	6958	5236	-	27	117	12339
Pacific bluefin tuna (PBF)	-	1	-	0	-	1
Skipjack tuna (SKJ)	167235	196	-	534	5	167971
Yellowfin tuna (YFT)	20565	2339	-	597	340	23842
Other tuna (TUN KAW FRI)	-	-	-	5	1	6
TOTAL TUNAS	194759	9384	547	1165	484	206339
Black marlin (BLM)	3	0	-	2	0	5
Blue marlin (BUM)	5	598	-	167	3	773
Sailfish (SFA)	-	11	-	4	-	14
Spearfish (SSP)	-	187	-	10	0	197
Striped marlin (MLS), North Pacific	0	375	-	12	-	387
Striped marlin (MLS), South Pacific	0	1	-	-	-	2
Other marlins (BIL)	-	1	-	0	-	1
Swordfish (SWO), North Pacific	-	631	-	1	3	634
Swordfish (SWO), South Pacific	-	6	-	-	-	6
TOTAL BILLFISHES	8	1811	-	195	6	2020
Blue shark (BSH)	-	3	-	0	-	3
Mako shark (MAK)	-	42	-	0	-	42
Thresher sharks (THR)	-	2	-	0	-	2
Other sharks (SKH OCS FAL SPN TIG CCL)	-	-	-	1	-	1
TOTAL SHARKS	-	47	-	1	-	48
Mahimahi (DOL)	2	174	-	323	9	508
Moonfish (LAP)	-	449	-	0	-	449
Oilfish (GEP)	-	112	-	0	-	112
Pomfrets (BRZ)	-	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	547	1875	513	210324

Table 1f. Longline retained catch in metric tons (t) by species and species group for U.S. and American Samoa (AS) vessels operating in the WCPFC Statistical Area of the North Pacific Ocean (NPO) and South Pacific Ocean (SPO) in 2018–2022. Totals may not match sums of values due to rounding to the nearest metric ton. Catch less than 0.5 t is indicated by 0 while no catch by a "-". No catch occurred in Guam from 2018–2022.

	U.S. (NPO)					CNMI (NPO)					AS (NPO)					AS (SPO)					Total				
	2022	2021	2020	2019	2018	2022	2021	2020	2019	2018	2022	2021	2020	2019	2018	2022	2021	2020	2019	2018	2022	2021	2020	2019	2018
Vessels	142	137	135	138	136	119	131	119	128	121	133	24	122	127	113	11	12	11	18	14	153	150	146	156	151
Species																									
Albacore, NPO	108	105	48	88	59	-	-	-	-	-	22	30	8	12	11	-	-	-	-	-	129	135	57	101	70
Albacore, SPO	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1,073	835	542	1,050	1,542	1,073	835	542	1,050	1,542
Bigeye tuna	3,237	3,748	3,546	3,459	3,393	544	1,500	925	999	993	1,546	405	1,563	1,514	798	19	30	23	31	53	5,346	5,683	6,058	6,003	5,236
Pacific bluefin tuna	1	1	0	1	0	-	-	-	-	-	0	0	-	0	0	-	0	0	0	1	1	1	1	2	1
Skipjack tuna	84	130	124	198	105	-	-	-	-	-	10	15	16	28	15	39	53	63	69	76	133	198	203	295	196
Yellowfin tuna	1,969	2,021	1,199	1,556	1,868	-	-	-	-	-	184	274	160	220	209	148	214	222	189	261	2,301	2,509	1,581	1,965	2,339
Other tuna	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TOTAL TUNAS	5,399	6,005	4,918	5,302	5,425	544	1,500	925	999	993	1,762	725	1,747	1,774	1,034	1,278	1,132	851	1,339	1,934	8,984	9,362	8,442	9,415	9,384
Black marlin	0	0	0	0	-	-	-	-	-	-	-	0	-	-	-	-	-	-	-	-	0	0	0	0	-
Blue marlin	351	332	440	747	529	-	-	-	-	-	52	31	44	83	38	47	34	28	29	32	450	397	513	860	598
Sailfish	8	9	5	12	9	-	-	-	-	-	1	1	1	2	1	1	1	1	2	1	9	11	7	16	11
Spearfish	111	110	94	154	171	-	-	-	-	-	8	10	11	16	15	1	1	0	2	1	120	121	105	173	187
Striped Marlin, NPO	230	196	241	397	332	-	-	-	-	-	25	30	47	62	44	-	-	-	-	-	255	226	288	458	375
Striped Marlin, SPO	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	3	2	2	1	2	3	2	2	1
Other marlins	0	1	1	0	1	-	-	-	-	-	-	0	-	0	-	-	-	-	-	-	0	1	1	0	1
Swordfish, NPO	735	528	266	510	590	-	-	-	-	-	26	39	40	44	41	-	-	-	-	-	760	567	306	555	631
Swordfish, SPO	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3	3	3	4	6	3	3	3	4	6
TOTAL BILLFISH	1,436	1,177	1,047	1,821	1,631	-	-	-	-	-	111	111	143	208	138	53	42	33	39	41	1,600	1,329	1,223	2,068	1,811
Blue shark	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3	-	-	-	0	3
Mako shark	1	1	2	32	36	-	-	-	-	-	-	-	0	3	5	-	-	0	0	0	1	1	2	35	42
Thresher	2	1	1	4	2	-	-	-	-	-	-	1	-	1	-	-	-	-	1	1	2	1	1	5	2
Sharks nei	0	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0	-	0	-	-
Oceanic whitetip	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Silky shark	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0	-	-	-	-	0
Hammerhead	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Tiger shark	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Blacktip shark	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TOTAL SHARKS	3	1	3	36	38	-	-	-	-	-	-	1	0	3	5	-	-	0	1	4	3	2	3	40	47
Mahimahi	129	109	75	123	155	-	-	-	-	-	14	18	11	20	14	6	1	5	2	5	149	128	92	145	174
Moonfish	80	109	198	368	390	-	-	-	-	-	12	26	40	59	58	0	1	1	1	1	92	136	238	428	449
Oilfish	57	52	55	89	98	-	-	-	-	-	7	6	8	15	14	0	0	0	0	0	64	58	63	103	112
Pomfret	138	132	157	246	265	-	-	-	-	-	17	18	23	29	32	0	0	0	0	0	155	150	181	275	298
Wahoo	194	314	239	401	264	-	-	-	-	-	25	41	35	60	34	12	16	18	18	31	231	371	292	479	329
Other fish	1	2	1	1	4	-	-	-	-	-	0	0	0	1	0	0	1	0	0	0	2	3	2	2	5
TOTAL OTHER	600	718	726	1,228	1,178	-	-	-	-	-	74	109	118	184	153	18	19	24	21	37	692	846	867	1,433	1,367
TOTAL	7,437	7,901	6,694	8,387	8,272	544	1,500	925	999	993	1,946	945	2,008	2,169	1,329	1,350	1,193	908	1,400	2,016	11,278	11,539	10,535	12,955	12,610

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 operating in the WCPFC Statistical Area in 2018–2022. Totals may not match sums of values due to rounding to the nearest metric ton. Catch less than 0.5 t is indicated by 0 while no catch by a "-".

	Hawaii					Guam					CNMI					American Samoa					Total Tropical Troll				
	2022	2021	2020	2019	2018	2022	2021	2020	2019	2018	2022	2021	2020	2019	2018	2022	2021	2020	2019	2018	2022	2021	2020	2019	2018
Vessels	1166	1186	1125	1294	1387	449	546	459	465	398	92	83	73	51	56	9	5	8	5	7	1716	1820	1665	1815	1848
Species																									
Albacore, NPO	1	1	0	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	1	0	1	1
Albacore, SPO	-	-	-	-	-	0	0	0	0	0	-	-	-	-	-	0	0	0	0	0	0	0	0	0	0
Bigeye tuna	13	13	18	35	27	0	0	0	0	0	-	-	-	-	-	0	0	0	0	0	13	13	19	35	27
Pacific bluefin tuna	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0	0	0	0	0	0	0	0	0	0
Skipjack tuna	101	69	78	106	84	190	302	158	215	277	60	139	108	157	170	2	6	3	5	3	353	516	347	482	534
Yellowfin tuna	345	331	294	410	564	15	42	25	29	24	6	12	11	17	5	0	2	2	1	4	367	387	331	456	597
Other tunas	1	1	1	3	3	0	0	0	0	0	1	1	0	0	1	0	0	0	0	0	2	3	1	3	5
TOTAL TUNAS	460	415	392	555	680	206	344	183	244	301	68	153	119	173	177	2	8	5	6	7	735	919	698	977	1165
Black marlin	1	1	1	2	2	0	0	0	0	0	-	-	-	-	-	0	0	0	0	0	1	1	1	2	2
Blue marlin	112	112	88	152	154	4	14	23	23	11	0	1	0	2	1	0	0	0	0	0	116	128	111	176	167
Sailfish	1	1	1	1	2	0	0	0	0	2	2	0	0	0	0	0	0	0	0	0	3	1	1	1	4
Spearfish	4	5	3	7	10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	5	3	7	10
Striped marlin, NPO	9	8	10	13	12	0	0	0	0	0	-	-	-	-	-	0	0	0	0	0	9	8	10	13	12
Striped marlin, SPO	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Other billfish	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0	0	0	0	0	0	0	0	0	0
Swordfish, NPO	0	0	-	0	1	0	0	0	0	0	-	-	-	-	-	0	0	0	0	0	0	0	0	0	1
Swordfish, SPO	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TOTAL BILLFISHES	128	128	102	175	179	4	14	23	23	13	2	1	0	2	1	0	0	0	0	1	134	143	125	200	195

Table 1g. Continued.

	Hawaii					Guam					CNMI					American Samoa					Total Tropical Troll				
	2022	2021	2020	2019	2018	2022	2021	2020	2019	2018	2022	2021	2020	2019	2018	2022	2021	2020	2019	2018	2022	2021	2020	2019	2018
Species																									
Blue shark	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0	0	0	0	0	0	0	0	0	0
Mako shark	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	0	0	0	0	0	0	0	0	0	0
Thresher sharks	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0	0	0	0	0	0	0	0	0	0
Other sharks	-	-	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
TOTAL SHARKS	-	-	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Mahimahi	162	166	138	249	253	43	14	42	62	40	26	14	14	33	30	0	0	0	0	0	231	194	195	344	323
Moonfish	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0	0	0	0	0	0	0	0	0	0
Oilfish	-	-	-	-	-	0	1	1	0	0	-	-	-	-	-	0	0	0	0	0	0	1	1	0	0
Pomfrets	-	-	-	0	-	2	1	0	0	0	0	0	0	0	0	0	0	0	0	0	2	1	0	0	0
Wahoo	49	121	47	146	137	26	10	21	11	44	9	2	1	1	3	0	0	0	0	0	85	134	69	158	184
Other pelagics	0	0	0	0	0	5	5	8	5	6	3	6	4	3	1	0	0	0	0	0	8	11	12	9	8
TOTAL OTHER	211	287	186	396	390	75	31	72	78	90	39	22	19	37	33	0	1	1	1	1	326	341	278	511	515
GEAR TOTAL	799	830	679	1126	1251	286	389	278	345	404	108	176	138	212	211	2	8	5	7	9	1195	1404	1101	1688	1875

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 2018–2022 to fulfill the reporting requirements of WCPFC CMM 2009-03. No catch was indicated by "-".

	U.S. Vessels South of 20° S	
Year	Catch (t)	Number of vessels fishing for swordfish
2022	-	0
2021	-	0
2020	-	0
2019	-	0
2018	-	0

Table 2a. Estimated number of United States and Participating Territories vessels operating in the WCPFC Statistical Area by gear type from 2018 to 2022. Data are preliminary for 2022.

	2022	2021	2020	2019	2018
Purse seine	13	21	23	31	34
Longline (N Pac-based) [1]	142	137	135	138	136
Longline (American Samoa-based)	133	24	122	127	113
Total U.S. Longline [2]	153	150	146	156	151
Albacore troll (N Pac)	1	0	3	0	4
Albacore troll (S Pac)	18	21	18	9	11
Albacore troll (N and S Pac combined)[3]	19	21	18	9	13
Tropical troll	1716	1820	1665	1815	1848
Handline	432	388	396	445	429
Tropical Troll and Handline (combined)[4]	1826	1918	1792	1933	1963
TOTAL	2010	2110	1979	2129	2159

[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 Albacore troll (N and S Pac combined) .
[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 and gross registered tonnage (GRT) from 2018 to 2022. Data are preliminary for 2022.

Gear and year	0-50	51-200	201-500	501-1000	1001-1500	1500+
2018 Purse seine	0	0	0	0	15	19
2019 Purse seine	0	0	0	0	12	19
2020 Purse seine	0	0	0	0	6	17
2021 Purse seine	0	0	0	0	6	15
2022 Purse seine	0	0	0	0	4	9
2018 Longline	7	144	0	0	0	0
2019 Longline	10	146	0	0	0	0
2020 Longline	6	140	0	0	0	0
2021 Longline	4	146	0	0	0	0
2022 Longline	3	150	0	0	0	0
	0-50	**51-200**	**150+**			
2018 Pole and line	1	1	0	0	0	0
2019 Pole and line	1	1	0	0	0	0
2020 Pole and line	1	1	0	0	0	0
2021 Pole and line	1	1	0	0	0	0
2022 Pole and line	1	1	0	0	0	0
2018 Albacore Troll	0	8	5	0	0	0
2019 Albacore Troll	0	6	3	0	0	0
2020 Albacore Troll	0	9	9	0	0	0
2021 Albacore Troll	0	12	9	0	0	0
2022 Albacore Troll	0	9	10	0	0	0

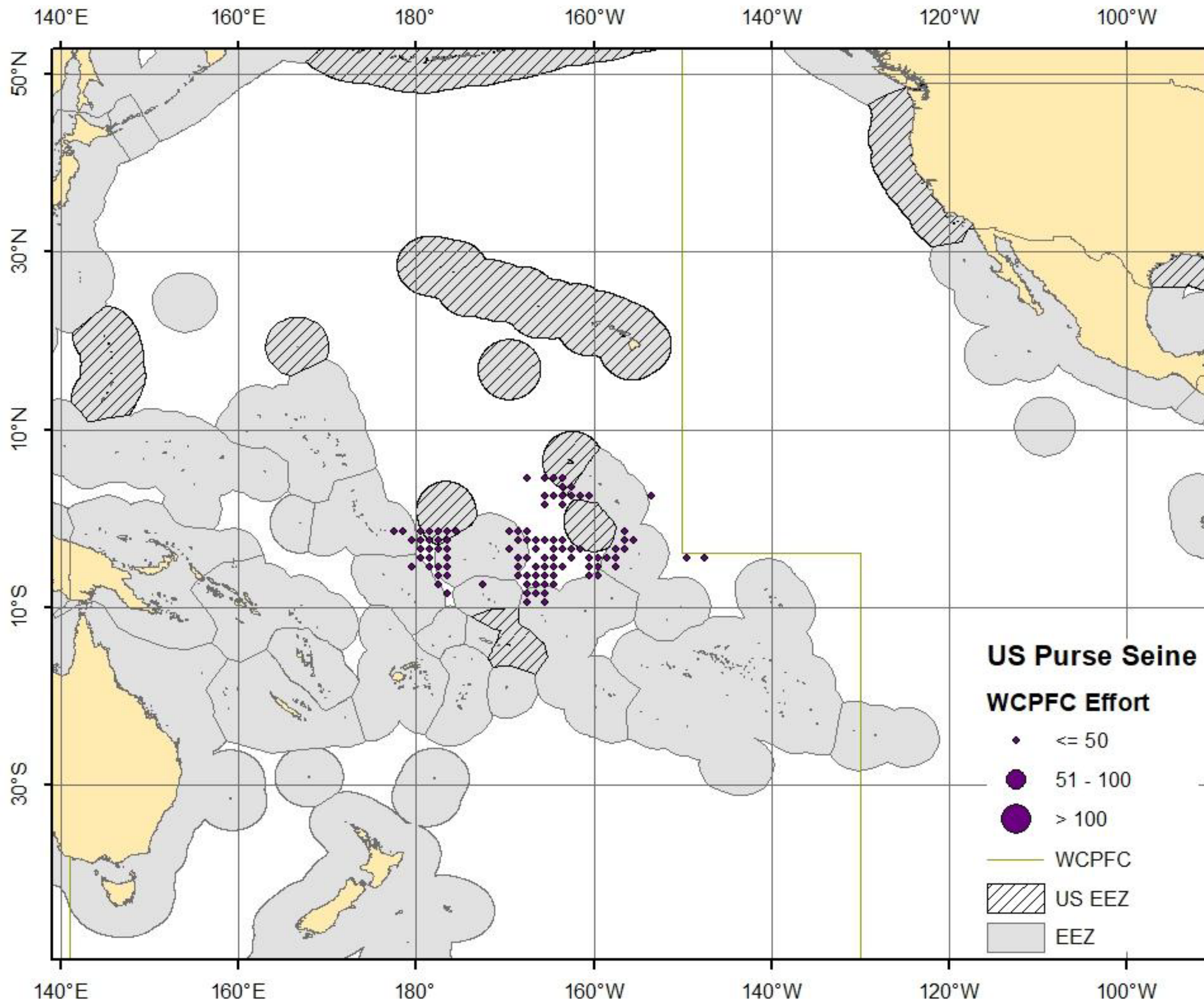

Figure 1. Spatial distribution of fishing effort (number of fishing sets) reported in logbooks by U.S.- flagged purse seine vessels the Pacific Ocean in 2022 (preliminary data). Effort in some areas is not shown to preserve data confidentiality.

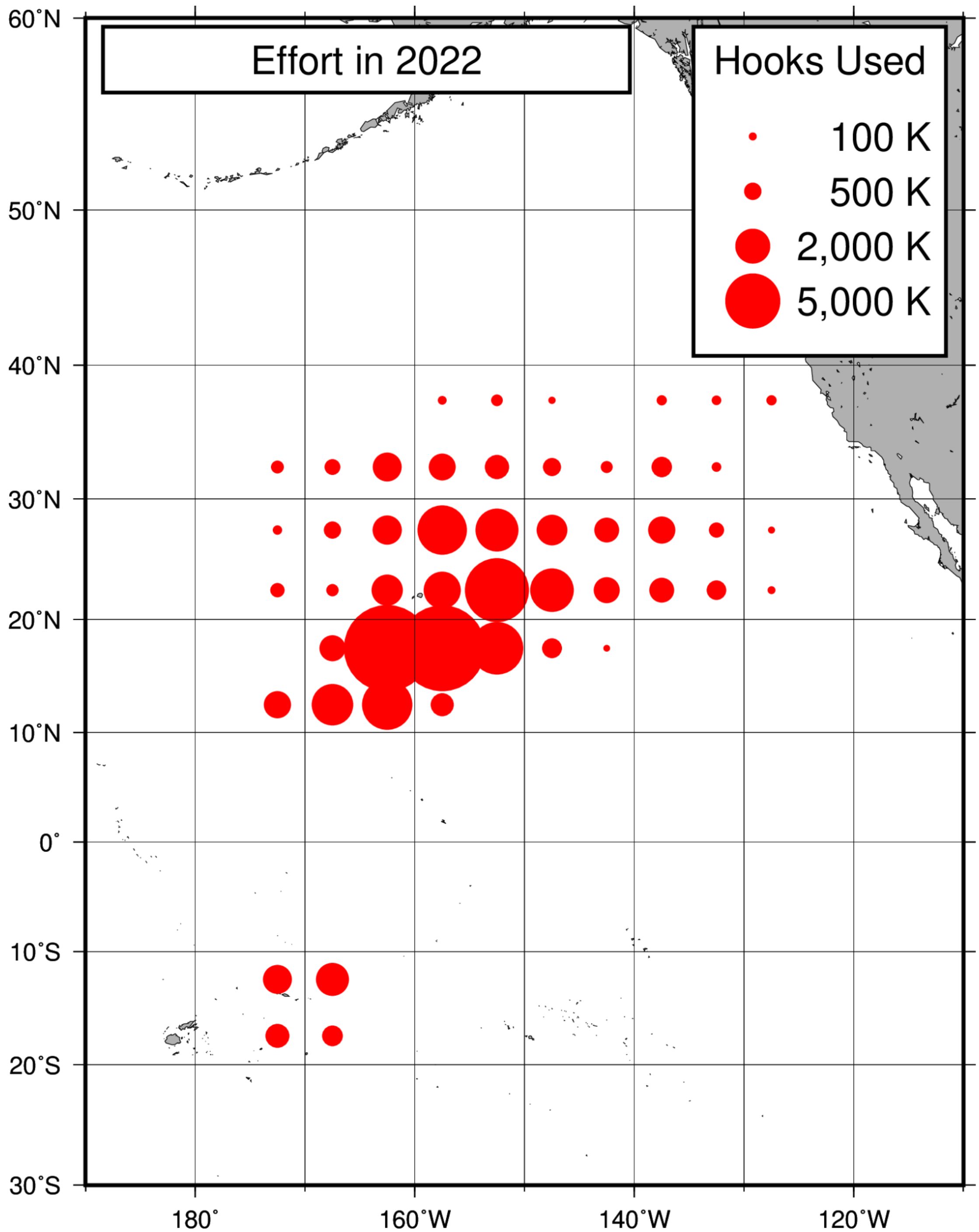

Figure 2a. Spatial distribution of fishing effort (K=1,000 hooks) reported by U.S.-flagged longline vessels in 2022 proportional to effort (preliminary data). Effort in some areas is not shown to preserve data confidentiality.

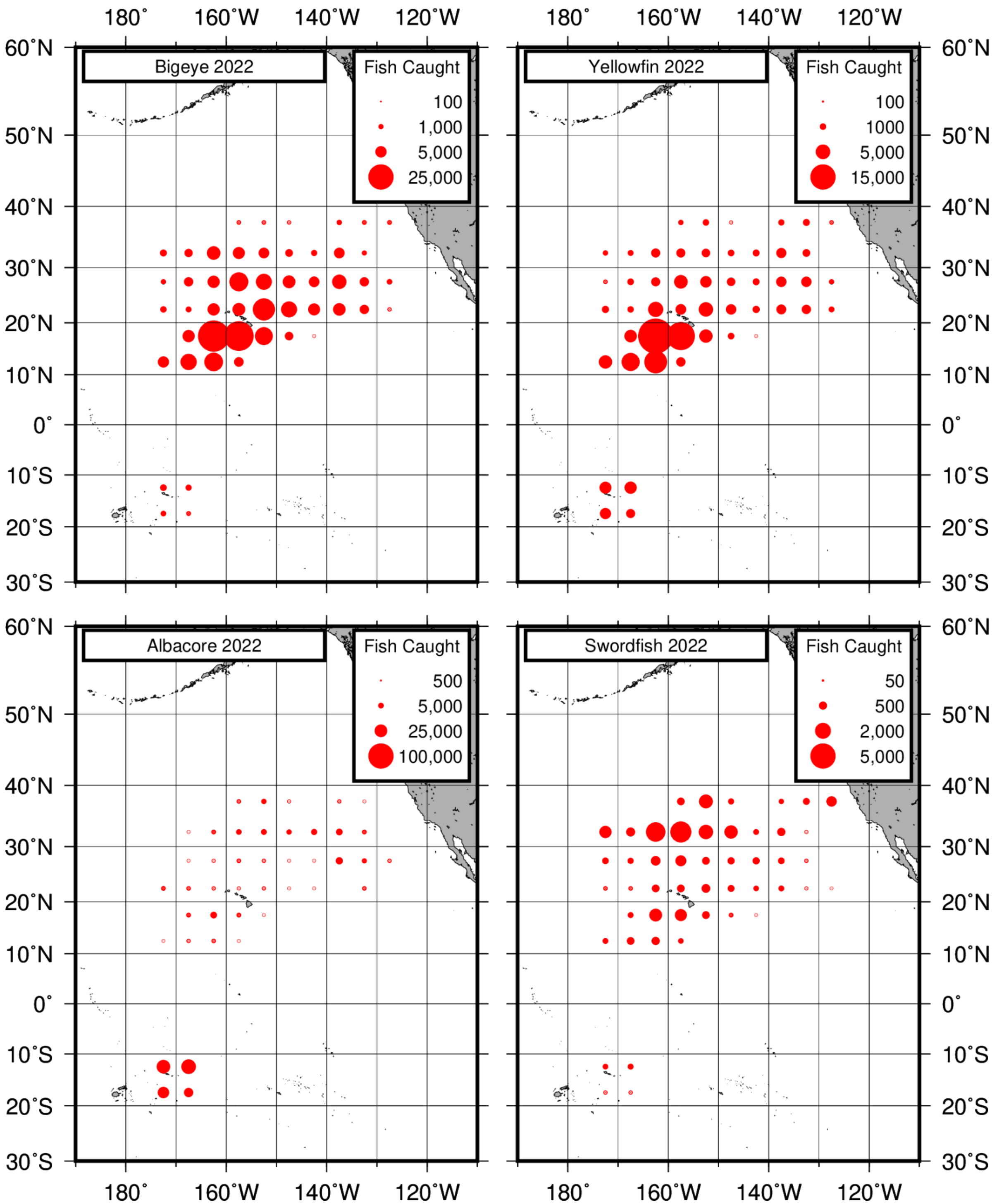

Figure 2b. Spatial distribution of catch by U.S.-flagged longline vessels, in numbers of fish (includes retained and released catch), in 2022 (preliminary data). Catches in some areas are not shown to preserve data confidentiality.

Flag State Reporting of National Fisheries

U.S. Purse seine Fishery

The U.S. purse seine catch of tunas in the WCPFC statistical area was 55,708 t in 2022, similar to the 2021 catch (50,479); however, this is less than half of the total catches for each of the three previous years (2018, 194,779; 2019, 165,971; 2020, 137,406; Table 1a-e). Total catch was primarily composed of skipjack tuna (77%), with smaller catches of yellowfin (8%) and bigeye tuna (15%). The total catches of tunas have fluctuated over the past 5 years (Tables 1a-1e) with the lowest catches of skipjack in 2021 and 2022. Participation in the U.S. fleet has declined over the past five years, and in 2022 the U.S. fleet had 13 purse seine vessels (Table 2a). Although this is a drop in seven vessels from 2021, the total catch and catch of skipjack increased slightly from 2021. In 2022, the fishery operated in a smaller area than in the previous year with fishing effort around the equator, mainly between 10° N and 10° S latitude and 175° E and 155° W longitude (Figure 1).

U.S. Longline Fisheries

The longline fisheries of the United States and the Territory of American Samoa in the WCPFC statistical area include vessels based in Hawaii, California, and American Samoa. The total number of longline vessels active in the WCPFC statistical area has ranged from 146 to 156 vessels from 2018 to 2022 with 153 participating vessels in 2022 (Table 2a) with 150 vessels greater than 50 gross registered tonnage (GRT; Table 2b). The U.S. longline fishery in the north Pacific Ocean within the WCPFC statistical area consistently had the highest number of vessels in operation with 142 vessels in 2022. Participation in the American Samoa-permitted fleet operating in the South Pacific has ranged from 11 to 18 vessels from 2018 to 2022 with 11 vessels operating in 2022 (Table 2a).

Retained catches are assigned to the longline fisheries of the United States, American Samoa, Guam or the CNMI based on the 1) port of landing, 2) location of catch, 3) the types of permit(s) registered to the vessel, and 4) if caught during a time period and from a vessel that was included in an arrangement[3] that allowed the bigeye tuna catch to be assigned to a longline fishery from the U.S. territories of American Samoa, Guam, or CNMI (Table 1). A few longline vessels operated with both Hawaii and American Samoa permits during 2018–2022. If longline catches from these vessels were outside of the U.S. EEZ in the NPO, the catches were attributed to American Samoa (even if landed in Hawaii) in accordance with federal fisheries regulations (50 *CFR* 300.224).

If longline catches are from vessels operating under an agreement attributing bigeye catch to a U.S. territory (American Samoa, Guam, or CNMI), then bigeye tuna catch during the time period of the agreement is included in catches for that Territory in the north Pacific Ocean within the WCPFC statistical area while other species caught during the same time period are attributed to the Hawaii longline fishery and included in the U.S. NPO catches. From 2018 to 2022

[3] Agreements allowing bigeye tuna catch from the Hawaii-permitted longline vessels that fished in the high seas or the Hawaii EEZ to be attributed to U.S territories of American Samoa, Guam, or CNM: 1) Consolidated and Further Continuing Appropriations Act, Sec. 113(a), 2012, Pub. L. 112-55, 125 Stat. 552 et seq., 2) of the Pelagics Fishery Ecosystem Plan, Amendment 7)

agreements were in place with the territories of American Samoa and CNMI (Table 1f).

The U.S. longline fishery in the north Pacific Ocean within the WCPFC statistical area operated mainly from 10° N to 40° N latitude and from 125° W to 175° W in 2022 (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 2022 (Figure 2a). The U.S. longline fishery in the NPO fishery targeted bigeye tuna and swordfish with catches also composed of yellowfin tuna (26% of retained catch in 2022) and other pelagic species (<5% of retained catch for any particular species in 2022). The distribution of bigeye tuna, yellowfin tuna, and swordfish catches in the north Pacific Ocean within the WCPFC statistical area were similar with areas of highest concentrations of swordfish differing slightly from the areas with the highest concentrations of catches for bigeye tuna and yellowfin tuna. The American Samoa longline fishery in the south Pacific Ocean targeted albacore, but also caught a noteworthy proportion of yellowfin tuna (10% of retained catch in 2022), which can be seen in the distribution of yellowfin tuna and albacore tuna catch in the SPO (Figure 2b). The total annual catch of all retained species from 2018 to 2022 ranged from a low of 10,483 t in 2020 to a high of 12,955 t in 2019 with the 2022 catch (11,278 t) similar to the annual average (11,783 t) for the 5-year period (Tables 1a-1e). Approximately 1 t of Pacific bluefin tuna catches were reported in logbooks annually for U.S. longline fisheries (Table 1f); however, it is possible that some of the reported bluefin tuna are other tuna species that were misidentified (Tables 1a-1f).

Most of the U.S. longline fishery in the NPO targets tuna using deep-set longline gear; while the U.S. longline fishery that targets swordfish uses shallow-set gear. Swordfish landings in the north Pacific Ocean within the WCPFC statistical area have varied from 2018 to 2022, ranging from 306 t in 2020 to 760 t in 2022. For two of the five reporting years (2018 and 2019), the U.S. longline shallow-set fishery exceeded its fleet-wide annual interaction limit on loggerhead sea turtles (34 loggerhead sea turtles in 2018, 17 loggerhead sea turtles in 2019, and no annual limit on loggerhead sea turtles 2020–2022), and in none of the five reporting years did they exceed the annual interaction limit on leatherback sea turtles (26 leatherback sea turtles 2018–2019, 6 leatherback sea turtles 2020–2022). The fishery is less likely to exceed fleet-wide annual interaction limits in the future as these limits have been removed for loggerhead sea turtles—the sea turtle they most commonly interact with. However, trip limits are now in place for loggerhead sea turtles in the shallow-set fishery, as well as for leatherback sea turtles (five loggerhead and two leatherback sea turtles). No swordfish were caught and no vessels targeted swordfish south of 20° S in the WCPFC Statistical Area from 2018–2022 (Table 1h).

U.S. Albacore Troll Fisheries

In recent years, participation in the U.S. troll fisheries for albacore in the WCPFC Statistical Area, has ranged from from 9 to 21 vessels annually from 2018 to 2022. Eighteen vessels participated in the South Pacific albacore troll fishery in 2022 similar to the average of 15 vessels participating annually from 2018 to 2022 (Table 2a). 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 catch in the WCPFC Statistical Area by the U.S. North Pacific albacore troll fishery was higher in 2022 (1400 t) compared to the annual average (1,072 t) from 2018 to 2022 (Tables 1a-1e). There was only participation in the North Pacific albacore troll fishery for 2020 (3 vessels) and 2018 (4 vessels) for the reporting period from 2018 to 2022.

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, small-scale fisheries are monitored by creel surveys (i.e. offshore fisheries catch and effort data collected shoreside by technicians through fisher interviews), and data from these surveys are included in the tropical troll statistics. Trolling is the fishing method 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 1,827 t in 2022. The catch was composed primarily of yellowfin tuna, skipjack tuna, bigeye tuna, mahimahi, and blue marlin (Table 1g).

Socioeconomic Factors and Trends in the Fisheries

Socio-economic Surveys and Analyses

NMFS staff and colleagues conducted surveys and analyses to better understand the socioeconomic considerations of U.S. fisheries in the WCPO.

Relevant Publications

Ayers, A., Leong, K., Hospital, J., Tam, C., Morioka, R. 2022. Hawai'i fisher observations data summary and analysis. Pacific Islands Fisheries Science Center, PIFSC Data Report, DR-22-27, 23 p. https://doi.org/10.25923/aepb-m302

Ayers, A., Leong, K., Hospital, J., Tam, C., Morioka, R. 2022. Guam & CNMI fisher observations data summary and analysis. Pacific Islands Fisheries Science Center, PIFSC Data Report, DR-22-26, 17 p. https://doi.org/10.25923/wmv2-y197

Ayers A.L, Leong K. 2022. Focusing on the human dimensions to reduce protected species bycatch. Fisheries Research, Volume 254: 106432. https://doi.org/10.1016/j.fishres.2022.106432

Chan, H.L. 2023. Economic and social characteristics of the Hawaii small boat fishery 2021. U.S. Dept. of Commerce, NOAA Technical Memorandum NOAA-TM-NMFS-PIFSC-138, 177 p.https://doi.org/10.25923/2s7e-7m45

Dombrow C, Rollins E, Sweeney J, Hospital J. 2022. Hawaii Pelagic Fisheries Market Analysis. U.S. Dept. of Commerce, NOAA Technical Memorandum NOAA-TM-NMFS-PIFSC-127, 72 p. https://doi.org/10.25923/nb9m-2x97

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; with more recently vessels shipping their catches from 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 being stored on the vessel, swordfish are headed and gutted, and other species caught are stored 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 is frozen whole with most vessels transporting their catches to Canada or New Zealand for sale with a few vessels landing in the west coast of the U.S. Most other small-scale fisheries 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

No major developments have occurred in processing plants or support facilities for the U.S. fisheries.

Future Prospects of the Fisheries

The U.S. longline fishery in the NPO is expected to continue targeting bigeye tuna and swordfish, as well as catch other associated pelagic species in future years and deliver them fresh to both local and mainland markets. However, the future growth of the Hawaii longline deep-set fishery that targets bigeye tuna is constrained due to annual catch limits for bigeye tuna (3,554 t) in the WCPO. When the annual limit is exceeded, then the overage is subtracted the following year further reducing the catch available to the fishery without purchasing quota from one of the Territories through an agreement[4]. During the last five years, the annual limit was exceeded only once (2021); however, additional quota was purchased annually from CNMI and/or American Samoa. In addition, the Hawaii longline fleet caught additional bigeye tuna in the NPO that were assigned to American Samoa as they were caught by fishers with both Hawaii and American Samoa permits. Bigeye tuna catch in the eastern Pacific Ocean (EPO) was well below the catch limit (750 t for vessels greater than 24 m) established by the Inter-American Tropical Tuna Commission (IATTC) with only 22 longline vessels greater than 24 m operating in the EPO. However, more effort is not expected by the U.S. longline deep-set fishery in the EPO due to increasing fuel costs.

[4] Agreements allowing bigeye tuna catch from the Hawaii-permitted longline vessels that fished in the high seas or the Hawaii EEZ to be attributed to U.S territories of American Samoa, Guam, or CNM: 1) Consolidated and Further Continuing Appropriations Act, Sec. 113(a), 2012, Pub. L. 112-55, 125 Stat. 552 et seq., 2) of the Pelagics Fishery Ecosystem Plan, Amendment 7)

Effort in the shallow-set fishery targeting swordfish increased in 2022 and is expected to continue to increase with market demand despite rising fuel costs. This sector of the longline fishery is not as adversely affected by the bigeye tuna catch limits with a smaller proportion of catch composed of bigeye tuna. However, the shallow-set fishery has potential constraints due to annual interaction limits on leatherback sea turtles (16 sea turtles) and trip interaction limits on loggerhead and leatherback sea turtles (two leatherback and five loggerhead sea turtles). This fishery overlaps spatially and temporally with seasonal abundance of sea turtles, which resulted in recent closures in 2018 and 2019 when annual interaction limits (34 loggerhead sea turtles in 2018 and 17 loggerhead sea turtles in 2019) on loggerhead sea turtles were reached. However, it is less likely that the swordfish fishery will close in future years unless effort increases greatly as current regulations no longer include an annual interaction limit on loggerhead sea turtles, which is the turtle they most commonly interact with.

In addition, both deep-set and shallow-set sectors of the U.S. longline fishery in the NPO are subject to an area closure within the main Hawaiian Islands EEZ if a "trigger" (currently two false killer whales (*Pseudorca crassidens*) with a determination of death or "serious injury") is reached based on the false killer whale's potential biological removal level.

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. However, effort by the American Samoa longline fishery in the South Pacific is expected to remain low with similar effort as in 2022 with only 11 vessels operating. This fleet has had recent operational challenges with limited available crew in this remote location. In addition, growth of this fishery may be prevented as the fishing area close to American Samoa is limited to its EEZ as waters outside are surrounded by the EEZs of other countries. A substantial distance must be traveled to reach international waters; consequently, requiring large amounts of fuel.

Fuel costs and supplies associated with fishing operations have increased dramatically in the last year and may affect participation and trip distance from ports for all U.S. large-scale and small-scale fisheries.

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 uncertainty in the economy and fish market prices along with increasing fuel and supply costs. 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

U.S. pelagic fisheries are monitored using fishery-dependent data collected from various sources: logbooks and fish catch reports submitted by fishers, at-sea observers, port samplers, market sales reports from fish dealers, and creel surveys (i.e. offshore fisheries catch and effort data collected shoreside by technicians through fisher interviews). The coverage rates for different data collection methods vary considerably.

The primary monitoring system for retained catches for the major U.S. fisheries (purse seine, longline, and albacore troll) in the WCPFC statistical area 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 have been submitted as a requirement of the South Pacific Tuna Treaty since 1988 with coverage rates at 100%. The Hawaii, California, and American Samoa-based longline fisheries are monitored using paper and electronic logbooks (NOAA Fisheries Western Pacific Daily Longline Fishing Logs) with electronic reporting first tested in the region in 2019 with full implementation mandated in 2021 for the Hawaii longline fleet. The use of electronic reporting throughout the U.S. and American Samoa longline fisheries is expected to assist in better real-time estimates of bigeye tuna catch. For the U.S. based longline trips, logbook coverage is generally at 100%. Since 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 supplement logbook data with sales records covering virtually 100% of the Hawaii-based longline landings. The Western Pacific Fisheries Information Network (WPacFIN) integrates Hawaii longline logbook catch data of numbers of fish caught by trip with the 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 addition, catch by weight can be approximated by geographic area by integrating location data from logbooks with weight data from dealer reports. 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. 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 surveys and market monitoring programs, as part of WPacFIN.

Relevant Publications

Bigelow, K. 2022. The American Samoa Longline Limited-entry Fishery Annual Report 1 January-31 December 2021. Pacific Islands Fisheries Science Center, PIFSC Data Report, DR-22-40, 12 p. https://doi.org/10.25923/peap-vt07

Ito, R. 2022. The Hawaii and California-based Pelagic Longline Vessels Annual Report for 1 January-31 December 2021. Pacific Islands Fisheries Science Center, PIFSC Data Report, DR-

22-41, 19 p. https://doi.org/10.25923/c2sp-8d23

Observer Programs

U.S. purse seine vessels operating in the WCPFC statistical area under the Treaty on Fisheries between the Governments of Certain Pacific Island States and the United States of America (Treaty) were monitored by observers provided by the Pacific Islands Forum Fisheries Agency (FFA) through 2022. Beginning in 2023 U.S. purse seine vessels are monitored by observers provided by the Parties to the Nauru Agreement (PNA). Monitoring includes both the collection of scientific data, as well as information on operator compliance with various Treaty-related and Pacific island country -mandated requirements (these data are not described in this report). NOAA Fisheries has a field station in Pago Pago, American Samoa, that facilitates the placement of PNA-deployed observers on U.S. purse seine vessels.

Since January 1, 2010, the observer coverage rate in the U.S. purse seine fishery in the Convention Area has been 100%. However, the mandatory observer requirement was suspended during the covid-19 pandemic and was reinstated January 1, 2023. Data previously collected by FFA-deployed and currently by PNA-deployed observers are 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 monitor the U.S. and American Samoa longline fisheries. In 2022, observers were placed with coverage goals of 100% in the Hawaii shallow-set longline trips and 20% in the Hawaii deep-set and American Samoa-based longline fishing trips.

The main focus of the longline observer program is to collect scientific data on interactions with protected species. The observer program also collects catch composition and biological data on retained and discarded catch and information on fishing operations. Biological data includes measurements 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.

Per reporting requirements agreed to at WCPFC 11, Table 3 contains estimates on observer coverage in U.S. longline fisheries for 2022 in the WCPFC Area excluding the U.S. EEZ. For the U.S. longline fishery in the north Pacific Ocean of the WCPFC statistical area, there were observers on 290 trips out of a total of 1,224 trips outside the U.S. EEZ, resulting in a coverage rate of 24% (Table 3). For the American Samoa longline fishery, there is limited effort outside of the American Samoa EEZ, as a result, there was no observer coverage in the high seas for the American-Samoa based longline fishery in 2022. These coverage statistics are from 2022 reports of the NOAA Pacific Islands Regional Observer Program (PIROP) and are based on longline trips that departed with observers in calendar year 2022.

Table 3. Observer coverage in 2022 for U.S. longline fisheries in the WCPFC Area excluding 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	38,557,903	8,537,988	22	13,519	3,410	25	1,224	290	24
American Samoa	0	0	0	0	0	0	0	0	0

Fishery Interactions with Protected Species

Information is provided on the estimated fishery interactions with non-fish species by the Hawaii-based (Tables 4a, 4c-4d) and American Samoa (Table 4b) longline fisheries during 2018–2022. This includes interactions with marine mammals and sea turtles in the Hawaii (Table 4a) and American Samoa longline fisheries (Table 4b) and for seabirds in the Hawaii longline fisheries (4c-4d). In the American Samoa longline fishery the only estimated interactions for seabirds from 2018 to 2022 was three shearwater (Procellariidae) and two frigate bird (Fregatidae) interactions from 2018 to 2022. In addition, Table 4e shows mitigation measures required for the Hawaii longline fisheries for seabird mitigation.

CMM 2011-01 requires CCMs to report instances in which cetaceans have been encircled by purse seine nets. In 2022, there were no reports of U.S. purse seine vessels encircling cetaceans.

Relevant Publications

Bradford A.L. 2023. Injury determinations for marine mammals observed interacting with Hawaii longline fisheries During 2020. Pacific Islands Fisheries Science Center, PIFSC Data Report, DR-23-02. https://doi.org/10.25923/sx2z-st94

McCracken M. 2023. Estimation of Bycatch with Seabirds, Sea Turtles, Bony Fish, Sharks, and Rays in the 2022 Permitted American Sāmoa Longline Fishery. Pacific Islands Fisheries Science Center, PIFSC Data Report, DR-23-06. https://doi.org/10.25923/mrva-ab86

McCracken M. 2023. Estimation of Bycatch with Bony Fish, Sharks, and Rays in the 2022 Hawaiʻi Permitted Deep-Set Longline Fishery. Pacific Islands Fisheries Science Center, PIFSC Data Report, DR-23-07. https://doi.org/10.25923/mfmp-fq29

McCracken M. 2022. Assessment of Incidental Interactions with Marine Mammals in the American Samoa Permitted Longline Fishery from 2017 through 2021. Pacific Islands Fisheries Science Center, PIFSC Data Report, DR-22-31. https://doi.org/10.25923/3y1y-5p44

McCracken M, Cooper B. 2022. Estimation of bycatch with bony fish, sharks, and rays in the 2021 Hawaii permitted deep-set longline fishery. Pacific Islands Fisheries Science Center, PIFSC Data Report, DR-22-025. https://doi.org/10.25923/rgap-5a09

McCracken M, Cooper B. 2022. Assessment of Incidental Interactions with Marine Mammals in the American Samoa Permitted Longline Fishery from 2016 through 2020. Pacific Islands Fisheries Science Center, PIFSC Data Report, DR-22-016. https://doi.org/10.25923/wtw6-zb45

McCracken M, Cooper B. 2022. Assessment of Incidental Interactions with Marine Mammals in the Hawaii Longline Deep- and Shallow-set Fisheries from 2017 through 2021. Pacific Islands Fisheries Science Center, PIFSC Data Report, DR-22-32. https://doi.org/10.25923/yeah-8q79

McCracken M, Cooper B. 2022. Estimation of bycatch with seabirds, sea turtles, bony fish, sharks, and rays in the 2020 permitted American Samoa longline fishery. Pacific Islands Fisheries Science Center, PIFSC Data Report, DR-22-001. https://doi.org/10.25923/qz9z-nd71

McCracken M, Cooper B. 2022. Assessment of Incidental Interactions with Marine Mammals in the Hawaii Longline Deep- and Shallow-set Fisheries from 2016 through 2020. Pacific Islands Fisheries Science Center, PIFSC Data Report, DR-22-017. https://doi.org/10.25923/6gaj-ns35

McCracken M, Cooper B. 2022. Hawaii Longline Fishery 2021 Seabird and Sea Turtle Bycatch for the Entire Fishing Grounds, Within the IATTC Convention Area, and Seabird Bycatch to the North of 23N and 23N-30. Pacific Islands Fisheries Science Center, PIFSC Data Report, DR-22-029. https://doi.org/10.25923/pjz0-4420

McCracken M, Cooper B. 2022. Estimation of Bycatch with Seabirds, Sea Turtles, Bony Fish, Sharks, and Rays in the 2021 Permitted American Samoa Longline Fishery. Pacific Islands Fisheries Science Center, PIFSC Data Report, DR-22-028. https://doi.org/10.25923/2vfs-cf37

McCracken M. 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. https://doi.org/10.25923/8cxm-9j54

Table 4a. Estimated fishery interactions (not necessarily resulting in mortality or serious injury) with marine mammals and sea turtles in shallow- and deep-set (combined) Hawaii-based longline fisheries, 2018–2021; observed counts only for marine mammals for 2022. Interactions were estimated for the complete distribution of the shallow- and deep-set fisheries which included areas outside of the WCPFC reporting area.

Marine Mammals	**2022**	**2021**	**2020**	**2019**	**2018**
Striped dolphin (*Stenella coeruleoalba*)	0	0	0	0	1
Common dolphin (*Delphinus delphis, D. capensis*)	0	0	0	0	0
Bottlenose dolphin (*Tursiops truncatus*)	1	10	10		4
Risso's dolphin (*Grampus griseus*)	3	0	16	7	2
Blainville's beaked whale (*Mesoplodon blainvillei*)	0	0	0	0	0
Bryde's whale (*Balaenoptera edeni*)	0	0	0	0	0
False killer whale (*Pseudorca crassidens*)	7	43	23	75	49
Ginkgo-toothed beaked whale (*Mesoplodon*	0	0	0	0	0
Shortfinned pilot whale (*Globicephala*	0	5	0	0	0
Rough-toothed dolphin (*Steno bradenensis*)	0	14	29	4	0
Northern elephant seal (*Mirounga angustirostris*)	0	0	0	0	0
Humpback whale (*Megaptera novangliae*)	0	0	0	0	0
Pygmy sperm whale (*Kogia Breviceps*)	0	0	0	0	0
Fin whale (*Balaenoptera physalus)*	0	0	0	0	0
Guadalupe fur seal (*Arctocephalus townsendi*)	2	0	7	0	0
Unspecified false killer or shortfinned pilot whale	0	0	0	6	4
Unidentified Cetacean (*Cetacea*)	2	24	23	10	15
Unidentified Pinniped *(Pinnipedia*)	1	0	0	0	0
Unspecified member of beaked whales (*Ziphiidae*)	1	1	6	7	0
Unspecified eared seal (*Otariidae*)	0	0	2	1	0
Unidentified Kogia Whale	0	0	4	0	0
Unidentified earless seal	0	0	0	1	0
Total Marine Mammals	**17**	**97**	**120**	**111**	**75**

Sea Turtles	**2022**	**2021**	**2020**	**2019**	**2018**
Loggerhead turtle (*Caretta caretta*)	42	21	34	20	42
Leatherback turtle (*Dermochelys coriacea*)	32	11	32	14	28
Olive Ridley turtle (*Lepidochelys olivacea*)	50	48	79	140	97
Green turtle (*Chelonia mydas*)	6	18	13	12	18
Unidentified hardshell turtle (Cheloniidae)	0	1	0	0	0
Total Sea Turtles	**130**	**99**	**158**	**186**	**185**

[2] Estimates are made by raising the number of observed interactions by a factor determined according to the design of the observer sampling program. Sources: Pacific Islands Regional Office observer program reports (http://www.fpir.noaa.gov/OBS/obs_qrtrly_annual_rprts.html) and PIFSC Internal Reports.

Table 4b. Estimated total numbers of fishery interactions (not necessarily resulting in mortality or serious injury) with marine mammals and sea turtles in the American Samoa longline fishery from 2018–2022. Estimates are not yet available for marine mammal interactions in 2022.

Marine Mammals	2022	2021	2020	2019	2018
Striped dolphin (*Stenella coeruleoalba*)	Not available	0	0	5	2
False killer whale (*Pseudorca crassidens*)	Not available	3	5	0	5
Shortfinned pilot whale (*Globicephala*	Not available	0	0.4	0	0
Rough-toothed dolphin (*Steno bradenensis*)	Not available	2	3	0	3
Total Marine Mammals	Not available	**5**	**8.4**	**5**	**10**

Sea Turtles	2022	2021	2020	2019	2018
Leatherback turtle (*Dermochelys coriacea*)	2	6	7	7	5
Olive Ridley turtle (*Lepidochelys olivacea*)	8	7	6	20	11
Green turtle (*Chelonia mydas*)	4	10	11	26	20
Hawksbill *(Eretmochelys imbricata*)	0	2	2	0	5
Total Sea Turtles	14	25	26	53	41

Table 4c. Effort and observed seabird captures 2018–2022 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. Interactions were for the complete distribution of the shallow- and deep-set fisheries which included areas outside of the WCPFC reporting area.

Fishing Effort					Observed Seabird Captures	
Year	Number of Vessels	Number of Hooks	Observed Hooks	% Hooks Observed	Number	Rate
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
2021	143	64,985,095	12,427,023	19.12	184	0.01
2022	143	63,169,864	13,692,495	21.68	209	0.02

Table 4d. Total number of observed seabird captures by species in Hawaii–based longline fishery 2018-2022 for north of 23° N and 23° N–30° S areas combined. Observed capture numbers for 2022 by area are preliminary. Interactions are for the complete distribution of the shallow- and deep-set fisheries which included areas outside of the WCPFC reporting area.

Species	2022	2022	2021	2021	2020	2020	2019	2019	2018	2018
	> 23 °N	23° N – 30° S	> 23°N	23° N – 30° S	> 23°N	23° N – 30° S	> 23°N	23° N – 30° S	> 23°N	23° N – 30° S
Blackfooted albatross (*Phoebastria nigripes*)	111	5	109	23	70	31	137	28	192	10
Laysan albatross (*Phoebastria diomedia*)	90	2	46	2	77	8	57	3	35	0
Unidentified albatross (*Diomedeidae*)	0	0	0	0	0	0	0	0	0	0
Red-footed booby (*Sula sula*)	0	0	0	0	0	0	0	0	1	0
Brown booby (*Sula leucogaster*)	0	0	1	0	0	1	0	1	0	1
Sooty shearwater (*Ardenna grisea*)	0	0	1	0	0	1	0	0	0	0
Unidentified shearwater (*Procellariidae*)	0	0	3	0	0	0	0	0	10	0
Totals	**201**	**8**	**159**	**25**	**147**	**41**	**194**	**32**	**238**	**11**

Table 4e. Seabird mitigation types mandated for use in Hawaii based longline fisheries regulated by type of set, location of set, and method employed to set (side setting or stern setting; mitigation types: 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 2012-2022
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

Port sampling is limited in the U.S. fisheries in the WCPFC statistical area. Usually purse seine caught fish are measured by SPC port samplers in ports where transshipping occurs. However, no transhipment occurred in 2022. During port sampling, 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

The U.S. purse-seine fishery has historically transshipped some of its catch unloaded in foreign ports in the WCPFC Statistical Area, but did not transship any of its catch in 2022.

Research Activities

Highlights

Anticyclonic eddies aggregate pelagic predators in a subtropical gyre
In nutrient-poor subtropical gyres—the largest marine biome—the role of eddies in modulating behavior throughout the pelagic predator community remains unknown. Using a large-scale fishery dataset in the North Pacific Subtropical Gyre, Researchers from NOAA fisheries collaborated with the University of Washington and Woods Hole Oceanographic Institute showed a pervasive pattern of increased pelagic predator catch inside anticyclonic eddies relative to cyclones and non-eddy areas. Results in Argostegui et al. (2022) indicate that increased mesopelagic prey abundance in anticyclone cores may be attracting diverse predators, forming ecological hotspots where these predators aggregate and exhibit increased abundance. In this energetically quiescent gyre, it is expected that isolated mesoscale features (and the habitat conditions in them) exhibit primacy over peripheral submesoscale dynamics in structuring the foraging opportunities of pelagic predators.

Influence of El Niño-Southern Oscillation on bigeye and yellowfin tuna longline catch per unit effort in the equatorial Pacific
The El Niño-Southern Oscillation (ENSO) has a strong effect on the oceanographic conditions in the equatorial Pacific, including bigeye tuna (BET) and yellowfin tuna (YFT) equatorial habitat and fishing grounds. For optimal fisheries management, the effects of environmental variability such as ENSO on the stocks and on the performance of fisheries must be known and predictable. However, besides some model predictions, the effects of ENSO on these two tuna species are not well understood. NOAA researcher Domokos (2023) used statistical relationships to investigate between past ENSO conditions and equatorial fisheries using the Multivariate ENSO Index, sea surface temperature (SST), and catch and effort records from the longline fisheries in the region. Results of this study indicate that El Niño events have both delayed and concurrent positive effects on BET and YFT catch per unit effort (CPUE). The delayed positive ENSO effect on CPUE is hypothesized to be the result of enhanced recruitment acting via different mechanisms in the west than in the east. The concurrent positive effects on CPUE could be due to catchability, abundance, and/or vertical distribution of BET and YFT relative to fishing gear and require further investigation. Further exploration of the mechanisms underlying the results could lead to better predictability of CPUE of these two tuna species.

Focusing on the front end: A framework for incorporating uncertainty in biological parameters in model ensembles of integrated stock assessments
An ensemble can be created by randomly drawing values from the likely parameter space using a Monte-Carlo/bootstrap (MCB ensemble) or fixed at either a high, medium, or low value that encapsulates the variability in the parameter and applied in a full factorial grid across the fixed parameters (factorial ensemble). Ducharme-Barth and Vincent (2022) presented management advice was presented for MCB ensembles of various sizes and a 243 model factorial ensemble for

Southwest Pacific swordfish (*Xiphias gladius)*, and reference points were compared which included model uncertainty only, model and estimation uncertainty, or both uncertainties weighted by sampling importance resampling. Median reference points were significantly different between the two ensemble types with the factorial ensemble having a significantly larger estimate of model uncertainty than the MCB ensemble. Stock assessments with fixed biological parameters can characterize uncertainty in these parameters more efficiently using a MCB ensemble approach. A factorial ensemble approach is appropriate for comparing different model structure assumptions and functional forms of relationships and can be used in combination with a MCB ensemble approach. Incorporation of both model and estimation uncertainty in estimates of reference points is important when providing management advice because including only model uncertainty can lead to biased estimates of the precision of reference points. Further work is needed regarding appropriate weighting of ensembles which incorporate different data sources or have different likelihood weightings.

Anticipating fluctuations of bigeye tuna in the Pacific Ocean from three-dimensional ocean biogeochemistry

NOAA researchers collaborated with other scientists to use three-dimensional, dynamical reconstructions and forecasts of ocean biogeochemistry to hindcast and assess the capacity to anticipate fluctuations in bigeye tuna (*Thunnus obesus*) in the Pacific Ocean. Taboada et al. (2023) reconstructed spatial patterns in catch per unit effort (CPUE) through the combination of physiological indices capturing both habitat preferences and physiological tolerance limits in bigeye tuna. Their analyses revealed four distinct regimes characterized by changes in distribution and average CPUE of bigeye tuna in the Pacific Ocean. Habitat models accounting for basin-wide fluctuations in the thermal structure and oxygen concentration throughout the water column captured interannual fluctuations in CPUE and regime switches that models based solely on surface information were unable to reproduce. Decade-long forecast experiments further suggested that forecasts of three-dimensional biogeochemical information might enable anticipation of fluctuations in bigeye tuna several years ahead. This study raises concerns about the future impact of ocean warming and deoxygenation and supports incorporating subsurface biogeochemical information into ecological forecasts to implement efficient dynamic management strategies.

Recent and Historical Data Show no Evidence of Pacific Bluefin Tuna Reproduction in The Southern California Current System

To investigate the possibility the Pacific bluefin tuna are spawning in the California Current system, Dewar et al. (2022) collected samples from 36 females (estimated 3–8 years old) between 2015 and 2019. Histological analyses revealed that two of 36 individuals had cortical aveoli and there was no sign of imminent, active, or recent spawning. Further examination of historical ichthyoplankton collections showed no records of larval bluefin tuna, but confirmed the presence of the larvae of other tuna species in waters > 24°C. Fishery-dependent records showed that bluefin tuna are rarely recorded in purse seine catches where surface temperatures exceed 23°C. Additionally, the conditions in the California Current differ from those in other bluefin tuna spawning grounds. Typically, spawning grounds occur in warm oligotrophic waters with larvae being advected to cooler, more nutrient rich waters. This is the opposite of the conditions in the productive south flowing, California Current. This study provided no evidence of bluefin tuna reproduction in the California Current. However, more comprehensive sampling, in particular off southern Baja California where temperatures can exceed 24°C, may be required to confirm the absence of spawning.

Otolith Geochemistry Reflects Life Histories of Pacific Bluefin Tuna

Mohan et al. (2022) analyzed otolith biominerals of large Pacific bluefin tuna collected from the western, eastern, and south Pacific Ocean for a suite of trace elements across calcified/proteinaceous growth zones to investigate patterns across ontogeny. They analyzed both life-history trans and the otolith edge for difference across regions and elemental signatures. Three elements: Ca ratios, Li:Ca, Mg:Ca, and Mn:Ca displayed enrichment in the otolith core, then decreased to low stable levels after age 1–2 years with little change after that point. Factors other than oceanography including temperature, metabolism, diets, likely influenced otolith crystallization, protein content, and elemental incorporation. Although similar patterns were also exhibited for otolith Sr:Ca, Ba:Ca and Zn:Ca in the first year, variability in these elements differed significantly after age-2 and in the otolith edges by capture region, suggesting ocean-specific environmental factors or growth-related physiologies affected otolith mineralization across ontogeny. Results confirm differences in biomineralization across regions and that some elements are more useful than others for examining migratory pathways.

Pacific Bluefin Tuna, Thunnus orientalis, Exhibits a Flexible Feeding Ecology in the Southern California Bight

To examine the foraging ecology of juvenile Pacific bluefin tuna, stomachs from 963 bluefin were collected in the Southern California Bight (SCB) from 2008 to 2016. Using classification and regression tree analysis, Portner et al. (2022) observed three periods characterized by distinct prey. In 2008, Pacific bluefin diet was dominated by midwater lanternfishes and enoploteuthid squids. During 2009–2014, PBF consumed diverse fishes, cephalopods, and crustaceans. Only in 2015–2016 did PBF specialize on relatively high energy, surface schooling prey (e.g., anchovy, pelagic red crab). Interestingly, the energetic value of prey was similar in Nodes 2 and 3, while stomachs from 2009-2014 had the smallest sized prey and the highest number of prey. This work demonstrated that Pacific bluefin tuna is an opportunistic predator that can exhibit distinct foraging behaviors to exploit diverse forage. They can forage across the water column on diverse prey types, schooling and non-schooling. Expanding understanding of Pacific bluefin tuna foraging ecology is improving the ability to predict their responses to changes in resource availability as well as potential impacts to the fisheries it supports. This work is continuing to produce results for Pacific bluefin stomachs collected from 2017 to 2022.

Juvenile Albacore Tuna (*Thunnus alalunga*) Foraging Ecology Varies with Environmental Conditions in the California Current Large Marine Ecosystem

Nickels et al. (2023) describes the diets of juvenile North Pacific albacore from three regions in the California Current Large Marine Ecosystem from 2007 to 2019 and uses classification and regression tree analysis to explore environmental drivers of variability. Important prey includes northern anchovy (*Engraulis mordax*), rockfishes (*Sebastes* spp.), boreal clubhook Squid (*Onychoteuthis borealijaponica*), euphausiids (Order: Euphausiidae), and amphipods (Order: Amphipoda), each contributing >5% mean proportional abundance. Most prey items were short lived species or young-of-the-year smaller than 10 cm. Diet variability was related to environmental conditions over the first 6 months of the year (Pacific decadal oscillation, sea surface temperature, and North Pacific Gyre Oscillation) and conditions concurrent with Albacore capture (region and surface nitrate flux). Nickels et al. describes foraging flexibility over regional and annual scales associated with these environmental influences. Continuous, long-term studies offer the opportunity to identify flexibility in Albacore foraging behavior and begin to make a predictive link between environmental conditions early in the year and Albacore foraging during summer and fall.

Albacore Tuna and Broadbill Swordfish Diets in the State of the California Current Ecosystem Report

Thompson et al. 2022 quantifies the diets of North Pacific albacore tuna and broadbill swordfish to provide insight into how forage varies over time and space, as well as provide a direct metric of forage utilization.

Juvenile albacore tuna were collected off Northern California, Oregon, and Washington during the summer and fall fishing season. Based on preliminary data from 2021, the dominant prey from 2021 were northern anchovy (*Engraulis mordax*), Euphausiids (Order: Euphausiacea), and Pacific saury (*Cololabis saira*). Northern anchovy consumption increased in 2020 and 2021 after a low in 2018-2019. Sardine (*Sardinops sagax*) consumption was also high in 2020 and 2021, well above the long term mean. Rockfish (*Sebastes* spp.) consumption demonstrated an opposing pattern, with consumption declining in 2020 and 2021 after a peak in 2019, coinciding with the northern anchovy low.

Swordfish were collected off Southern and Central California during the commercial drift gillnet season (August 15 through January 31). Stomachs are classified by the year the fishing season began (stomachs from January are assigned to the previous year’s fishing season). Swordfish fed mainly on fish and cephalopods. In 2019, the dominant prey was northern anchovy followed by market squid (*Doryteuthis opalescens*). In 2020, slender blacksmelt (*Bathylagus pacificus*) was the most important followed by northern anchovy and market squid. Northern anchovy and market squid were consumed above the long-term mean in 2019-2020, with Northern anchovy well above the mean. Pacific hake (*Merluccius productus*) fell near the mean in both years. The other small pelagics and rockfish were a minor part of swordfish diets across years. Fished species were less important in swordfish diets overall when compared with albacore.

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