INTER-AMERICAN TROPICAL TUNA COMMISSION

103rd MEETING

Panama City, Panama
01-05 September 2025

DOCUMENT IATTC-103-01a

THE TUNA FISHERY IN THE EASTERN PACIFIC OCEAN IN 2024

This report provides a summary of the catches and effort in 2024 of the fishery for tunas in the eastern Pacific Ocean (EPO), for whose management the Inter-American Tropical Tuna Commission (IATTC) is responsible. It is based on data available to the IATTC staff in March 2025; therefore, some of the data for 2023 and 2024 are incomplete, and all data for 2021, 2022, 2023 and 2024 should be considered preliminary. Any changes in the fishery statistics provided in this report for the years prior to 2020 are due to data updates reported by CPCs.

All weights of catches and discards are in metric tons (t). In the tables, 0 means no effort, or a catch of less than 0.5 t; - means no data collected; * means data missing or not available. The following acronyms are used:

Species:	
ALB	Albacore tuna (*Thunnus alalunga*)
BET	Bigeye tuna (*Thunnus obesus*)
BIL	Unidentified istiophorid billfishes
BKJ	Black skipjack (*Euthynnus lineatus*)
BLM	Black marlin (*Makaira indica*)
BUM	Blue marlin (*Makaira nigricans*)
BZX	Bonito (*Sarda* spp.)
MLS	Striped marlin (*Kajikia audax*)
PBF	Pacific bluefin tuna (*Thunnus orientalis*)
SFA	Indo-Pacific sailfish (*Istiophorus platypterus)*
SKJ	Skipjack tuna (*Katsuwonus pelamis*)
SSP	Shortbill spearfish (*Tetrapturus angustirostris*)
SWO	Swordfish (*Xiphias gladius*)
TUN	Unidentified tunas
YFT	Yellowfin tuna (*Thunnus albacares*)

Fishing gears:	
FPN	Trap
GN	Gillnet
HAR	Harpoon
LHP	Handline
LL	Longline
LP	Pole and line
LTL	Troll
LX	Hook and line
MO	Multi-purpose

OTR	Other[1]
UNK	Unknown
PS	Purse seine
RG	Recreational
TX	Trawl

Ocean areas:	
EPO	Eastern Pacific Ocean
WCPO	Western and Central Pacific Ocean

Set types:	
DEL	Dolphin
NOA	Unassociated school
OBJ	Floating object LOG: Flotsam FAD: Fish-aggregating device

Flags:

IATTC Members & Cooperating Non-Members	
BLZ	Belize
BOL	Bolivia
CAN	Canada
CHL	Chile
CHN	China
COL	Colombia
CRI	Costa Rica
ECU	Ecuador
EUR	European Union
EU (CYP)	Cyprus
EU (ESP)	Spain
EU (PRT)	Portugal
FRA	France
FRA (PYF)	French Polynesia
GTM	Guatemala
HND	Honduras
IDN	Indonesia
JPN	Japan
KIR	Kiribati
KOR	Republic of Korea
LBR	Liberia
MEX	Mexico
NIC	Nicaragua
PAN	Panama
PER	Peru
SLV	El Salvador
TWN	Chinese Taipei
USA	United States of America
VEN	Venezuela
VUT	Vanuatu

Other flag codes	
COK	Cook Islands
MHL	Marshall Islands
NZL	New Zealand
PHL	Philippines
SLB	Solomon Islands
THA	Thailand
UNK	Unknown

Stock assessment:	
B	Biomass
C	Catch
CPUE	Catch per unit of effort
F	Rate of fishing mortality
MSY	Maximum sustainable yield
S	Index of spawning biomass
SBR	Spawning biomass ratio
SSB	Spawning stock biomass

[1] Used to group known gear types.

INTRODUCTION

This document summarizes the catches and effort of the fisheries for species covered by the IATTC's Antigua Convention ("*tunas and tuna-like species and other species of fish taken by vessels fishing for tunas and tuna-like species*") in the eastern Pacific Ocean (EPO) in 2024. The most important of these species are the scombrids (family Scombridae), which include tunas, bonitos, seerfishes, and some mackerels. The principal species of tunas caught are the three tropical tuna species (yellowfin, skipjack, and bigeye), followed by the temperate tunas (albacore, and lesser catches of Pacific bluefin); other scombrids, such as bonitos and wahoo, are also caught. In addition to the tunas, this document covers the billfishes (swordfish, marlins, shortbill spearfish, and sailfish).

Complementary to this document, EB-03-01 (*Ecosystem Considerations*), provides information on other, non-target species (e.g., elasmobranchs (sharks, rays, and skates), sea turtles, and teleosts (e.g., dorado, wahoo, carangids), that belong to the same ecosystem and are affected by fishing for, or dependent on or associated with, the fish stocks covered by the Antigua Convention.

Access to the fisheries is regulated by Resolution C-02-03, which allows only vessels on the IATTC Regional Vessel Register to fish for tunas in the EPO. Vessels are authorized to fish by their respective flag governments, and only duly authorized vessels are included in the Register. The Register lists, in addition to a vessel's name and flag, its fishing gear, dimensions, carrying capacity, date of construction, ownership, home port, and other characteristics. However, this requirement has not been applied to the thousands of small artisanal vessels, called *pangas*, that are known to catch tunas, among other species, in coastal waters of the EPO, but data on their numbers, effort, and catches are incomplete or unavailable. A pilot program, focused on sharks, to collect data on these fisheries in Central America has been completed (SAC-11-14). The results of the pilot study offer guidance in the development of a long-term sampling program in the region. With support from a second phase of the IATTC Common Oceans project to improve data collection for shark fisheries in the EPO, the sampling research conducted in Central America is expanding to other EPO coastal states, specifically Ecuador, Mexico and Peru (SAC-15-10, SAC-16 INF-V, SAC-16 INF-W).

The IATTC staff has collected and compiled data on the longline fisheries since 1952, on catches of yellowfin and skipjack since 1954, bluefin since 1973, and bigeye since 1975. The data in this report, which are as accurate and complete as possible, are derived from various sources, including vessel logbooks, on-board observer data, unloading records provided by canners and other processors, export and import records, reports from governments and other entities, and the IATTC species and size composition port sampling program.

CATCHES AND LANDINGS OF TUNAS, BILLFISHES, AND ASSOCIATED SPECIES

Almost all the catches in the EPO are made by the purse-seine and longline fleets; pole-and-line vessels, and various artisanal and recreational fisheries, account for a small percentage of the total catches. The IATTC staff compiles catch data for all fishing gears, including trolls, harpoons, and gillnets.

Detailed catch data are available for the purse-seine fishery, which takes over 90% of the total reported catches; the data for the other fisheries are incomplete. Purse-seine data for 2023 and 2024, and 2021-2023 data for longlines and other gears, are preliminary.

Since 1993 all Class-6[2] purse-seine vessels carry observers, who collect detailed data on catches, including those discarded at sea. Estimates of the "retained" catch (the portion of the total catch that is landed) are based principally on data collected during vessel unloadings.

Longline vessels, particularly the larger ones, fish primarily for bigeye, yellowfin, albacore, and swordfish. Data on the retained catches of most of the larger longline vessels are obtained from the vessels' flag governments; data for smaller longliners, artisanal vessels, and other vessels that fish for species covered

[2] Class 6: carrying capacity greater than 363 metric tons (t).

by the Antigua Convention are incomplete or unavailable, but some are obtained from vessel logbooks, or from governments or governmental reports.

Data for the western and central Pacific Ocean (WCPO) are taken from the Tuna Fishery Yearbook for 2024, published by the Western and Central Pacific Fisheries Commission (WCPFC).

This report summarizes data from all the above sources. The estimated total catches of tropical tunas (yellowfin, skipjack, and bigeye) in the entire Pacific Ocean are shown in Table A-1 and are discussed further in the sections below.

Estimates of the annual retained and discarded catches of tunas and other species taken by tuna-fishing vessels in the EPO during 1995-2024 are shown in Tables A-2a-b.

The catches of tropical tunas during 1995-2024, by flag, are shown in Tables A-3a-e, and the purse-seine catches and landings of tunas during 2023-2024 are summarized by flag in Tables A-4a-b.

CATCHES BY SPECIES

1.1. Yellowfin tuna

The total annual catches of yellowfin in the Pacific Ocean during 1995-2024 are shown in Table A-1. The 2024 EPO catch of 294 thousand t is 14% higher than the average of 258 thousand t for the previous 10-year period (2014-2023). In the WCPO, the catches of yellowfin reached a record high of 747 thousand t in 2021.

The annual retained catches of yellowfin in the EPO, by gear, during 1995-2024 are shown in Table A-2a. Over the most recent 10-year period (2014-2023), the annual retained purse-seine catches have fluctuated around an average of 246 thousand t (range: 211 to 298 thousand t). The preliminary estimate of the retained catch in 2024, 294 thousand t, is 1% lower than that of 2023, and 19% higher than the 2014-2023 average. Less than 1% of the total purse-seine catch of yellowfin was discarded at sea during the most recent 10-year period (average at 0.2% during the most recent 10-year period, 2014-2023) (Table A-2a).

During 1995-2006, annual longline catches in the EPO averaged about 19 thousand t (range: 10 to 30 thousand t), or about 6% of the total retained catches of yellowfin on average. They then declined sharply, to an annual average of 10 thousand t (range: 7 to 13 thousand t), or about 4% of the total retained catches, during 2007-2023. Catches by other fisheries (pole and line, recreational, gillnet, troll, artisanal, *etc.*), whether incidental or targeted, are shown in Table A-2a, under "Other gears" (OTR); during 1995-2022 they averaged about 1.5 thousand t.

1.2. Skipjack tuna

The total annual catches of skipjack in the Pacific Ocean during 1995-2024 are shown in Table A-1. Most of the catch is taken in the WCPO. WCPO total annual catches of skipjack averaged 1.8 million t over the most recent 10-year period (2014-2023), reaching an all-time catch high of 2 million t in 2019. In the EPO, total catches of skipjack reached its maximum historical level of 645 thousand t in 2024, higher than the previous 10-year (2014-2023) average of 323 thousand t by approximately 100%.

The annual retained catches of skipjack in the EPO, by gear, during 1995-2024 are shown in Table A-2a. During 2014-2023 the annual retained purse-seine catch averaged 320 thousand t (range: 261 to 389 thousand t). The preliminary estimate of the retained catch in 2024, 641 thousand t, is the highest historic level. This value is 100% greater than the 10-year average (320 thousand t) for 2014-2023.

Discards of skipjack at sea were less than 1.2% of the total purse-seine catches of the species (average at 0.7% during the most recent 10-year period, 2014-2023) (Table A-2a).

Catches of skipjack in the EPO by longlines and other gears are negligible (Table A-2a).

1.3. Bigeye tuna

The total annual catches of bigeye in the Pacific Ocean during 1995-2024 are shown in Table A-1. In the

WCPO starting in 1995 the bigeye has been fluctuating between 107 thousand t and a historic peak of 183 thousand t in 2004. In the EPO, the average catch during 1995-2024 was 101 thousand t, with a low of 52 thousand t in 2024 and a high of 149 thousand t in 2000.

The annual retained catches of bigeye in the EPO by purse-seine vessels during 1995-2024 are shown in Table A-2a. The introduction of fish-aggregating devices (FADs) in 1993, deployed by fishers to attract tunas, led to a sudden and dramatic increase in the purse-seine catches. From 1995 to 1999, the average annual retained purse-seine catch of bigeye in the EPO was 53 thousand t, and then in 2000 was over 95 thousand t. From 2001-2023, it has fluctuated between 42 and 84 thousand t; the preliminary estimates for 2024 is 34 thousand t.

During 2000-2024 the percentage of the purse-seine catch of bigeye discarded at sea has steadily decreased, from 5% in 2000 to less than 1% in 2022, averaging about 1.4%.

Before the expansion of the FAD fishery, longliners caught almost all the bigeye in the EPO. Since 1995, coinciding with the expansion of the FAD fishery, the longline fishery has accounted for about 38% of the total bigeye catch, averaging 39 thousand t during 1995-2023. The preliminary estimate for 2024 is approximately 18 thousand t (Table A-2a).

Small amounts of bigeye are caught in the EPO by other gears (Table A-2a).

1.4. Pacific bluefin tuna

The catches of Pacific bluefin in the entire Pacific Ocean, by flag and gear, as reported by the vessels' flag governments to the International Scientific Committee for Tuna and Tuna-like Species in the North Pacific Ocean (ISC), are shown in Table A-5a.

The catches of Pacific bluefin in the EPO during 1995-2024, by gear, are shown in Table A-2a. EPO total annual catches of bluefin averaged 4.4 thousand t over the most recent 10-year period (2014-2023). During this same period, the purse-seine vessels accounted for 78% of the annual catch, on average. The 2014-2023 average EPO retained catch by purse seine vessels is 3.4 thousand t (range: 2.5 t to 5.3 thousand t); the preliminary estimate for 2024 is 3.5 thousand t (Table A-2a).

Catches of Pacific bluefin by recreational gear in the EPO during 1995-2024 are reported in numbers of individual fish caught (Table A-5b).

1.5. Albacore tuna

Data provided by the relevant CPCs on catches of albacore in the EPO, by gear, are shown in Table A-2a. The same information, by area (north and south of the equator), is also shown in Table A-6. On average over the most recent 10-year period (2014-2023), troll vessels (LTL, included under "Other gears" (OTR) in Table A-2a) have accounted for 80% of the annual retained catches of albacore north of the equator. The total annual retained catches of albacore north of the equator averaged 14 thousand tons over the most recent 10-year period (2014-2023), with a range of 6 to 23 thousand tons. In contrast, retained catches of albacore south of the equator are predominantly taken by longline (LL) gear (averaging 99% over the same period). Total annual retained catches of albacore south of the equator during 2014-2023 averaged 25 thousand t (range: 17 to 30 thousand t).

1.6. Other tunas and tuna-like species

While yellowfin, skipjack, and bigeye tunas comprise the great majority of the retained purse-seine catches in the EPO, other tunas and tuna-like species, such as albacore, black skipjack, Pacific bluefin, bonito, frigate and bullet tunas, contribute to the overall harvest. The estimated annual retained and discarded catches of these species during 1995-2024 are shown in Table A-2a. The catches reported in the "unidentified tunas" (TUN) category in Table A-2a contain some catches reported by species (frigate and bullet tunas) along with the unidentified tunas. The total retained catch of these other species by the purse-seine fishery in 2024 was 13 thousand t, equal to the 10-year average (2014-2023) average of 12 thousand t (range: 8 to 16 thousand t).

Black skipjack are also caught by other gears in the EPO, mostly by coastal artisanal fisheries. Bonitos are also caught by artisanal fisheries, and have been reported as catch by longline vessels in some years. Except for 2022, annual catch reports for bonitos have increased greatly from 2019 to 2023 (45-67 thousand t), largely due to new reports submitted by one CPC from its artisanal fisheries.

1.7. Billfishes

Catch data for billfishes (swordfish, blue marlin, black marlin, striped marlin, shortbill spearfish, and sailfish) are shown in Table A-2b.

Swordfish are caught in the EPO with large-scale and artisanal longlines, gillnets, harpoons, and occasionally with recreational gear. During 1995-2014 the longline catch averaged 14 thousand t, but during 2015-2018 this increased by about 76%, to over 24 thousand t, possibly due to increased abundance of swordfish, increased effort directed toward the species along with improved fishing efficiency, increased reporting, or a combination of all of these.

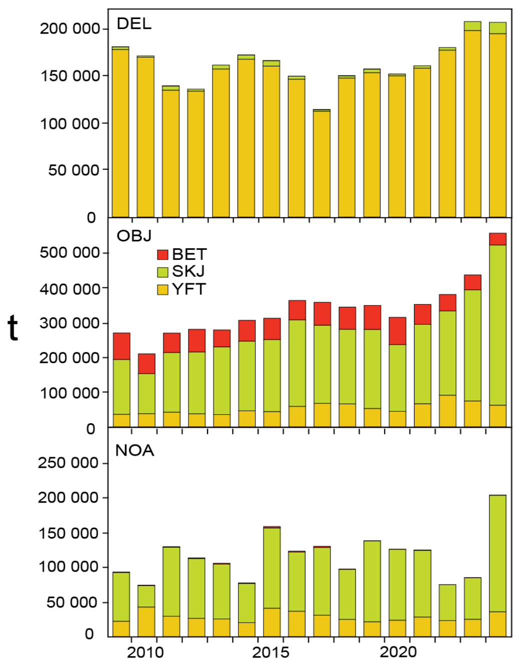


FIGURE 1. Purse-seine catches of tunas, by species and set type, 2009-2024

Other billfishes are caught with large-scale and artisanal longlines and recreational gear. The average annual longline catches of blue marlin and striped marlin during the recent 10-year period (2014-2023) were about 3.0 thousand and 1.6 thousand t, respectively. Smaller amounts of other billfishes are taken by longline.

Little information is available on the recreational catches of billfishes, but, the retained catches are believed to be substantially less than the commercial catches for all species, due to catch-and-release practices.

Billfishes are caught incidentally in the purse-seine fisheries, which during 2014-2023 accounted for about 1% of the total catch of billfishes in the EPO. Table A-2b

CATCHES AND FISHING EFFORT

1.8. Purse seine

Estimates of the numbers of purse-seine sets of each type (associated with dolphins (DEL), associated with floating objects (OBJ), and unassociated (NOA)) in the EPO during 2009-2024, and the retained catches from those sets, are shown in Table A-7 and Figure 1. The estimates for Class 1-5[3] vessels were calculated from logbook data in the IATTC statistical data base and some observer data from the voluntary TUNACONS program, and those for Class-6 vessels from the observer data bases of the IATTC, Colombia, Ecuador, the European Union, Mexico, Nicaragua, Panama, the United States, and Venezuela.

Since the introduction of artificial fish-aggregating devices (FADs) in the mid-1990s, they have become predominant in the floating-object fishery, and now account for an estimated 98% of all floating-object sets by Class-6 vessels (Table A-8).

1.9. Longline

The reported nominal fishing effort (in thousands of hooks) by longline vessels in the EPO, and their catches of

[3] ≤363 t carrying capacity.

the predominant tuna species, are shown in Table A-9.

DISTRIBUTIONS OF THE CATCHES OF TROPICAL TUNAS

1.10. Purse-seine catches

The average annual distributions of purse-seine catches, by set type, of tropical tunas (yellowfin, skipjack, and bigeye) in the EPO during 2014-2023 are shown in Figures A-1a, A-2a, and A-3a, respectively, and preliminary estimates for 2024 are shown in Figures A-1b, A-2b, and A-3b.

Yellowfin: The majority of catches in 2024 were taken in sets associated with dolphins in two principal areas: north of 10°N from 105°W to 130°W, and inshore north of 5°S from 95°W to the coast. Lesser amounts of yellowfin were taken in dolphin and floating-objects sets in the offshore area when compared to the previous 10 years (Figure A-1b).

Skipjack: In 2024, catches primarily occurred in two main fishing areas: predominantly on floating object sets between 10°N and 5°S and from 90°W to 120°W, and also on floating objects and unassociated sets inshore between 5°N and 20°S from 90°W to the coast. The proportion of skipjack catch from floating object sets in the area between 10°N and 5°S and from 90°W to 120°W has increased over the previous 10 years and in the area inshore between 5°N and 20°S from 90°W to the coast the unassociated sets have increased over the previous 10 years. Also, the amount of skipjack caught in 2024 in floating-object sets on the western edge of the EPO is less than the previous 10 years, and catches from unassociated sets in the same area have also decreased (Figure A-2b).

Bigeye are not often caught north of about 10°N in the EPO. Almost all of the 2024 catches were taken in sets on floating object sets between the 10°N and 15°S and west of 90°W (Figure A-3b). Lesser amounts of bigeye were taken in floating object sets between 90°W to 150W than in the previous 10 years.

1.11. Longline catches

Since 2009, the IATTC has received tuna catch and effort data from Belize, China, France (French Polynesia), Japan, the Republic of Korea, Panama, Chinese Taipei, the United States, and Vanuatu. Albacore, bigeye and yellowfin tunas make up the majority of the catches by most of these vessels. The distributions of the catches of bigeye and yellowfin in the Pacific Ocean by Chinese, Japanese, Korean, and Chinese Taipei longline vessels during 2019-2023 are shown in Figure A-4.

SIZE COMPOSITIONS OF THE CATCHES OF TUNAS

1.12. Purse-seine

Length-frequency samples are the basic source of data used for estimating the size and age compositions of the various species of fish in the landings. This information is necessary to obtain age-structured estimates of the populations for various purposes, primarily the integrated modeling that the staff uses to assess the status of the stocks (see Stock Assessment Reports). Length-frequency samples are obtained from the catches of purse-seine vessels in the EPO by IATTC personnel at ports of landing in Ecuador and Mexico. The methods for sampling the catches of tunas are described in the IATTC Annual Report for 2000 and in IATTC Stock Assessment Reports 2 and 4.

Historical long-term time series of size-composition data for yellowfin and bigeye are available in the Stock Assessment Reports, and average length stock status indicators (SSIs) are available for yellowfin, bigeye and skipjack (SAC-16-02). In this report, data on the size composition of the catches during 2019-2024 are presented (Figures A-6 to A-8), with two sets of length-frequency histograms for each species: the first shows the data for 2024 by stratum (gear type, set type, and area), and the second the combined data for each year of the 2019-2024 period.

Yellowfin: nine purse-seine fisheries (four associated with floating objects (OBJ), three associated with dolphins (DEL), and two unassociated (NOA)) and one pole-and-line (LP) fishery, which includes all 13 sampling areas) are defined (Figure A-5). Of the 923 wells with fish caught during 2024, 741 contained yellowfin. The estimated size compositions of the fish caught are shown in Figure A-6a. Most of the yellowfin catch was taken in the DEL fisheries throughout the year, with smaller amounts taken in the OBJ fisheries during the first three quarters of 2024. Large yellowfin (95-140 cm) were caught primarily in the DEL-I, DEL-S and DEL-N fishery in the all four quarters and in the NOA-N fishery in the first, third and fourth quarters. Smaller yellowfin (<80 cm) were taken in the OBJ fisheries in all four quarters.

The estimated size compositions of the yellowfin caught by all fisheries combined during 2019-2024 are shown in Figure A-6b. The average weight of yellowfin in 2024, 9.8 kg, was higher than the previous years with the exception of 2020 that had an average weight of 10.5 kg. The size distribution shifted toward the middle of the range when compared to previous years, indicating fewer smaller and larger sized yellowfin in 2024.

Skipjack: seven purse-seine fisheries (four OBJ, two NOA, one DEL) and one LP fishery are defined (Figure A-5); the last two include all 13 sampling areas. Of the 923 wells with fish caught, 587 contained skipjack. The estimated size compositions of the fish caught during 2024 are shown in Figure A-7a. Most of the skipjack catch was taken in the OBJ-N, OBJ-E, OBJ-I, OBJ-S and NOA-S fisheries in all four quarters. The largest skipjack (60-70 cm) were caught in the OBJ-E and OBJ-N fisheries in the third and fourth quarters. The smallest (<50 cm) were caught primarily in the OBJ-N, OBJ-I, OBJ-E, OBJ-S and NOA-S fisheries in the first two quarters.

The estimated size compositions of skipjack caught by all fisheries combined during 2019-2024 are shown in Figure A-7b. The majority of the skipjack in 2024 was in the 40-60 cm range.

Bigeye: six purse-seine fisheries (four OBJ, one NOA, one DEL) and one LP fishery are defined (Figure A-5); all except the OBJ fisheries include all 13 sampling areas. Of the 923 wells with fish caught, 101 contained bigeye. The estimated size compositions of the fish caught during 2024 are shown in Figure A-8a. Most of the smaller bigeye catch (<80 cm) was taken in the OBJ-N and OBJ-S fishery in the second and fourth quarters. The larger bigeye (>80 cm) was taken in the OBJ-N and OBJ-S fisheries in the second and fourth quarters.

The estimated size compositions of bigeye caught by all fisheries combined during 2019-2024 are shown in Figure A-8b. The average weight of bigeye in 2024 (5.5 kg) was considerably higher than 2022 to 2023 (4.0 – 4.4 kg) and slightly higher than 2019 to 2021 (5.1 – 5.2 kg). The majority of bigeye caught in 2024 was in the 40-80 cm range, with less of the larger bigeye >80 cm than 2019-2023.

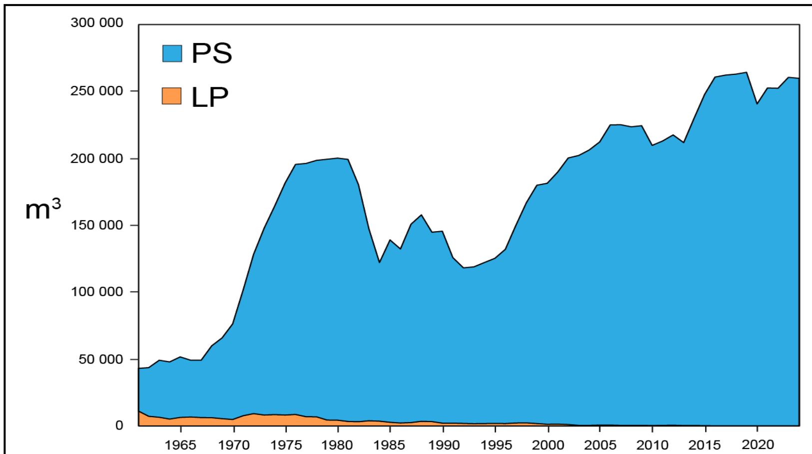


FIGURE 2. Carrying capacity, in cubic meters of well volume, of the purse-seine and pole-and-line fleets in the EPO, 1961-2024

Pacific bluefin are caught by purse-seine and recreational gears off California and Baja California, historically from about 23°N to 35°N, but only between 28°N and 32°N in recent years. The 2024 purse-seine fishing season continued the trend of starting the first day in January: in 2024, bluefin were first caught in early January, and the fishery was closed in early March, when the annual catch limit was reached. Most of the catch is transported live to grow-out pens near the coast of Mexico. Mexico's National Observer Program (PNAAPD) submitted the length-composition data for purse-seine catches during 2018-2023 (Figure A-9). This data is provided every other year, so the figure will next be updated in 2026.

1.13. Longline fishery

The size compositions of yellowfin and bigeye caught by the Japanese longline fleet (commercial and training vessels) in the EPO during 2019-2023 are shown in Figures A-10 and A-11. The average annual weight during that period ranged from 42.8 to 55.2 kg for yellowfin, and from 64.7 kg to 77.3 kg for bigeye. Size composition data for 2021 and 2022 was not available due to difficulties resulting from the COVID-19 pandemic, which impacted the collection and analysis of 2021 and 2022 YFT and BET size data.

1.14. Catches of tunas, by flag and gear

The annual retained catches of tunas in the EPO during 1995-2024, by flag and gear, are shown in Tables A-3a-e. The purse-seine catches of tunas in 2023 and 2024, by flag and species, are summarized in Table A-4a. Of the nearly 981 thousand t of tunas caught in 2024, 43% were caught by Ecuadorian vessels, and 19% by Mexican vessels. Other countries with significant catches included Panama (15%), United States (6%), Colombia (4%), Venezuela (4%) and Nicaragua (2%). The purse-seine landings of tunas in 2023 and 2024, by species and country of landing, are summarized in Table A-4b. Of the more than 984 thousand t of tunas landed in the EPO in 2024, 63% were landed in Ecuadorian ports, and 19% in Mexican ports. Other countries with landings of tunas in the EPO included Colombia (4%), Peru (3%) and the United States (3%).

THE FLEETS

1.15. Purse seine

The IATTC Regional Vessel Register contains detailed records of all purse-seine vessels that are authorized to fish for tunas in the EPO. However, only vessels that fished for yellowfin, skipjack, bigeye, and/or Pacific bluefin tuna in the EPO in 2024 are included in the following description of the purse-seine fleet.

The IATTC uses well volume, in cubic meters (m^3), to measure the carrying capacity of purse-seine vessels (Table A-10; Figure 2).

The 2023 and preliminary 2024 data for numbers and total well volumes of purse-seine vessels that fished for tunas in the EPO are shown in Tables A-11a and A-11b. During 2024, the fleet was dominated by Ecuadorian and Mexican vessels, with about 35% and 23%, respectively, of the total well volume; they were followed by the Panama (12%), United States (9%), Venezuela (6%), Colombia (6%), European Union (Spain) (4%), Nicaragua (2%), El Savador (2%) and Peru (1%).[4]

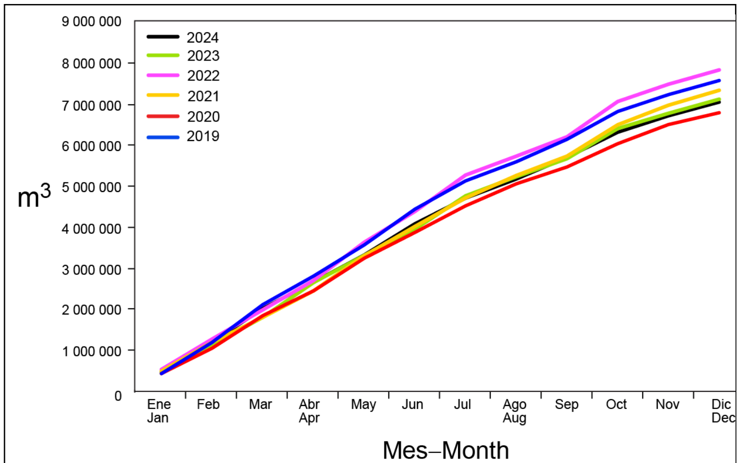


FIGURE 3. Cumulative capacity of the purse-seine fleet at sea, by month, 2019-2024

The cumulative capacity at sea during 2024 is compared to those of the previous five years in Figure 3.

The monthly average, minimum, and maximum total well volumes at sea (VAS), in thousands of cubic meters, of purse-seine and pole-and-line vessels that fished for tunas in the EPO during 2014-2023, and the 2024 values, are shown in Table A-12. The monthly values are averages of the VAS estimated at weekly intervals by the IATTC staff. The average VAS value for 2014-2023 was higher, at about 146 thousand m^3 (57% of total capacity), compared to 137 thousand m^3 (52% of total capacity) in 2024.

[4] The sum of the percentages may not add up to 100% due to rounding.

1.16. Other fleets of the EPO

Information on other types of vessels that are authorized to fish in the EPO is available in the IATTC's Regional Vessel Register. In some cases, particularly for large longline vessels, the Register contains information for vessels authorized to fish not only in the EPO, but also in other oceans, and which may not have fished in the EPO during 2024, or ever.

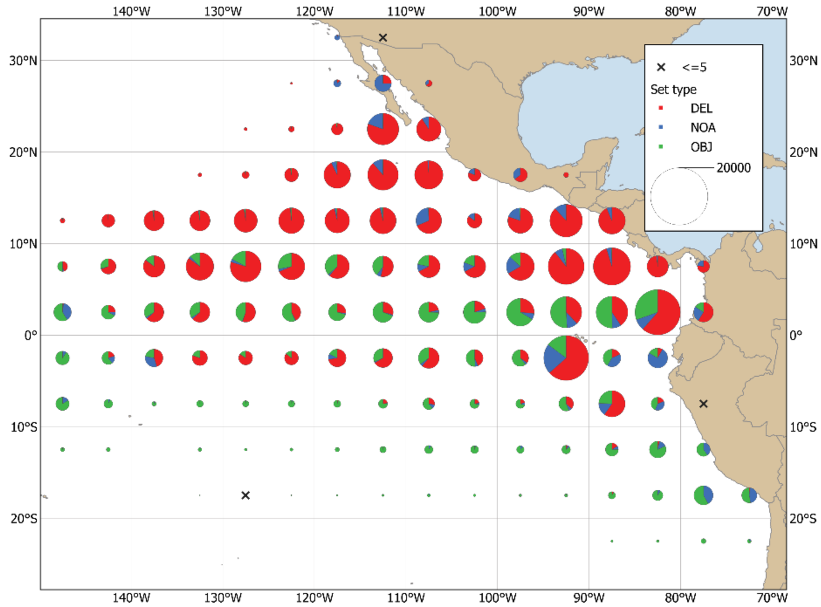


FIGURE A-1a. Average annual distributions of the purse-seine catches of yellowfin, by set type, 2014-2023. The sizes of the circles are proportional to the amounts of yellowfin caught in those 5° by 5° areas.
FIGURA A-1a. Distribución media anual de las capturas cerqueras de aleta amarilla, por tipo de lance, 2014-2023. El tamaño de cada círculo es proporcional a la cantidad de aleta amarilla capturado en la cuadrícula de 5° x 5° correspondiente.

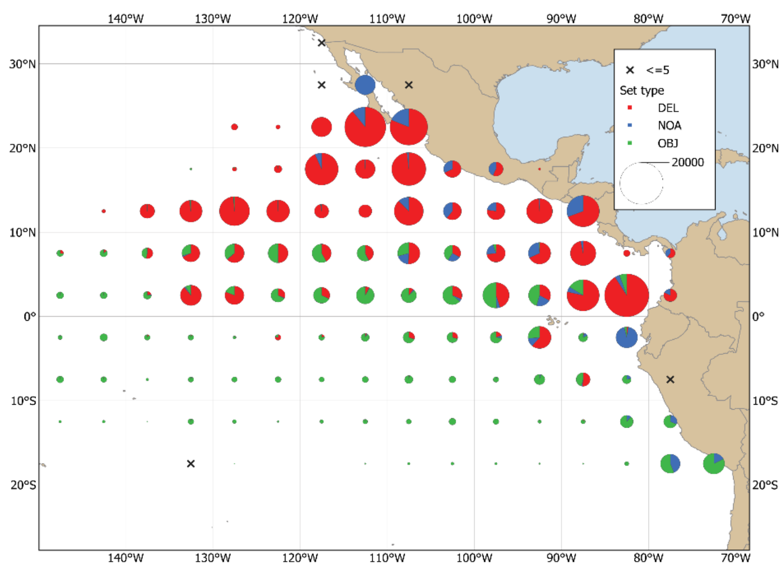


FIGURE A-1b. Annual distributions of the purse-seine catches of yellowfin, by set type, 2024. The sizes of the circles are proportional to the amounts of yellowfin caught in those 5° by 5° areas.
FIGURA A-1b. Distribución anual de las capturas cerqueras de aleta amarilla, por tipo de lance, 2024. El tamaño de cada círculo es proporcional a la cantidad de aleta amarilla capturado en la cuadrícula de 5° x 5° correspondiente.

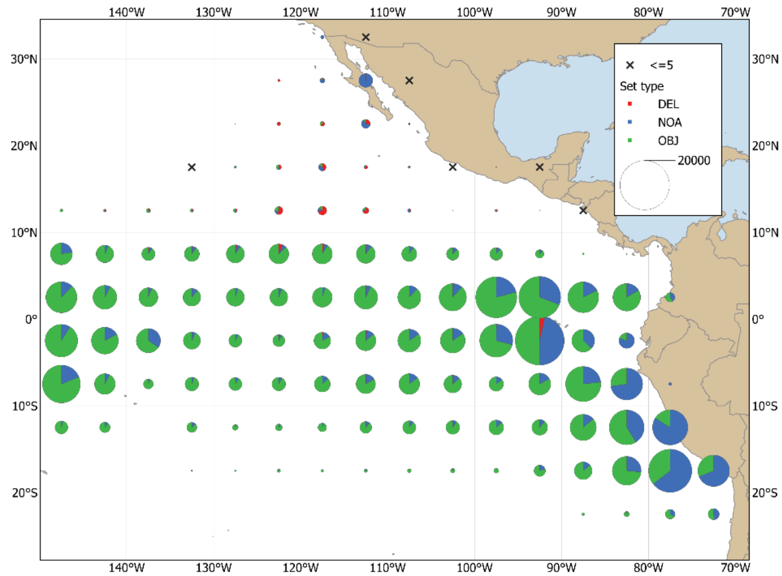


FIGURE A-2a. Average annual distributions of the purse-seine catches of skipjack, by set type, 2014-2023. The sizes of the circles are proportional to the amounts of skipjack caught in those 5° by 5° areas.
FIGURA A-2a. Distribución media anual de las capturas cerqueras de barrilete, por tipo de lance, 2014-2023. El tamaño de cada círculo es proporcional a la cantidad de barrilete capturado en la cuadrícula de 5° x 5° correspondiente.

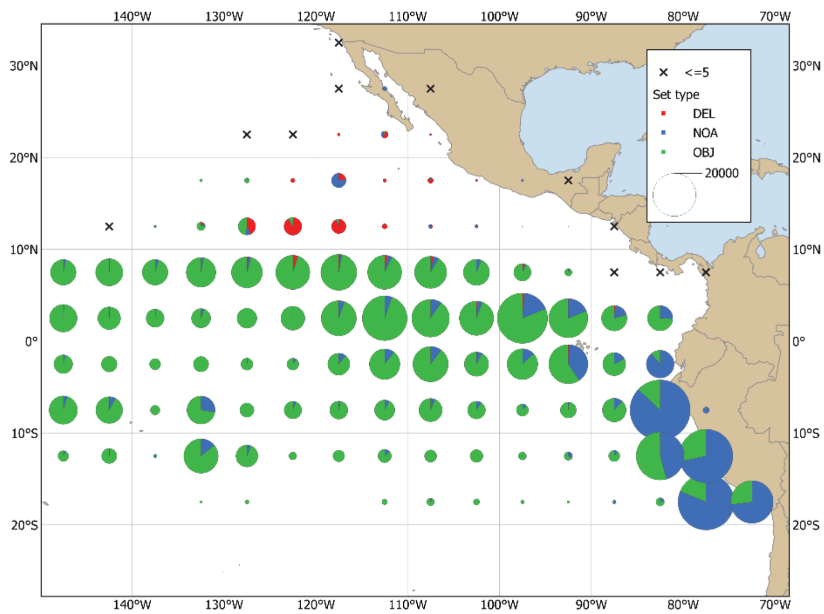


FIGURE A-2b. Annual distributions of the purse-seine catches of skipjack, by set type, 2024. The sizes of the circles are proportional to the amounts of skipjack caught in those 5° by 5° areas.
FIGURA A-2b. Distribución anual de las capturas cerqueras de barrilete, por tipo de lance, 2024. El tamaño de cada círculo es proporcional a la cantidad de barrilete capturado en la cuadrícula de 5° x 5° correspondiente.

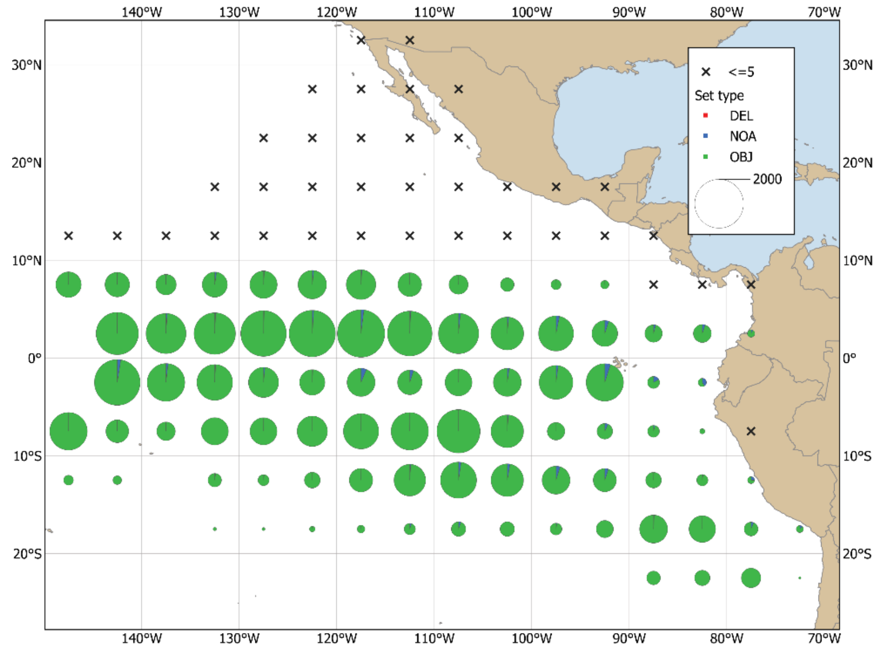


FIGURE A-3a. Average annual distributions of the purse-seine catches of bigeye, by set type, 2014-2023. The sizes of the circles are proportional to the amounts of bigeye caught in those 5° by 5° areas.
FIGURA A-3a. Distribución media anual de las capturas cerqueras de patudo, por tipo de lance, 2014-2023. El tamaño de cada círculo es proporcional a la cantidad de patudo capturado en la cuadrícula de 5° x 5° correspondiente.

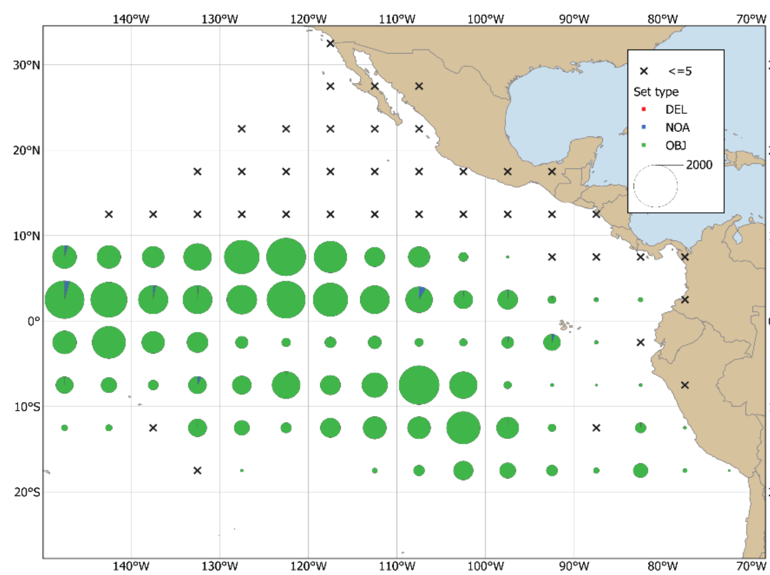


FIGURE A-3b. Annual distributions of the purse-seine catches of bigeye, by set type, 2024. The sizes of the circles are proportional to the amounts of bigeye caught in those 5° by 5° areas.
FIGURA A-3b. Distribución anual de las capturas cerqueras de patudo, por tipo de lance, 2024. El tamaño de cada círculo es proporcional a la cantidad de patudo capturado en la cuadrícula de 5° x 5° correspondiente.

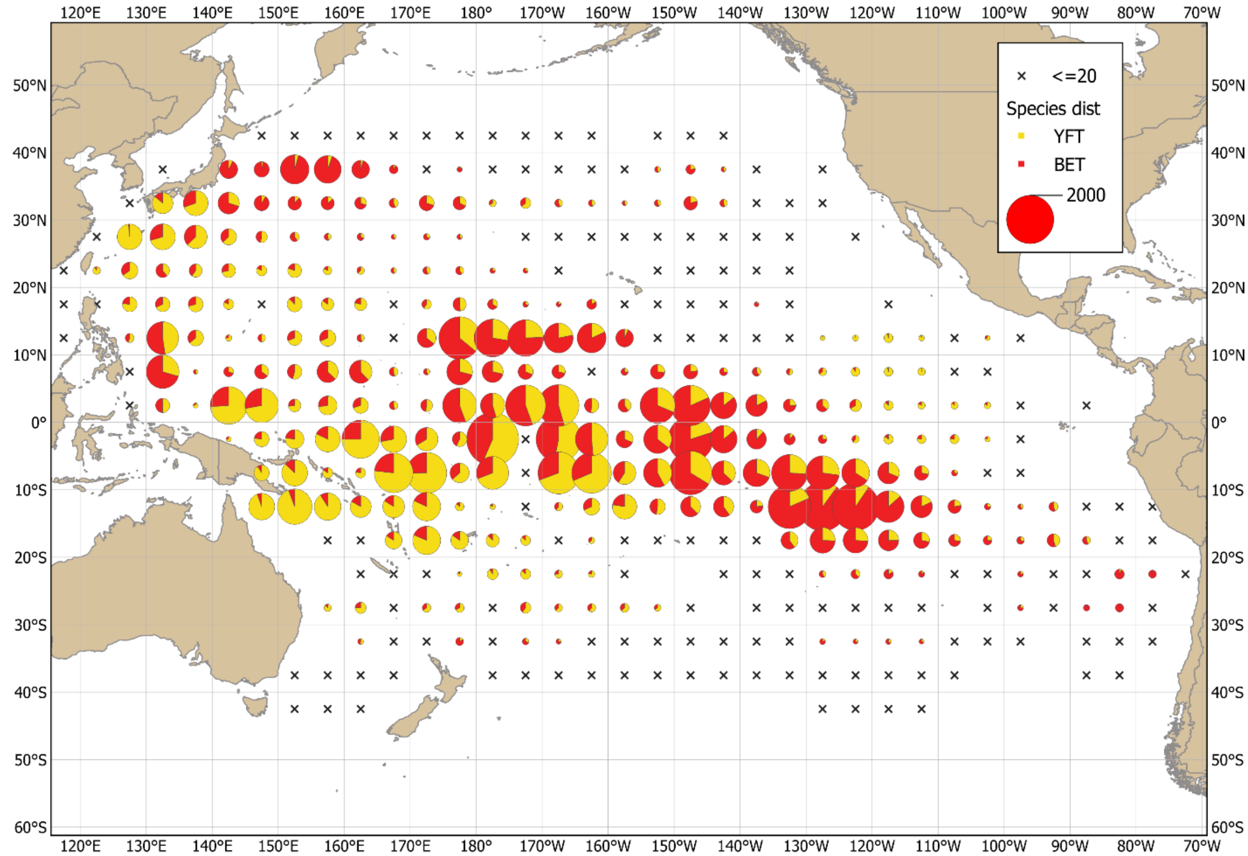


FIGURE A-4. Distributions of the average annual catches of bigeye and yellowfin tunas in the Pacific Ocean, in metric tons, by Chinese, Japanese, Korean, and Chinese Taipei longline vessels, 2019-2023. The sizes of the circles are proportional to the amounts of bigeye and yellowfin caught in those 5° by 5° areas.
FIGURA A-4. Distribución de las capturas anuales medias de atunes patudo y aleta amarilla en el Océano Pacifico, en toneladas métricas, por buques palangreros de China, Corea, Japón, y Taipei Chino, 2019-2023. El tamaño de cada círculo es proporcional a la cantidad de patudo y aleta amarilla capturado en la cuadrícula de 5° x 5° correspondiente.

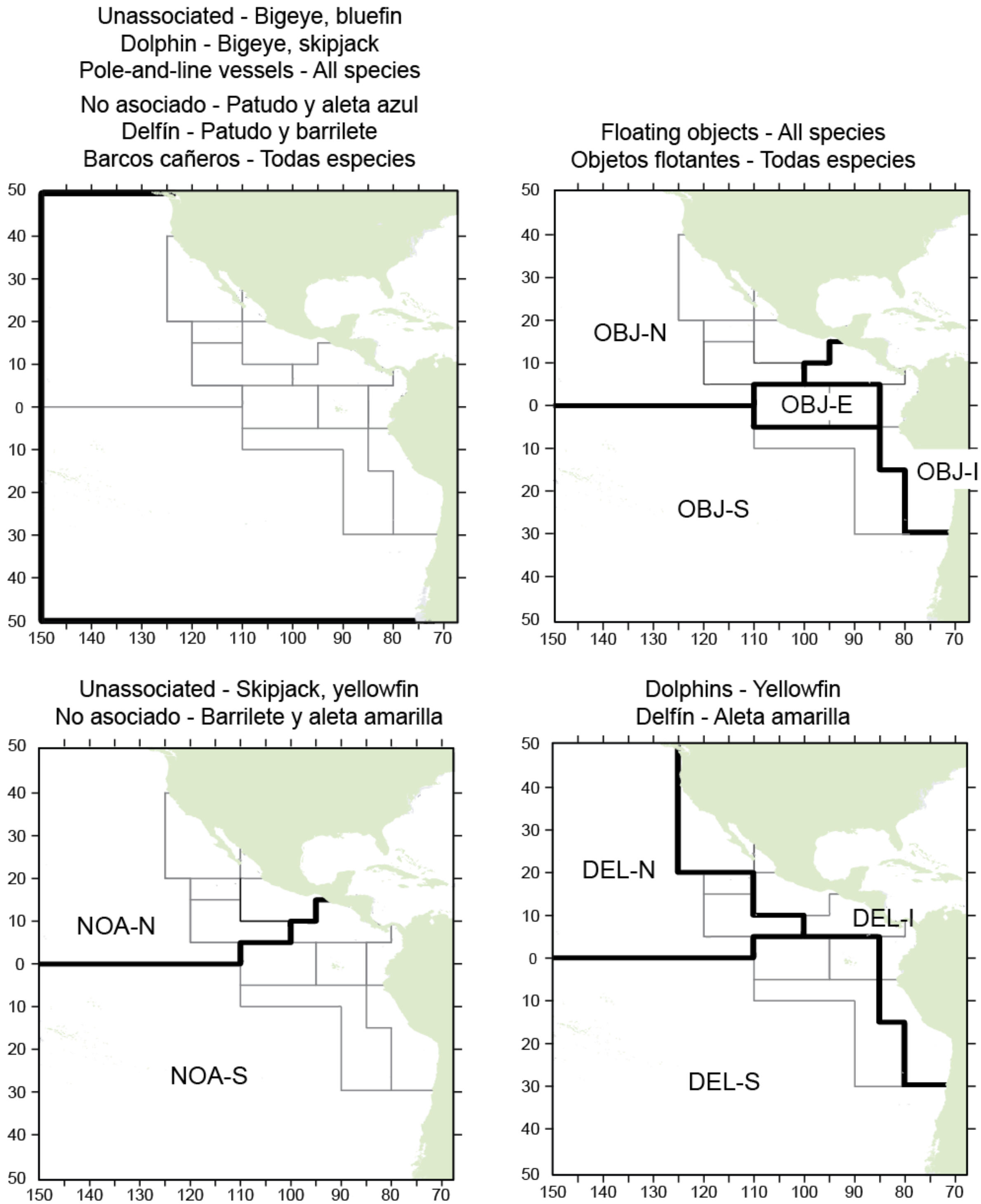


FIGURE A-5. The purse-seine fisheries defined by the IATTC staff for analyses of yellowfin, skipjack, and bigeye in the EPO. The thin lines indicate the boundaries of the 13 length-frequency sampling areas, and the bold lines the boundaries of the fisheries.

FIGURA A-5. Las pesquerías cerqueras definidas por el personal de la CIAT para los análisis de los atunes aleta amarilla, barrilete, y patudo en el OPO. Las líneas delgadas indican los límites de las 13 zonas de muestreo de frecuencia de tallas, y las líneas gruesas los límites de las pesquerías.

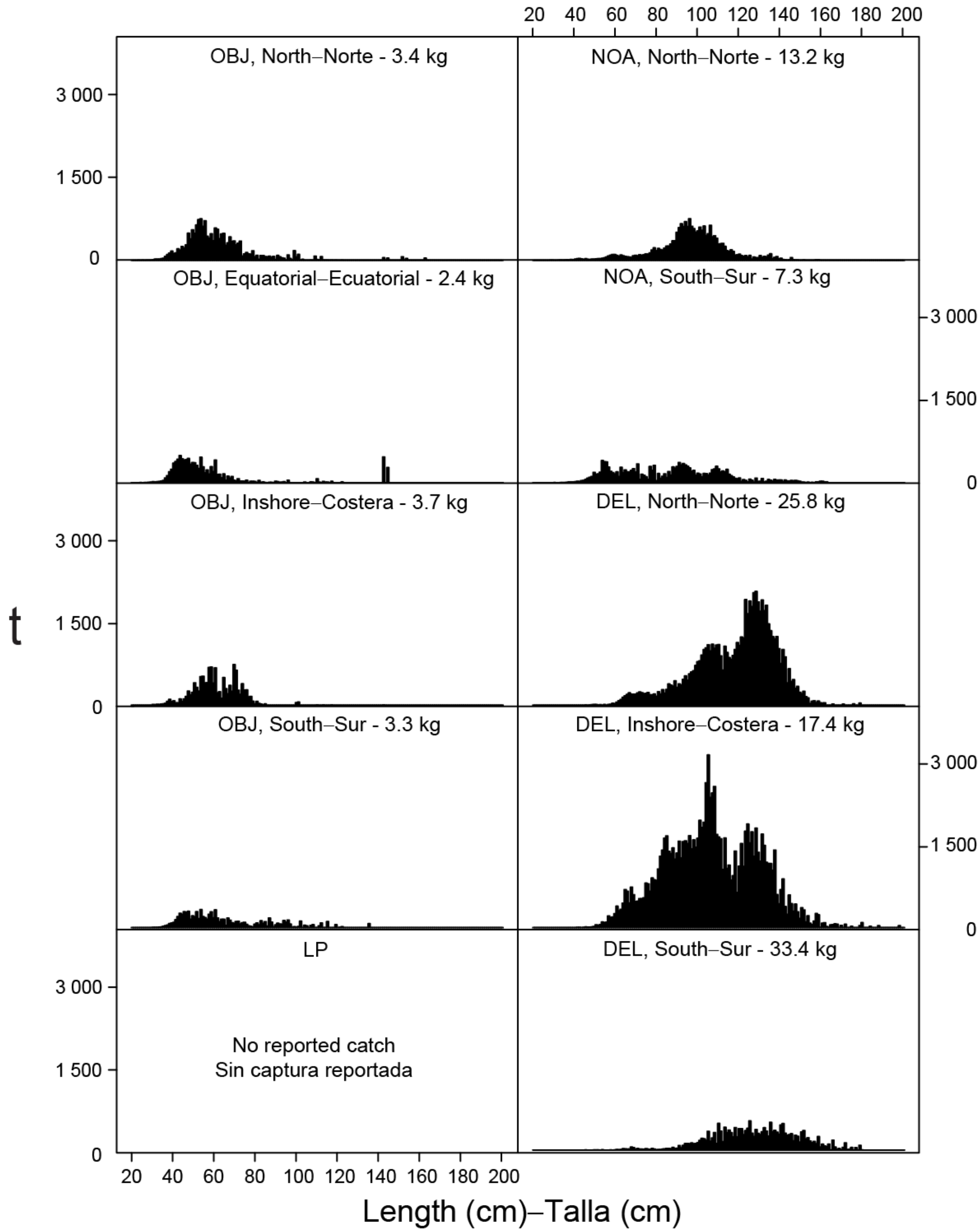


FIGURE A-6a. Estimated size compositions of the yellowfin caught in the EPO during 2024 for each fishery designated in Figure A-5. The value at the top of each panel is the average weight of the fish in the samples.

FIGURA A-6a. Composición por tallas estimada del aleta amarilla capturado en el OPO durante 2024 en cada pesquería ilustrada en la Figura A-5. El valor en cada recuadro representa el peso promedio del pescado en las muestras.

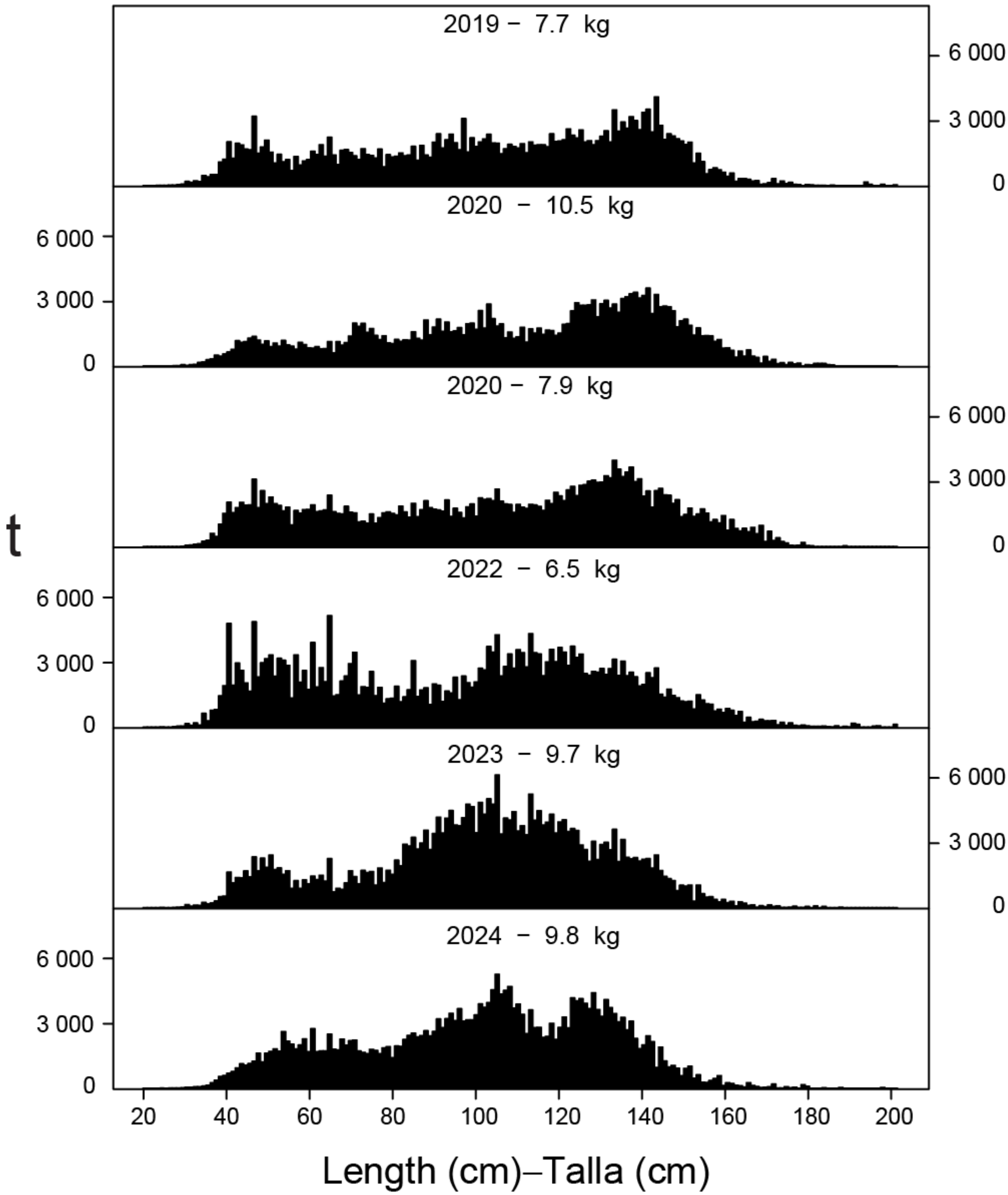


FIGURE A-6b. Estimated size compositions of the yellowfin caught by purse-seine and pole-and-line vessels in the EPO during 2019-2024. The value at the top of each panel is the average weight of the fish in the samples.

FIGURA A-6b. Composición por tallas estimada del aleta amarilla capturado por buques cerqueros y cañeros en el OPO durante 2019-2024. El valor en cada recuadro representa el peso promedio del pescado en las muestras.

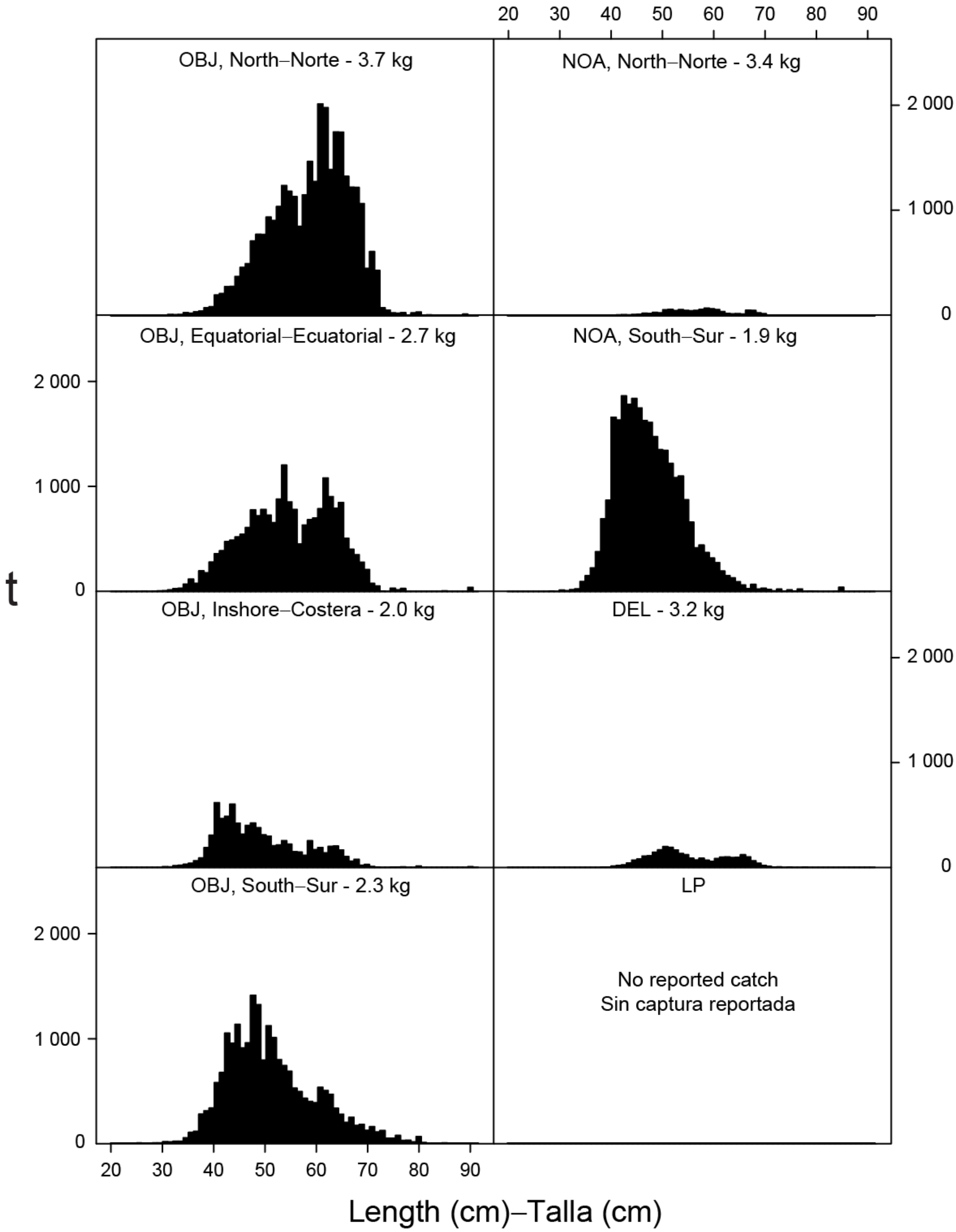


FIGURE A-7a. Estimated size compositions of the skipjack caught in the EPO during 2024 for each fishery designated in Figure A-5. The value at the top of each panel is the average weight of the fish in the samples.
FIGURA A-7a. Composición por tallas estimada del barrilete capturado en el OPO durante 2024 en cada pesquería ilustrada en la Figura A-5. El valor en cada recuadro representa el peso promedio del pescado en las muestras.

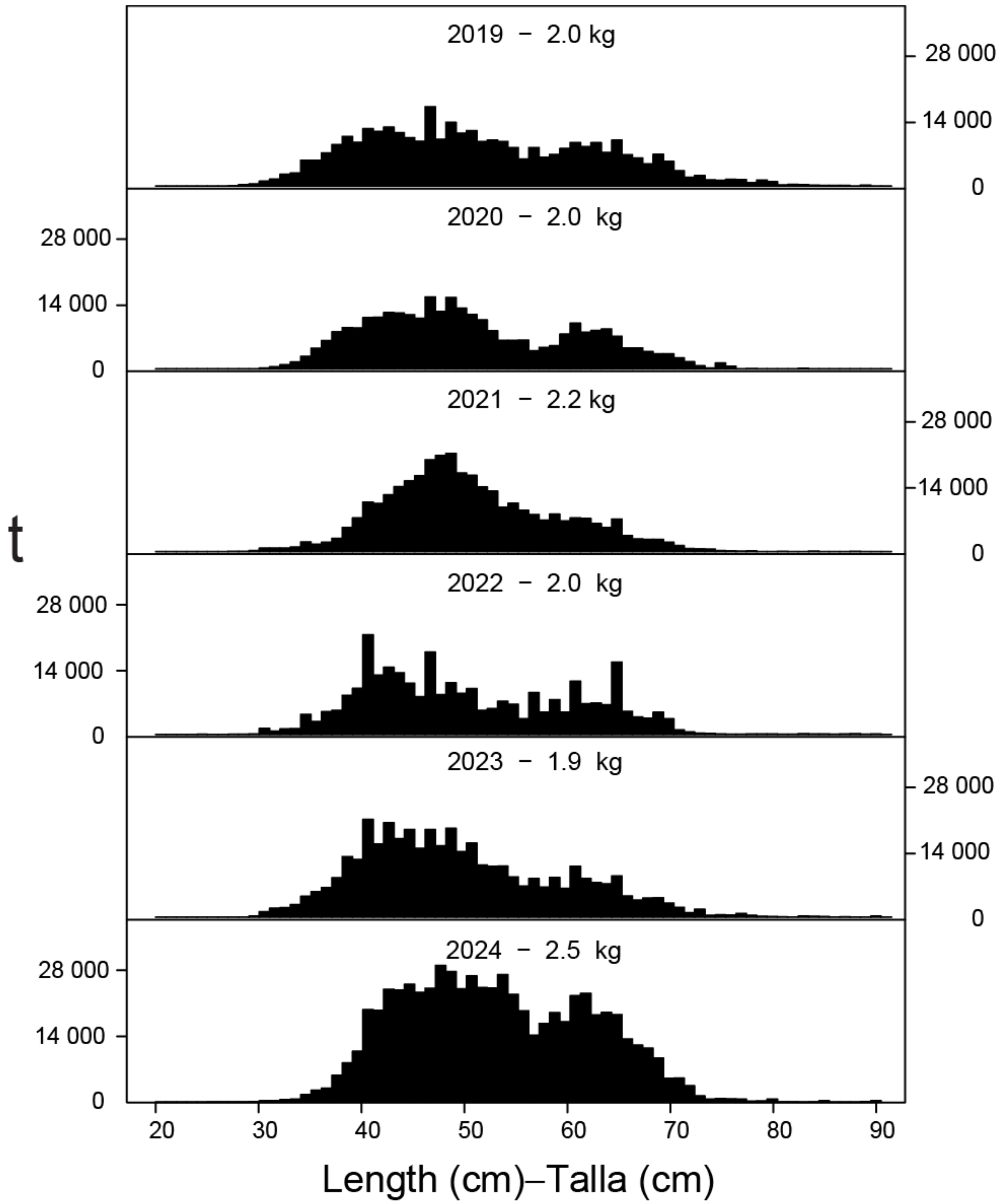


FIGURE A-7b. Estimated size compositions of the skipjack caught by purse-seine and pole-and-line vessels in the EPO during 2019-2024. The value at the top of each panel is the average weight of the fish in the samples.

FIGURA A-7b. Composición por tallas estimada del barrilete capturado por buques cerqueros y cañeros en el OPO durante 2019-2024. El valor en cada recuadro representa el peso promedio del pescado en las muestras.

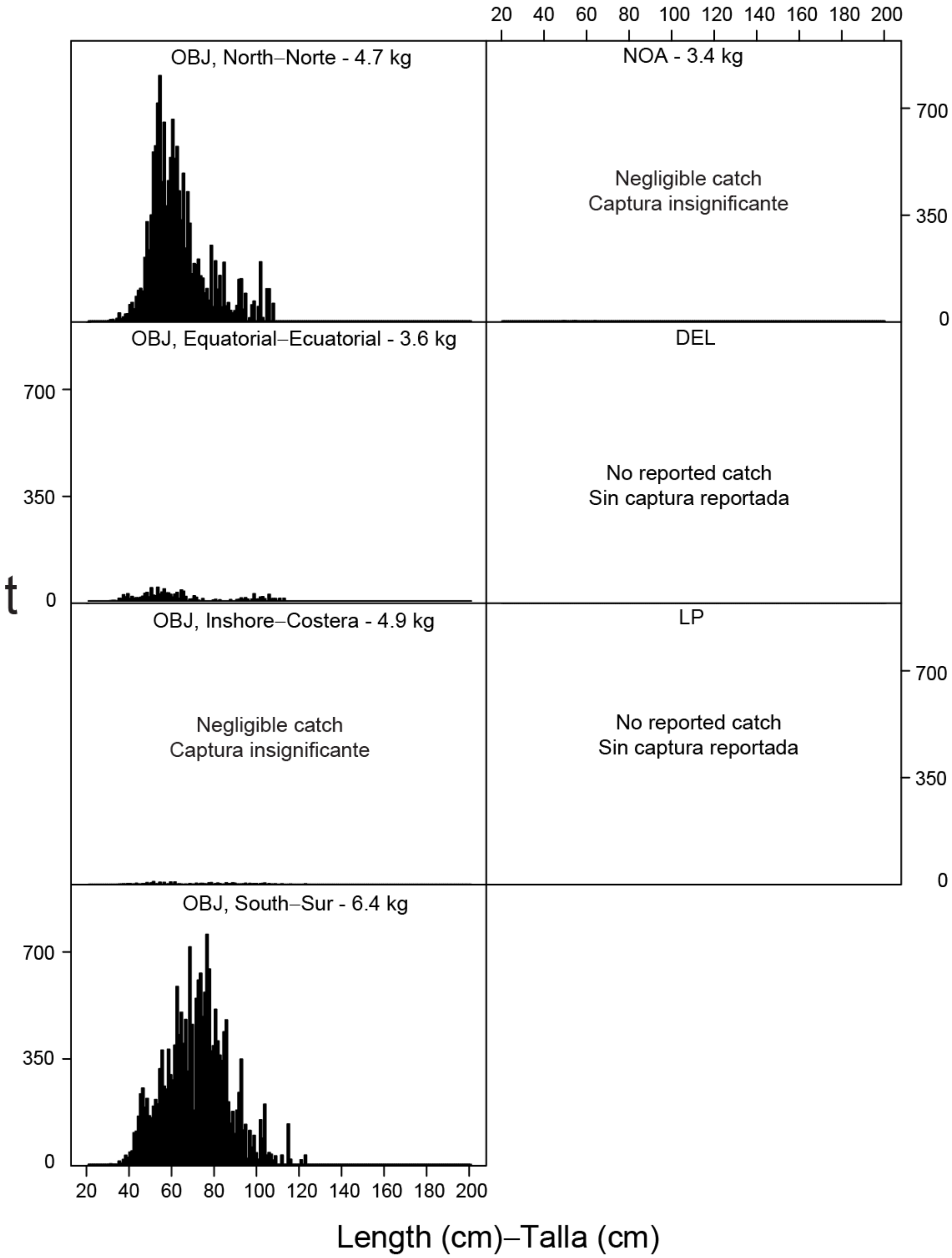


FIGURE A-8a. Estimated size compositions of the bigeye caught in the EPO during 2024 for each fishery designated in Figure A-5. The value at the top of each panel is the average weight.

FIGURA A-8a. Composición por tallas estimada del patudo capturado en el OPO durante 2024 en cada pesquería ilustrada en la Figura A-5. El valor en cada recuadro representa el peso promedio del pescado en las muestras.

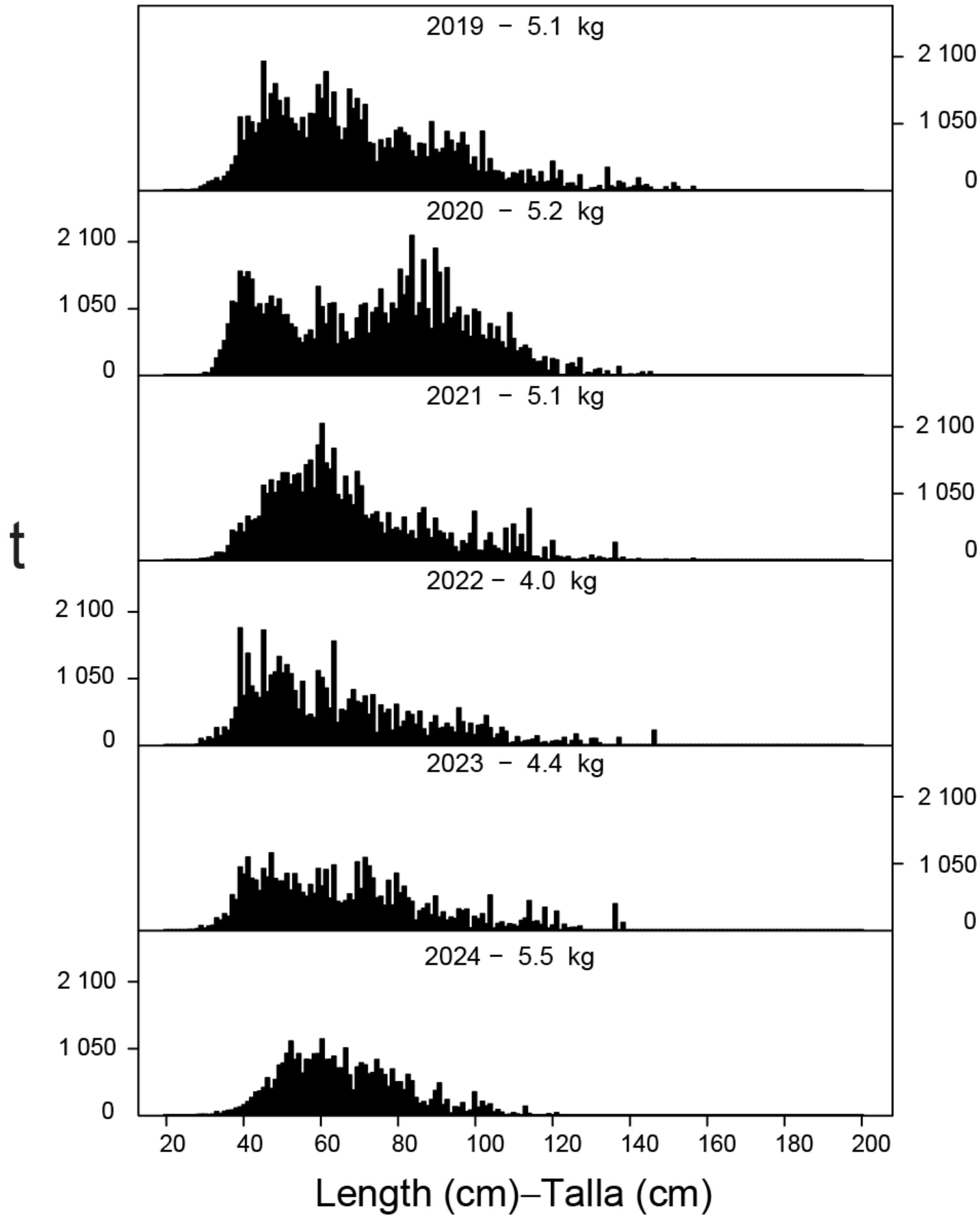


FIGURE A-8b. Estimated size compositions of the bigeye caught by purse-seine vessels in the EPO during 2019-2024. The value at the top of each panel is the average weight.

FIGURA A-8b. Composición por tallas estimada del patudo capturado por buques cerqueros en el OPO durante 2019-2024. El valor en cada recuadro representa el peso promedio del pescado en las muestras.

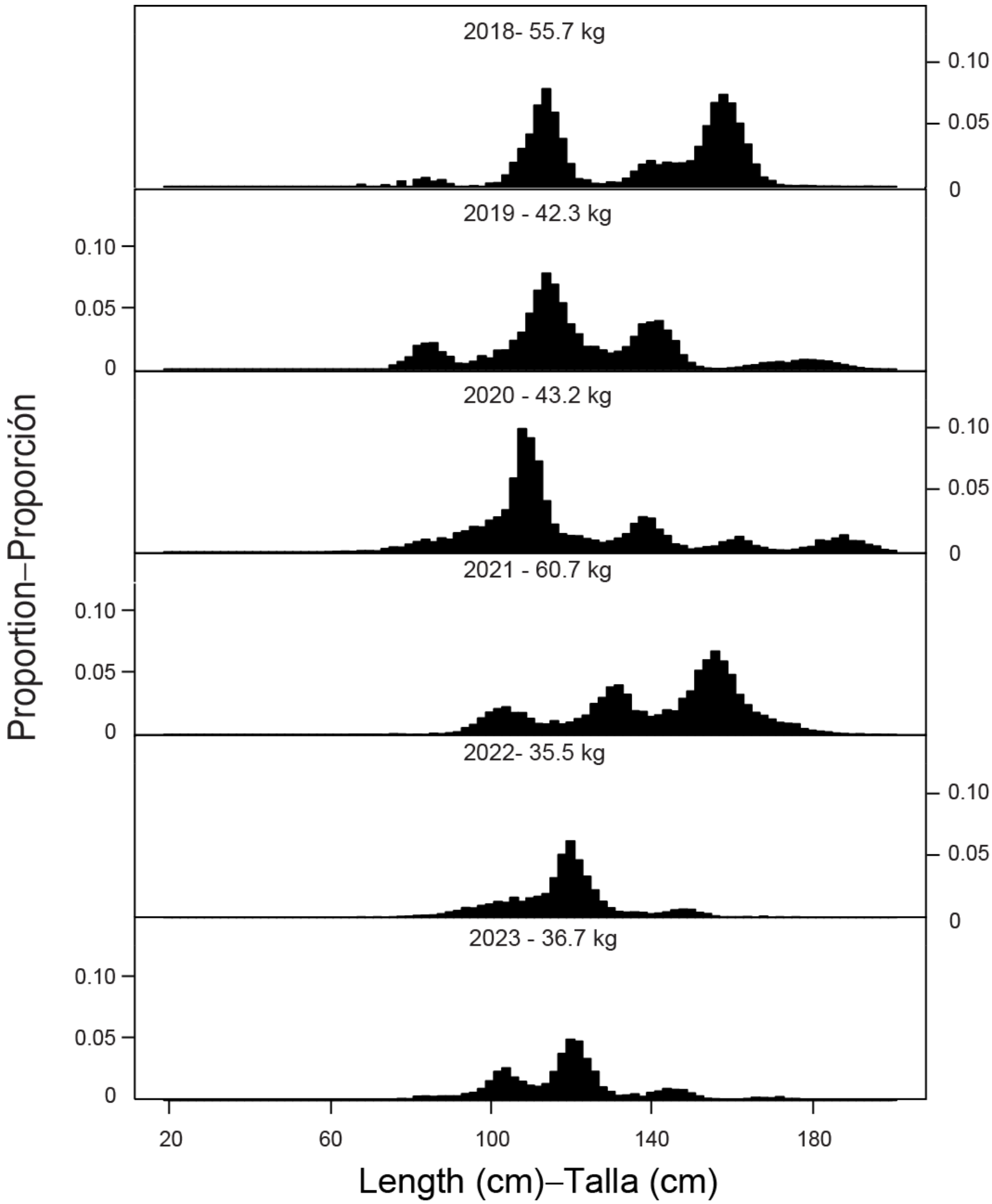


FIGURE A-9. Estimated length compositions of purse-seine catches of Pacific bluefin tuna, 2018-2023. The length distribution has been standardized as a proportion of the total number of measured tuna in each length interval. The value at the top of each panel is the average weight.
Source: Mexico's National Observer Program (PNAAPD).

FIGURA A-9. Composición por talla estimada de las capturas cerqueras de atún aleta azul del Pacífico, 2018-2023. La distribución de las tallas ha sido estandarizada como proporción del número total de atunes medidos en cada intervalo de talla. El valor en cada recuadro representa el peso promedio.
Fuente: Programa Nacional de Observadores de México (PNAAPD).

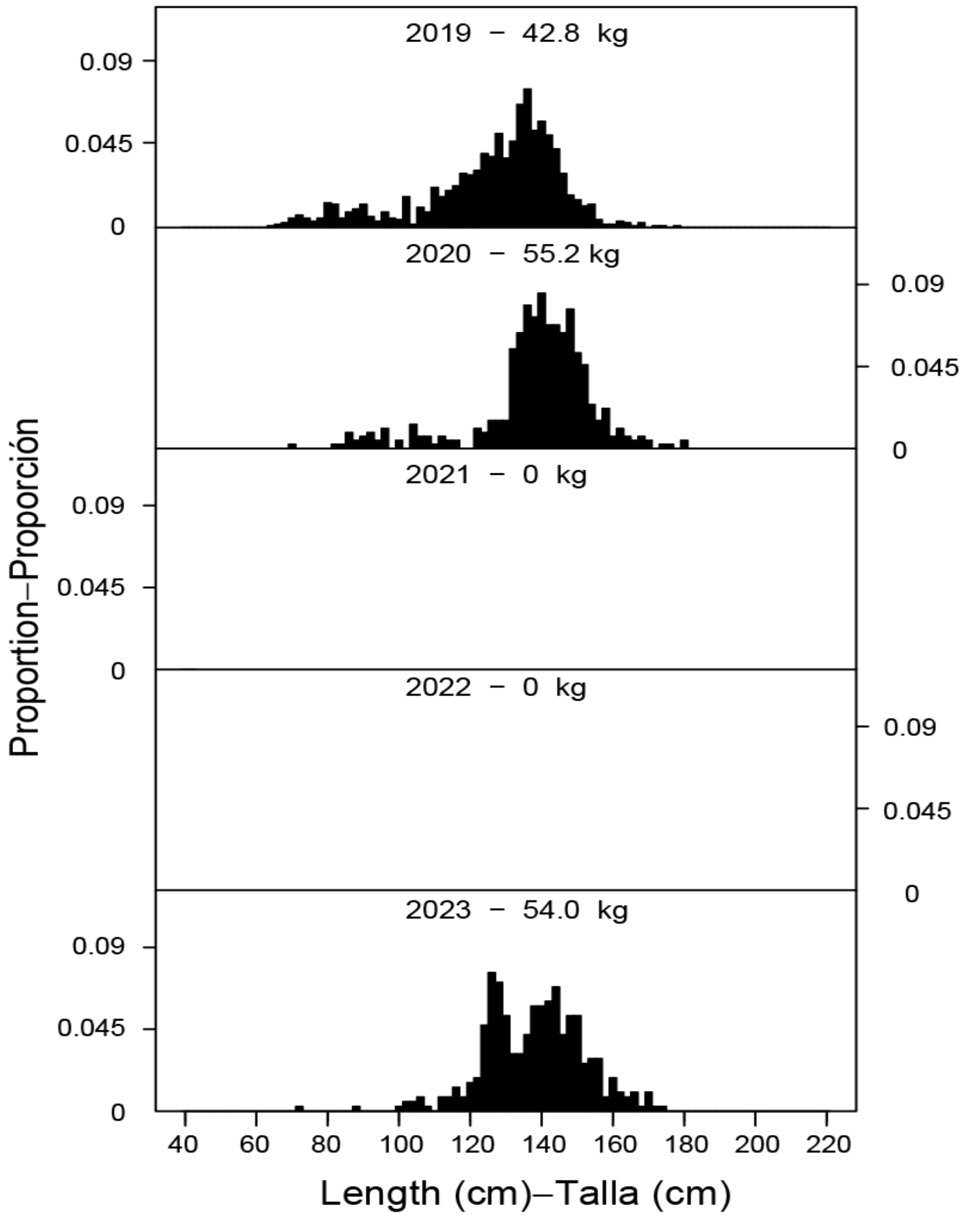


FIGURE A-10. Estimated size compositions of the catches of yellowfin by the Japanese longline fleet in the EPO, 2019-2023. The size distribution has been standardized as a proportion of the total number of measured tunas in each size range. The value at the top of each panel is the average weight. Source: Fisheries Agency of Japan. [Size composition data for 2021 and 2022 was not available due to difficulties resulting from the COVID-19 pandemic, which impacted the collection and analysis of 2021 and 2022 YFT size data.]

FIGURA A-10. Composición por tallas estimada de las capturas de aleta amarilla por la flota palangrera japonesa en el OPO, 2019-2023. La distribución de las tallas ha sido estandarizada como proporción del número total de atunes medidos en cada gama de tallas. El valor en cada recuadro representa el peso promedio. Fuente: Agencia Pesquera de Japón. [Los datos de composición por talla de 2021 y 2022 no estaban disponibles debido a las dificultades derivadas de la pandemia de COVID-19, que afectaron la recolección y el análisis de los datos de talla de YFT de 2021 y 2022.]

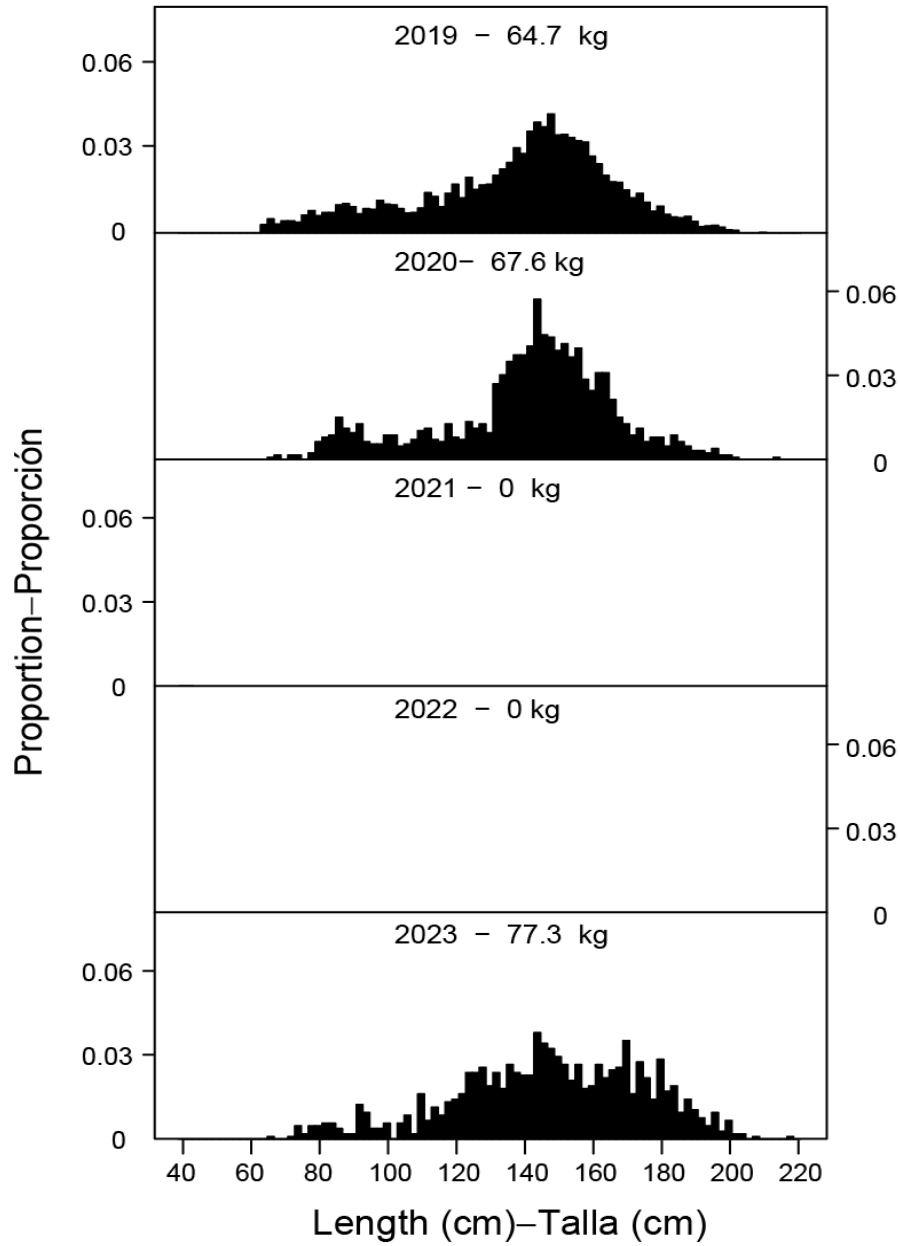


FIGURE A-11. Estimated size compositions of the catches of bigeye by the Japanese longline fleet in the EPO, 2019-2023. The size distribution has been standardized as a proportion of the total number of measured tunas in each size range. The value at the top of each panel is the average weight. Source: Fisheries Agency of Japan. [Size composition data for 2021 and 2022 was not available due to difficulties resulting from the COVID-19 pandemic, which impacted the collection and analysis of 2021 and 2022 BET size data.]

FIGURA A-11. Composición por tallas estimada de las capturas de patudo por la flota palangrera japonesa en el OPO, 2019-2023. La distribución de las tallas ha sido estandarizada como proporción del número total de atunes medidos en cada gama de tallas. El valor en cada recuadro representa el peso promedio. Fuente: Agencia Pesquera de Japón. [Los datos de composición por talla de 2021 y 2022 no estaban disponibles debido a las dificultades derivadas de la pandemia de COVID-19, que afectaron la recolección y el análisis de los datos de talla de BET de 2021 y 2022.]

TABLE A-1. Total annual catches (t) of yellowfin, skipjack, and bigeye tunas, by all types of gear combined, in the Pacific Ocean. The EPO totals for 1995-2024 include discards from purse-seine vessels with carrying capacities greater than 363 t.

TABLA A-1. Capturas totales anuales (t) de atunes aleta amarilla, barrilete, y patudo, por todas las artes combinadas, en el Océano Pacífico. Los totales del OPO de 1995-2024 incluyen los descartes de buques cerqueros de más de 363 t de capacidad de acarreo.

	YFT			SKJ			BET			Total		
	EPO	WCPO	Total	EPO	WCPO	Total	EPO	WCPO	Total	EPO	WCPO	Total
1995	244,639	442,805	687,444	150,661	977,478	1,128,139	108,210	110,385	218,595	503,510	1,530,668	2,034,178
1996	266,928	425,669	692,597	132,335	999,701	1,132,036	114,706	107,168	221,874	513,969	1,532,538	2,046,507
1997	277,575	481,019	758,594	188,285	939,497	1,127,782	122,274	133,495	255,769	588,134	1,554,011	2,142,145
1998	280,606	536,845	817,451	165,489	1,244,132	1,409,621	93,954	152,415	246,369	540,049	1,933,392	2,473,441
1999	304,638	474,648	779,286	291,249	1,070,280	1,361,529	93,078	162,524	255,602	688,965	1,707,452	2,396,417
2000	286,863	506,028	792,891	230,479	1,194,139	1,424,618	148,557	148,094	296,651	665,899	1,848,261	2,514,160
2001	425,008	504,501	929,509	157,676	1,100,714	1,258,390	130,546	134,459	265,005	713,230	1,739,674	2,452,904
2002	443,458	489,995	933,453	167,048	1,253,634	1,420,682	132,806	157,958	290,764	743,312	1,901,587	2,644,899
2003	415,933	563,926	979,859	300,470	1,245,155	1,545,625	115,175	143,471	258,646	831,578	1,952,552	2,784,130
2004	296,847	595,888	892,735	217,249	1,354,765	1,572,014	110,722	182,599	293,321	624,818	2,133,252	2,758,070
2005	286,492	551,822	838,314	283,453	1,418,105	1,701,558	110,514	154,748	265,262	680,459	2,124,675	2,805,134
2006	180,519	537,076	717,595	309,090	1,479,366	1,788,456	117,328	165,386	282,714	606,937	2,181,828	2,788,765
2007	182,141	565,930	748,071	216,324	1,663,353	1,879,677	94,260	165,365	259,625	492,725	2,394,648	2,887,373
2008	197,328	644,365	841,693	307,699	1,649,067	1,956,766	103,350	171,317	274,667	608,377	2,464,749	3,073,126
2009	250,413	558,914	809,327	239,408	1,761,272	2,000,680	109,255	169,294	278,549	599,076	2,489,480	3,088,556
2010	261,871	564,607	826,478	153,092	1,680,215	1,833,307	95,408	139,796	235,204	510,371	2,384,618	2,894,989
2011	216,720	530,946	747,666	283,509	1,536,806	1,820,315	89,460	168,119	257,579	589,689	2,235,871	2,825,560
2012	213,310	625,697	839,007	273,519	1,731,944	2,005,463	102,687	167,245	269,932	589,516	2,524,886	3,114,402
2013	231,170	578,467	809,637	284,043	1,831,413	2,115,456	86,029	154,783	240,812	601,242	2,564,663	3,165,905
2014	246,784	618,262	865,046	265,490	1,985,110	2,250,600	96,054	169,046	265,100	608,328	2,772,418	3,380,746
2015	260,265	589,128	849,393	334,049	1,788,545	2,122,594	104,820	145,709	250,529	699,134	2,523,382	3,222,516
2016	255,465	660,291	915,756	345,163	1,788,760	2,133,923	92,952	156,656	249,608	693,580	2,605,707	3,299,287
2017	224,800	710,202	935,002	327,629	1,609,970	1,937,599	102,860	130,595	233,455	655,289	2,450,767	3,106,056
2018	253,305	696,706	950,011	291,352	1,843,398	2,134,750	94,479	154,404	248,883	639,136	2,694,508	3,333,644
2019	242,248	682,704	924,952	350,992	2,044,477	2,395,469	97,145	131,808	228,953	690,385	2,858,989	3,549,374
2020	231,603	726,403	958,006	298,583	1,721,476	2,020,059	104,893	146,497	251,390	635,079	2,594,376	3,229,455
2021	263,755	747,354	1,011,109	328,616	1,684,029	2,012,645	79,953	132,915	212,868	672,324	2,564,298	3,236,622
2022	298,897	689,051	987,948	298,136	1,715,934	2,014,070	68,217	140,838	209,055	665,250	2,545,823	3,211,073
2023	306,170	739,277	1,045,447	390,549	1,631,322	2,021,871	67,233	140,673	207,906	763,952	2,511,272	3,275,224
2024	294,493	*	294,493	645,260	*	645,260	51,936	*	51,936	991,689	*	991,689

TABLE A-2a. Estimated catches, in metric tons, of tunas and bonitos in the EPO, by fishing gear, 1995-2024. For purse-seine (PS) vessels, retained (Ret.) catches include all vessels; discard (Dis.) data are for Class-6 vessels only. 'C' indicates that the catch has been combined with the total in the 'OTR' column. The purse-seine and pole-and-line (LP) data for yellowfin, skipjack, and bigeye tunas have been adjusted to the species composition estimate, and are preliminary. The data for 2021-2024 are preliminary.

TABLA A-2a. Capturas estimadas, en toneladas métricas, de atunes y bonitos en el OPO, por arte de pesca, 1995-2024. En el caso de los buques de cerco (PS), las capturas retenidas (Ret) incluyen todos los buques; los datos de descartes (Dis.) son de buques de Clase 6 únicamente. 'C' indica que la captura se ha combinado con el total en la columna 'OTR'. Los datos de los atunes aleta amarilla, barrilete, y patudo de las pesquerías de cerco y de caña (LP) fueron ajustados a la estimación de composición por especies, y son preliminares. Los datos de 2021-2024 son preliminares.

	Yellowfin—Aleta amarilla						Skipjack—Barrilete						Bigeye—Patudo					
	PS		LP	LL	OTR + UNK	Total	PS		LP	LL	OTR + UNK	Total	PS		LP	LL	OTR + UNK	Total
	Ret.	Dis.§					Ret.	Dis.§					Ret.	Dis.§				
1995	215,434	5,275	1,268	20,596	2,066	244,639	127,047	16,373	5,253	77	1,911	150,661	45,321	3,251	-	58,269	1,369	108,210
1996	238,607	6,312	3,762	16,608	1,639	266,928	103,973	24,494	2,555	52	1,261	132,335	61,311	5,689	-	46,958	748	114,706
1997	244,878	5,516	4,418	22,163	600	277,575	153,456	31,338	3,260	135	96	188,285	64,272	5,402	-	52,580	20	122,274
1998	253,959	4,697	5,085	15,336	1,529	280,606	140,631	22,643	1,684	294	237	165,489	44,129	2,822	-	46,375	628	93,954
1999	281,920	6,547	1,783	11,682	2,706	304,638	261,565	26,046	2,044	201	1,393	291,249	51,158	4,932	-	36,450	538	93,078
2000	253,263	6,205	2,431	23,855	1,109	286,863	205,647	24,467	231	68	66	230,479	95,282	5,417	-	47,605	253	148,557
2001	383,936	7,028	3,916	29,608	520	425,008	143,165	12,815	448	1,214	34	157,676	60,518	1,254	-	68,755	19	130,546
2002	412,286	4,140	950	25,531	551	443,458	153,546	12,506	616	261	119	167,048	57,421	949	-	74,424	12	132,806
2003	383,279	5,865	470	25,174	1,145	415,933	273,968	22,453	638	634	2,777	300,470	53,052	2,326	-	59,776	21	115,175
2004	272,557	3,000	1,884	18,779	627	296,847	197,824	17,078	528	713	1,106	217,249	65,471	1,574	-	43,483	194	110,722
2005	268,101	2,771	1,822	11,946	1,852	286,492	263,229	16,915	1,299	231	1,779	283,453	67,895	1,900	-	40,694	25	110,514
2006	166,631	1,534	686	10,210	1,458	180,519	296,268	11,177	435	224	986	309,090	83,838	1,680	-	31,770	40	117,328
2007	170,016	1,725	894	8,067	1,439	182,141	208,295	6,450	276	238	1,065	216,324	63,450	890	-	29,876	44	94,260
2008	185,057	696	814	9,820	941	197,328	296,603	8,249	499	1,185	1,163	307,699	75,028	2,086	-	26,208	28	103,350
2009	236,757	1,262	709	10,444	1,241	250,413	230,523	6,064	151	1,584	1,086	239,408	76,799	1,019	-	31,422	15	109,255
2010	251,009	1,031	460	8,339	1,032	261,871	147,192	2,769	47	1,815	1,269	153,092	57,752	564	-	37,090	2	95,408
2011	206,851	415	276	8,048	1,130	216,720	276,035	5,215	24	1,384	851	283,509	56,512	631	-	32,317	-	89,460
2012	198,017	451	400	12,954	1,488	213,310	266,215	3,511	303	2,381	1,109	273,519	66,020	473	-	36,167	27	102,687
2013	218,187	207	759	10,783	1,234	231,170	278,560	2,254	164	2,024	1,041	284,043	49,487	273	-	36,170	99	86,029
2014	234,066	517	C	8,649	3,552	246,784	261,469	2,596	C	194	1,231	265,490	60,445	83	-	35,356	170	96,054
2015	245,727	334	C	10,622	3,582	260,265	328,907	3,699	C	187	1,256	334,049	62,913	177	-	41,709	21	104,820
2016	242,118	404	C	9,801	3,142	255,465	337,561	4,086	-	214	3,302	345,163	56,731	541	-	35,656	24	92,952
2017	210,980	412	C	10,647	2,761	224,800	324,759	1,765	C	185	920	327,629	66,973	201	-	35,650	36	102,860
2018	238,981	231	C	12,576	1,517	253,305	288,821	865	C	1,221	445	291,352	64,523	145	C	29,787	24	94,479
2019	228,313	578	C	11,921	1,436	242,248	347,405	2,851	C	263	473	350,992	69,223	117	-	27,787	18	97,145
2020	218,747	148	C	11,584	1,124	231,603	295,961	1,787	C	269	566	298,583	78,784	106	-	25,959	44	104,893
2021	253,415	246	C	9,390	704	263,755	326,524	1,824	C	225	43	328,616	58,170	69	C	21,705	9	79,953
2022	291,661	332	C	6,757	147	298,897	296,791	1,058	C	201	86	298,136	46,974	50	C	21,106	87	68,217
2023	297,980	379	C	7,187	624	306,170	388,884	1,323	C	212	130	390,549	42,366	92	C	24,601	174	67,233
2024	293,770	723	*	*	*	294,493	640,670	4,590	*	*	*	645,260	34,058	238	*	17,640	*	51,936

§ Class-6 (carrying capacity >363 t) purse-seine vessels only-Buques cerqueros de Clase 6 (capacidad de acarreo >363 t) solamente

TABLE A-2a. (continued)
TABLA A-2a. (continuación)

	Pacific bluefin—Aleta azul del Pacífico						Albacore—Albacora						Black skipjack—Barrilete negro					
	PS		LP	LL	OTR + UNK	Total	PS		LP	LL	OTR + UNK	Total	PS		LP	LL	OTR + UNK	Total
	Ret.	Dis. §					Ret.	Dis. §					Ret.	Dis. §				
1995	659	-	-	25	264	948	-	-	465	6,185	7,427	14,077	202	1,448	-	-	-	1,650
1996	8,333	-	-	19	83	8,435	11	-	72	7,631	8,398	16,112	704	2,304	-	12	-	3,020
1997	2,608	3	2	14	235	2,862	1	-	59	9,678	7,540	17,278	100	2,512	-	11	-	2,623
1998	1,772	-	-	95	516	2,383	42	-	81	12,635	13,158	25,916	489	1,876	39	-	-	2,404
1999	2,553	54	5	151	514	3,277	47	-	227	11,633	14,510	26,417	171	3,404	-	-	-	3,575
2000	3,712	-	61	46	349	4,168	71	-	86	9,663	13,453	23,273	294	1,995	-	-	-	2,289
2001	1,155	3	1	148	378	1,685	3	-	157	19,410	13,727	33,297	2,258	1,019	-	-	-	3,277
2002	1,758	1	3	71	620	2,453	31	-	381	15,289	14,433	30,134	1,459	2,283	8	-	-	3,750
2003	3,233	-	3	87	369	3,692	34	-	59	24,901	20,397	45,391	433	1,535	6	13	117	2,104
2004	8,880	19	-	15	59	8,973	105	-	126	18,444	22,011	40,686	884	387	-	27	862	2,160
2005	4,743	15	-	-	80	4,838	2	-	66	9,350	15,668	25,086	1,472	2,124	-	-	22	3,618
2006	9,928	-	-	-	93	10,021	109	-	1	13,831	18,980	32,921	1,999	1,972	-	-	-	3,971
2007	4,189	-	-	-	14	4,203	187	-	21	11,107	19,261	30,576	2,307	1,625	-	2	54	3,988
2008	4,392	14	15	-	63	4,484	49	-	1,050	9,218	16,505	26,822	3,624	2,251	-	-	8	5,883
2009	3,428	24	-	-	161	3,613	50	2	-	12,072	19,090	31,214	4,256	1,020	-	2	-	5,278
2010	7,746	-	-	3	89	7,838	25	-	-	14,256	19,363	33,644	3,425	1,079	-	8	184	4,696
2011	2,829	4	-	1	244	3,078	10	-	-	16,191	16,074	32,275	2,317	719	-	6	-	3,042
2012	6,705	-	-	1	405	7,111	-	-	-	24,198	18,100	42,298	4,504	440	-	5	7	4,956
2013	3,154	-	-	1	819	3,974	-	-	-	25,396	18,513	43,909	3,580	805	-	10	24	4,419
2014	5,263	66	C	1	427	5,757	-	-	-	29,231	19,463	48,694	4,153	486	-	11	81	4,731
2015	3,168	-	C	7	412	3,587	-	-	-	28,939	17,142	46,081	3,763	356	-	1	111	4,231
2016	3,025	-	C	0	728	3,753	2	-	-	26,777	14,567	41,346	6,606	792	-	-	178	7,576
2017	4,109	-	C	3	482	4,594	-	-	-	26,592	9,442	36,034	5,079	306	C	-	54	5,439
2018	2,852	-	C	0	588	3,440	8	-	-	25,759	11,138	36,905	3,002	732	C	-	120	3,854
2019	2,475	-	C	0	530	3,005	-	-	-	20,814	11,876	32,690	5,199	499	C	-	132	5,830
2020	3,383	19	C	1	857	4,260	-	-	-	19,983	10,338	30,321	4,573	684	C	-	363	5,620
2021	3,069	0	C	0	1,466	4,535	-	-	-	31,439	6,962	38,401	4,699	472	C	109	129	5,409
2022	3,392	7	C	2	1,749	5,150	76	0	-	31,809	12,758	44,643	6,453	591	C	-	9	7,053
2023	3,402	1	C	2	2,068	5,473	0	0	-	29,789	4,901	34,690	5,456	345	C	1	25	5,827
2024	3,531	18	*	*	*	3,549	1	0	-	*	*	1	6,647	811	*	*	*	7,458

§ Class-6 (carrying capacity >363 t) purse-seine vessels only-Buques cerqueros de Clase 6 (capacidad de acarreo >363 t) solamente

TABLE A-2a. (continued)
TABLA A-2a. (continuación)

	Bonitos						Unidentified tunas—Atunes no identificados						Total					
	PS		LP	LL	OTR + UNK	Total	PS		LP	LL	OTR + UNK	Total	PS		LP	LL	OTR + UNK	Total
	Ret.	Dis.§					Ret.	Dis.§					Ret.	Dis.§				
1995	7,929	55	81	-	54	8,119	11	626	-	-	1,004	1,641	396,603	27,028	7,066	85,152	14,096	529,945
1996	647	1	7	-	16	671	37	1,028	-	-	1,038	2,103	413,623	39,827	6,395	71,283	13,183	544,311
1997	1,097	4	8	-	34	1,143	71	3,383	-	7	1,437	4,898	466,483	48,157	7,747	84,588	9,962	616,936
1998	1,330	4	7	-	588	1,929	13	1,233	-	24	18,158	19,428	442,365	33,276	6,897	74,758	34,815	592,111
1999	1,719	-	-	24	369	2,112	27	3,092	-	2,113	4,279	9,511	599,160	44,076	4,059	62,254	24,310	733,859
2000	636	-	-	75	56	767	190	1,410	-	1,992	1,468	5,060	559,095	39,494	2,809	83,305	16,756	701,459
2001	17	-	-	34	19	70	191	679	-	2,448	55	3,373	591,243	22,799	4,523	121,616	14,755	754,935
2002	-	-	-	-	1	1	576	1,863	-	482	1,422	4,343	627,077	21,741	1,958	116,057	17,158	783,992
2003	-	-	1	-	25	26	80	1,238	-	215	750	2,283	714,079	33,416	1,177	110,799	25,600	885,071
2004	15	35	1	8	3	62	256	973	-	349	258	1,836	545,992	23,066	2,539	81,818	25,120	678,536
2005	313	18	-	-	11	342	190	1,922	-	363	427	2,902	605,945	25,664	3,187	62,585	19,865	717,246
2006	3,507	80	12	-	3	3,602	50	1,910	-	29	193	2,182	562,330	18,353	1,134	56,066	21,754	659,636
2007	15,906	628	107	2	-	16,643	598	1,221	-	2,197	301	4,317	464,948	12,540	1,298	51,488	22,179	552,452
2008	7,874	37	9	6	26	7,952	136	1,380	1	727	883	3,127	572,763	14,712	2,388	47,164	19,617	656,644
2009	9,720	15	-	8	77	9,820	162	469	-	1,933	74	2,638	561,695	9,875	860	57,466	21,743	651,640
2010	2,820	19	4	2	70	2,915	136	709	-	1,770	36	2,651	470,105	6,170	511	63,279	22,045	562,111
2011	7,969	45	18	10	11	8,053	108	784	-	3,178	-	4,070	552,631	7,813	318	61,136	18,311	640,208
2012	8,191	156	-	1	64	8,412	41	354	-	196	221	812	549,693	5,385	704	75,900	21,419	653,101
2013	2,067	9	-	13	27	2,116	53	461	-	-	529	1,043	555,088	4,009	923	74,397	22,286	656,703
2014	2,821	38	-	-	154	3,013	113	328	-	269	392	1,102	568,330	4,113	C	73,711	25,470	671,625
2015	789	28	-	1	-	818	90	242	-	-	1,232	1,564	645,357	4,836	C	81,466	23,756	755,415
2016	3,806	15	-	-	1	3,822	129	212	-	-	294	635	649,978	6,050	C	72,448	22,236	750,712
2017	3,438	54	-	-	130	3,622	234	303	C	1	366	904	615,572	3,041	C	73,078	14,191	705,882
2018	2,409	58	-	-	44	2,511	75	448	-	3	213	739	600,671	2,479	C	69,346	14,089	686,585
2019	7,255	27	-	-	37,775	45,057	83	276	-	4	66	429	659,953	4,348	C	60,789	52,306	777,396
2020	3,169	6	-	-	41,446	44,621	211	480	-	4	44	739	604,828	3,230	C	57,800	54,782	720,640
2021	6,899	75	-	-	46,153	53,127	1,253	441	-	1	172	1,867	654,029	3,127	C	62,869	55,638	775,663
2022	3,242	9	-	-	*	3,251	2,379	705	-	0	0	3,084	650,968	2,752	C	59,875	14,836	728,431
2023	855	0	C	-	64,831	65,686	1,943	589	-	-	424	2,956	740,886	2,729	C	61,792	73,177	878,584
2024	0	18	*	-	*	18	2,643	601	-	-	*	3,244	981,320	6,999	*	17,640	*	1,005,959

§ Class-6 (carrying capacity >363 t) purse-seine vessels only-Buques cerqueros de Clase 6 (capacidad de acarreo >363 t) solamente

TABLE A-2b. Estimated catches, in metric tons, of billfishes in the EPO, by fishing gear, 1995-2024. Purse-seine (PS) vessel data are for Class-6 vessels only. The data for 2021-2024 are preliminary.
TABLA A-2b. Capturas estimadas, en toneladas métricas, de peces picudos en el OPO, por arte de pesca, 1995-2024. En el caso de los buques de cerco (PS), los datos son de buques de Clase 6 únicamente. Los datos de 2021-2024 son preliminares.

	Swordfish—Pez espada					Blue marlin—Marlín azul					Black marlin—Marlín negro					Striped marlin-Marlín rayado				
	PS §		LL	OTR	Total	PS §		LL	OTR	Total	PS §		LL	OTR	Total	PS §		LL	OTR	Total
	Ret.	Dis.				Ret.	Dis.				Ret.	Dis.				Ret.	Dis.			
1995	3	-	4,495	2,974	7,472	70	16	7,288	-	7,374	43	23	158	-	224	18	8	3,249	296	3,571
1996	1	-	7,071	2,486	9,558	62	15	3,596	-	3,673	46	24	100	-	170	20	9	3,218	430	3,677
1997	2	1	10,580	1,781	12,364	126	15	5,915	-	6,056	71	22	154	-	247	28	3	4,473	329	4,833
1998	3	-	9,800	3,246	13,049	130	20	4,856	-	5,006	72	28	168	-	268	20	3	3,558	509	4,090
1999	2	-	7,569	1,965	9,536	181	38	3,691	-	3,910	83	42	94	-	219	26	11	2,621	376	3,034
2000	3	-	8,930	2,383	11,316	120	23	3,634	-	3,777	67	21	105	-	193	17	3	1,889	404	2,313
2001	3	1	16,007	1,964	17,975	119	40	4,196	-	4,355	67	48	123	-	238	13	8	1,961	342	2,324
2002	1	-	17,598	2,119	19,718	188	33	3,480	-	3,701	86	30	78	-	194	69	5	2,158	412	2,644
2003	3	1	18,161	354	18,519	185	21	4,015	-	4,221	121	26	73	-	220	31	4	1,904	417	2,356
2004	2	-	15,372	309	15,683	140	21	3,783	-	3,944	62	5	41	-	108	23	1	1,547	390	1,961
2005	2	-	8,935	4,304	13,241	209	14	3,350	-	3,573	95	9	39	-	143	37	4	1,531	553	2,125
2006	7	-	9,890	3,800	13,697	164	21	2,934	105	3,224	124	21	77	-	222	54	3	1,735	490	2,282
2007	4	-	9,639	4,390	14,033	124	13	2,393	106	2,636	74	8	47	-	129	32	4	1,656	1,024	2,716
2008	6	-	12,248	3,071	15,325	125	8	1,705	114	1,952	76	9	100	-	185	33	2	1,291	1,045	2,371
2009	4	-	15,539	3,905	19,448	159	15	2,102	131	2,407	76	8	94	-	178	23	2	1,333	7	1,365
2010	4	-	18,396	4,480	22,880	176	12	2,920	126	3,234	62	9	160	-	231	21	2	2,129	9	2,161
2011	3	-	20,400	5,101	25,504	150	6	2,025	144	2,325	59	7	187	-	253	28	1	2,640	16	2,685
2012	5	-	23,587	7,148	30,740	178	15	3,723	177	4,093	71	4	444	-	519	28	-	2,703	20	2,751
2013	2	-	22,342	5,560	27,904	172	15	4,202	168	4,557	99	4	138	-	241	21	1	2,439	19	2,480
2014	4	-	21,331	6,332	27,667	209	12	4,069	186	4,476	70	4	151	-	225	22	1	1,929	3	1,955
2015	5	1	26,021	6,159	32,186	306	11	4,170	182	4,669	117	14	239	-	370	26	-	1,267	474	1,767
2016	4	-	24,370	7,513	31,887	247	6	3,776	175	4,204	62	3	80	-	145	19	-	1,562	4	1,585
2017	1	2	22,449	8,073	30,525	151	4	3,903	191	4,249	39	1	211	-	251	10	-	1,752	7	1,769
2018	2	-	24,571	7,040	31,613	167	1	4,094	174	4,436	23	-	298	-	321	10	1	1,819	5	1,835
2019	3	-	21,874	9,248	31,125	201	4	2,499	186	2,890	45	-	162	-	207	16	-	1,733	11	1,760
2020	2	-	22,489	5,768	28,259	131	1	2,787	194	3,113	45	-	611	-	656	10	-	1,843	9	1,862
2021	2	-	18,861	5,046	23,909	117	1	1,622	-	1,740	38	-	372	-	410	12	-	1,340	2	1,354
2022	3	-	20,687	5,038	25,728	168	3	1,250	-	1,421	39	1	213	-	253	16	1	1,062	2	1,081
2023	3	0	21,871	7,354	29,228	185	2	1,415	-	1,602	52	2	260	-	314	16	0	1,392	2	1,410
2024	3	0	*	*	3	205	6	*	-	211	50	1	*	-	51	22	0	*	*	22

§ Class-6 (carrying capacity >363 t) purse-seine vessels only-Buques cerqueros de Clase 6 (capacidad de acarreo >363 t) solamente

TABLE A-2b. (continued)
TABLA A-2b. (continuación)

	Shortbill spearfish—Marlín trompa corta					Sailfish—Pez vela					Unidentified istiophorid billfishes—Picudos istio-fóridos no identificados					Total billfishes—Total de peces picudos				
	PS §		LL	OTR	Total	PS §		LL	OTR	Total	PS §		LL	OTR	Total	PS §		LL	OTR	Total
	Ret.	Dis.				Ret.	Dis.				Ret.	Dis.				Ret.	Dis.			
1995	1	-	155	-	156	12	15	1,351	-	1,378	4	9	232	-	245	151	71	16,928	3,270	20,420
1996	1	-	126	-	127	10	12	738	-	760	6	13	308	-	327	146	73	15,157	2,916	18,292
1997	1	-	141	-	142	12	11	1,891	-	1,914	3	5	1,324	-	1,332	243	57	24,478	2,110	26,888
1998	-	-	200	-	200	28	31	1,382	-	1,441	5	7	575	55	642	258	89	20,539	3,810	24,696
1999	1	-	278	-	279	33	8	1,216	-	1,257	6	12	1,136	-	1,154	332	111	16,605	2,341	19,389
2000	1	-	285	-	286	33	17	1,380	-	1,430	3	6	880	136	1,025	244	70	17,103	2,923	20,340
2001	-	-	304	-	304	18	45	1,539	325	1,927	2	5	1,741	204	1,952	222	147	25,871	2,835	29,075
2002	1	-	273	-	274	19	15	1,792	17	1,843	4	5	1,862	14	1,885	368	88	27,241	2,562	30,259
2003	1	4	290	-	295	38	49	1,174	-	1,261	6	5	1,389	-	1,400	385	110	27,006	771	28,272
2004	1	-	207	-	208	19	13	1,400	17	1,449	4	4	1,385	-	1,393	251	44	23,735	716	24,746
2005	1	-	229	-	230	32	11	805	15	863	5	3	901	-	909	381	41	15,790	4,872	21,084
2006	1	-	231	-	232	30	13	1,007	35	1,085	23	4	490	1	518	403	62	16,364	4,431	21,260
2007	1	-	239	-	240	41	8	1,032	64	1,145	13	4	1,171	15	1,203	289	37	16,177	5,599	22,102
2008	1	-	266	-	267	28	7	524	72	631	16	5	1,587	8	1,616	285	31	17,721	4,310	22,347
2009	1	-	446	-	447	17	6	327	8	358	11	1	1,799	12	1,823	291	32	21,640	4,063	26,026
2010	1	-	519	-	520	27	20	655	3	705	8	2	2,604	-	2,614	299	45	27,383	4,618	32,345
2011	-	-	462	-	462	18	5	658	28	709	15	1	2,377	3	2,396	273	20	28,749	5,292	34,334
2012	1	-	551	-	552	14	2	685	15	716	10	1	2,178	-	2,189	307	22	33,871	7,360	41,560
2013	1	-	913	-	914	16	2	614	9	641	15	3	2,743	1	2,762	326	25	33,391	5,757	39,499
2014	-	-	721	-	721	16	1	481	8	506	8	2	220	3	233	329	20	28,902	6,532	35,783
2015	1	-	498	-	499	18	8	1,403	22	1,451	19	1	654	4	678	492	35	34,252	6,841	41,620
2016	1	-	416	-	417	49	9	458	19	535	112	9	633	1	755	494	27	31,295	7,712	39,528
2017	-	-	245	-	245	22	2	526	15	565	164	12	259	16	451	387	21	29,345	8,302	38,055
2018	-	-	234	-	234	13	2	466	17	498	123	6	204	12	345	338	10	31,686	7,248	39,282
2019	-	-	751	-	751	17	1	857	5	880	121	5	416	51	593	403	11	28,292	9,501	38,207
2020	1	-	611	-	612	18	1	492	3	514	77	3	564	32	676	284	5	29,397	6,006	35,692
2021	-	-	115	-	115	10	1	602	-	613	70	6	78	23	177	249	8	22,990	5,071	28,318
2022	1	-	174	-	175	8	2	548	-	558	61	4	101	2	168	296	11	24,035	5,042	29,384
2023	1	0	107	-	108	9	1	458	-	468	63	3	51	16	133	328	8	25,554	7,372	33,263
2024	0	0	*	-	-	18	1	*	-	19	62	3	*	*	65	360	11	*	*	371

§ Class-6 (carrying capacity >363 t) purse-seine vessels only-Buques cerqueros de Clase 6 (capacidad de acarreo >363 t) solamente

TABLE A-3a. Retained catches (t) of yellowfin tuna by purse-seine vessels in the EPO, by vessel flag. 'C' indicates that the catch has been combined with the total in the 'OTR' column. The data have been adjusted to the species composition estimate and are preliminary.

TABLA A-3a. Capturas retenidas (t) de atún aleta amarilla por buques de cerco en el OPO, por bandera del buque. 'C' indica que la captura se ha combinado con el total en la columna 'OTR'. Los datos están ajustados a la estimación de composición por especie, y son preliminares.

	COL	CRI	ECU	EU (ESP)	MEX	NIC	PAN	PER	SLV	USA	VEN	VUT	C + OTR[1]	Total
1995	8,829	C	17,044	C	108,749	-	1,714	-	-	5,069	47,804	22,220	4,005	215,434
1996	9,855	C	17,125	C	119,878	-	3,084	-	-	6,948	62,846	10,549	8,322	238,607
1997	9,402	-	18,697	C	120,761	-	4,807	-	-	5,826	57,881	20,701	6,803	244,878
1998	15,592	-	36,201	5,449	106,840	-	3,330	-	C	2,776	61,425	17,342	5,004	253,959
1999	13,267	-	53,683	8,322	114,545	C	5,782	-	C	3,400	55,443	16,476	11,002	281,920
2000	6,138	-	35,492	10,318	101,662	C	5,796	-	-	4,374	67,672	8,247	13,563	253,262
2001	12,950	-	55,347	18,448	130,087	C	9,552	-	C	5,670	108,974	10,729	32,180	383,937
2002	17,574	-	32,512	16,990	152,864	C	15,719	C	7,412	7,382	123,264	7,502	31,068	412,287
2003	9,770	-	34,271	12,281	172,807	-	16,591	C	C	3,601	96,914	9,334	27,710	383,279
2004	C	-	40,886	13,622	91,442	C	33,563	-	C	C	39,094	7,371	46,577	272,555
2005	C	-	40,596	11,947	110,898	4,838	33,393	-	6,470	C	28,684	C	31,276	268,102
2006	C	-	26,049	8,409	69,449	4,236	22,521	-	C	C	13,286	C	22,679	166,629
2007	C	-	19,749	2,631	65,091	3,917	26,024	-	C	C	20,097	C	32,507	170,016
2008	C	-	18,463	3,023	84,462	4,374	26,993	C	C	C	17,692	C	30,050	185,057
2009	C	-	18,167	7,864	99,785	6,686	35,228	C	C	C	25,298	C	43,729	236,757
2010	20,493	-	34,764	2,820	104,969	9,422	34,538	C	C	-	21,244	C	22,758	251,008
2011	18,643	-	32,946	1,072	99,812	7,781	18,607	-	C	C	18,712	C	9,278	206,851
2012	20,924	-	29,485	1,065	93,323	7,541	15,932	-	C	C	23,408	C	6,339	198,017
2013	16,476	-	27,655	511	114,706	8,261	18,301	C	C	-	24,896	C	7,381	218,187
2014	17,185	-	37,546	760	120,980	8,100	19,349	C	C	1,105	23,025	-	6,016	234,066
2015	17,270	-	50,153	C	106,171	6,876	26,558	783	C	3,212	30,428	-	4,276	245,727
2016	19,280	-	59,280	C	93,928	11,047	23,249	1,647	C	4,578	23,812	-	5,298	242,118
2017	15,106	-	55,705	C	80,870	9,347	19,921	3,349	C	6,500	16,809	-	3,373	210,980
2018	21,855	-	57,164	C	101,651	7,552	22,625	1,458	C	3,808	19,527	-	3,341	238,981
2019	17,177	-	46,102	C	105,426	7,114	17,826	1,782	C	6,515	22,558	-	3,814	228,313
2020	16,641	-	39,897	C	102,137	5,423	22,585	561	C	3,728	24,475	-	3,300	218,747
2021	14,613	-	50,420	C	107,945	7,429	30,095	C	C	4,595	33,293	-	5,025	253,415
2022	15,710	-	59,897	C	119,381	8,918	39,151	*	C	4,399	37,995	-	6,210	291,661
2023	21,147	-	53,588	C	143,062	10,083	35,118	C	C	4,811	24,089	-	6,082	297,980
2024	8,034	-	45,369	C	157,601	6,683	35,884	C	C	3,335	33,186	-	3,678	293,770

[1] Includes—Incluye: BLZ, BOL, CHN, EU(CYP), GTM, HND, LBR, NZL, UNK

TABLE A-3b. Total annual catches (t) of yellowfin tuna by longline vessels, and totals for all gears, in the EPO, by vessel flag. 'C' indicates that the catch has been combined with the total in the 'OTR' column. The data for 2021-2024 are preliminary.
TABLA A-3b. Capturas totales anuales (t) de atún aleta amarilla por buques de palangre en el OPO, y totales de todas las artes, por bandera del buque. 'C' indica que la captura se ha combinado con el total en la columna 'OTR'. Los datos de 2021-2024 son preliminares.

	CHN	CRI	FRA (PYF)	JPN	KOR	MEX	PAN	TWN	USA	VUT	C + OTR[1]	Total LL	Total PS+LL	OTR[2]
1995	-	542	198	17,042	2,748	7	-	28	31	-	*	20,596	236,030	3,334
1996	-	183	253	12,631	3,491	0	-	37	13	-	*	16,608	255,215	5,401
1997	-	715	307	16,218	4,753	-	-	131	11	-	28	22,163	267,041	5,018
1998	-	1,124	388	10,048	3,624	16	-	113	15	-	8	15,336	269,295	6,614
1999	-	1,031	206	7,186	3,030	10	-	186	7	-	26	11,682	293,602	4,489
2000	-	1,084	1,052	15,265	5,134	153	359	742	10	5	51	23,855	277,118	3,540
2001	942	1,133	846	14,808	5,230	29	732	3,928	29	13	1,918	29,608	413,544	4,436
2002	1,457	1,563	278	8,513	3,626	4	907	7,360	5	290	1,528	25,531	437,817	1,501
2003	2,739	1,418	462	9,125	4,911	365	C	3,477	5	699	1,973	25,174	408,453	1,615
2004	798	1,701	767	7,338	2,997	32	2,802	1,824	6	171	343	18,779	291,336	2,511
2005	682	1,791	530	3,966	532	0	1,782	2,422	7	51	183	11,946	280,047	3,674
2006	246	1,402	537	2,968	928	0	2,164	1,671	21	164	109	10,210	176,841	2,144
2007	224	1,204	408	4,582	353	8	-	745	11	154	378	8,067	178,083	2,333
2008	469	1,248	335	5,383	83	5	-	247	33	175	1,842	9,820	194,877	1,755
2009	629	1,003	590	4,268	780	10	-	636	84	244	2,200	10,444	247,201	1,950
2010	459	3	301	3,639	737	6	-	872	54	269	1,999	8,339	259,348	1,492
2011	1,807	-	349	2,373	754	6	-	647	55	150	1,907	8,048	214,899	1,406
2012	2,591	1,482	538	3,600	631	7	519	749	39	155	2,643	12,954	210,971	1,888
2013	1,874	1,424	410	3,117	928	8	325	572	43	101	1,981	10,783	228,970	1,993
2014	2,120	1,072	567	2,633	704	4	249	896	61	323	20	8,649	242,715	3,552
2015	2,642	1,415	929	2,177	957	20	419	1,287	107	530	139	10,622	256,349	3,582
2016	2,398	1,010	825	1,839	1,124	29	688	1,222	247	166	253	9,801	251,919	3,142
2017	2,907	837	1,252	1,463	1,176	10	612	1,263	532	406	190	10,647	221,627	2,761
2018	5,386	1,190	1,101	1,412	1,189	*	231	1,212	423	293	139	12,576	251,557	1,517
2019	3,372	1,490	1,015	1,652	1,725	*	314	1,556	253	344	199	11,921	240,234	1,436
2020	3,392	1,719	853	1,338	2,110	*	94	1,185	373	242	278	11,584	230,331	1,124
2021	2,299	-	1,933	1,027	1,641	*	1,037	895	204	215	139	9,390	262,805	704
2022	1,388	-	1,096	904	1,597	*	44	1,202	271	80	175	6,757	298,418	147
2023	1,474	-	1,007	579	2,347	*	81	1,216	257	143	83	7,187	305,167	624
2024	*	-	*	*	*	*	*	*	*	*	*	*	293,770	*

[1] Includes—Incluye: BLZ, CHL, ECU, EU(ESP), EU(PRT), GTM, HND, NIC, SLV
[2] Includes gillnets, Handline, Harpoon, pole-and-line, recreational, Trawler, Troll and unknown gears—Incluye red agallera, línea de mano, arpon, caña, artes deportivas, red de arrastre, curricán y desconocidas

TABLE A-3c. Total annual catches (t) of skipjack tuna by purse-seine and longline vessels in the EPO, by vessel flag, adjusted to the species composition estimate. ‘C’ indicates that the catch has been combined with the total in the ‘OTR’ column. The 2021-2024 data are preliminary.

TABLA A-3c. Capturas totales anuales (t) de atún barrilete por buques de cerco y de palangre en el OPO, por bandera del buque, ajustadas a la estimación de composición por especie. ‘C’ indica que la captura se ha combinado con el total en la columna ‘OTR’. Los datos de 2021-2024 son preliminares.

	PS														LL+OTR[2]
	COL	CRI	ECU	EU(ESP)	MEX	NIC	PAN	PER	SLV	USA	VEN	VUT	C+OTR[1]	Total	
1995	13,081	C	31,934	C	29,406	-	4,084	-	-	14,032	5,508	13,910	15,092	127,047	7,241
1996	13,230	C	32,433	C	14,501	-	3,619	-	-	12,012	4,104	10,873	13,201	103,973	3,868
1997	12,332	-	51,826	C	23,416	-	4,277	-	-	13,687	8,617	14,246	25,055	153,456	3,491
1998	4,698	-	67,074	20,012	15,969	-	1,136	-	C	6,898	6,795	11,284	6,765	140,631	2,215
1999	11,210	-	124,393	34,923	16,767	C	5,286	-	C	13,491	16,344	21,287	17,864	261,565	3,638
2000	10,138	-	104,849	17,041	14,080	C	9,573	-	-	7,224	6,720	13,620	22,399	205,644	365
2001	9,445	-	66,144	13,454	8,169	C	6,967	-	C	4,135	3,215	7,824	23,813	143,166	1,696
2002	10,908	-	80,378	10,546	6,612	C	9,757	C	4,601	4,582	2,222	4,657	19,283	153,546	996
2003	14,771	-	139,804	18,567	8,147	-	25,084	C	C	5,445	6,143	14,112	41,895	273,968	4,049
2004	C	-	89,621	8,138	24,429	C	20,051	-	C	C	23,356	4,404	27,825	197,824	2,347
2005	C	-	140,927	9,224	32,271	3,735	25,782	-	4,995	C	22,146	C	24,149	263,229	3,309
2006	C	-	138,490	16,668	16,790	8,396	44,639	-	C	C	26,334	C	44,952	296,269	1,645
2007	C	-	93,553	2,879	21,542	4,286	28,475	-	C	C	21,990	C	35,571	208,296	1,579
2008	C	-	143,431	4,841	21,638	7,005	43,230	C	C	C	28,333	C	48,125	296,603	2,847
2009	C	-	132,712	6,021	6,847	5,119	26,973	C	C	C	19,370	C	33,481	230,523	2,821
2010	11,400	-	82,280	1,569	3,010	5,242	19,213	C	C	-	11,818	C	12,660	147,192	3,132
2011	23,269	-	149,637	5,238	11,899	3,889	29,837	-	C	C	27,026	C	25,240	276,035	2,259
2012	15,760	-	151,280	15,773	18,058	3,931	25,786	-	C	C	20,829	C	14,798	266,215	3,793
2013	22,168	-	172,002	2,900	17,350	4,345	31,022	C	C	-	17,522	C	11,251	278,560	3,229
2014	22,732	-	172,239	5,581	8,783	6,300	21,776	C	C	521	13,767	-	9,770	261,469	1,425
2015	16,431	-	208,765	C	23,515	1,261	31,427	5,225	C	16,826	4,792	-	20,665	328,907	1,443
2016	20,665	-	190,577	C	13,286	1,971	32,844	6,449	C	40,036	9,067	-	22,666	337,561	3,516
2017	19,284	-	190,139	C	21,238	6,959	37,419	6,257	C	24,989	7,288	-	11,186	324,759	1,105
2018	15,365	-	177,456	C	17,014	7,759	36,504	4,119	C	11,869	6,679	-	12,056	288,821	1,667
2019	23,395	-	211,827	C	19,656	8,089	33,662	8,944	C	19,706	5,719	-	16,407	347,405	735
2020	15,569	-	189,750	C	7,322	9,049	39,058	2,618	C	14,119	4,578	-	13,898	295,961	834
2021	26,107	-	193,168	C	7,944	7,574	44,375	C	C	24,116	7,306	-	15,934	326,524	268
2022	20,493	-	170,116	C	11,601	7,760	47,962	*	C	17,593	6,412	-	14,854	296,791	287
2023	21,830	-	231,535	C	12,034	8,934	53,570	C	C	29,843	2,767	-	28,371	388,884	342
2024	32,886	-	354,799	C	23,176	14,822	105,758	C	C	50,602	3,934	-	54,693	640,670	*

[1] Includes—Incluye: BLZ, BOL, CHN, EU(CYP), GTM, HND, LBR, NZL, UNK

[2] Includes gillnets, Handline, Harpoon, pole-and-line, recreational, Trawler, Troll and unknown gears—Incluye red agallera, línea de mano, arpon, caña, artes deportivas, red de arrastre, curricán y desconocidas

TABLE A-3d. Retained catches (t) of bigeye tuna by purse-seine vessels in the EPO, by vessel flag. 'C' indicates that the catch has been combined with the total in the 'OTR' column. The data have been adjusted to the species composition estimate and are preliminary for 2023 and 2024.
TABLA A-3d. Capturas retenidas (t) de atún patudo por buques de cerco en el OPO, por bandera del buque. 'C' indica que la captura se ha combinado con el total en la columna 'OTR'. Los datos están ajustados a la estimación de composición por especie, y los de 2023 y 2024 son preliminares.

	COL	CRI	ECU	EU(ESP)	MEX	NIC	PAN	PER	SLV	USA	VEN	VUT	C + OTR[1]	Total
1995	5,815	C	8,304	C	91	-	839	*	-	11,042	706	12,072	6,452	45,321
1996	7,692	C	20,279	C	82	-	1,445	*	-	8,380	619	12,374	10,440	61,311
1997	3,506	-	30,092	C	38	-	1,811	*	-	8,312	348	6,818	13,347	64,272
1998	596	-	25,113	5,747	12	-	12	*	C	5,309	348	4,746	2,246	44,129
1999	1,511	-	24,355	11,703	33	C	1,220	*	C	2,997	10	5,318	4,011	51,158
2000	7,443	-	36,094	12,511	0	C	7,028	*	-	5,304	457	10,000	16,446	95,283
2001	5,230	-	24,424	7,450	0	C	3,858	*	C	2,290	0	4,333	12,933	60,518
2002	5,283	-	26,262	5,108	0	C	4,726	C	2,228	2,219	0	2,256	9,340	57,422
2003	3,664	-	22,896	4,605	0	-	6,222	C	C	1,350	424	3,500	10,390	53,051
2004	C	-	30,817	3,366	0	C	8,294	*	C	C	9,661	1,822	11,511	65,471
2005	C	-	30,507	3,831	0	1,551	10,707	*	2,074	C	9,197	C	10,028	67,895
2006	C	-	39,302	5,264	6	2,652	14,099	*	C	C	8,317	C	14,197	83,837
2007	C	-	40,445	711	0	1,058	7,029	*	C	C	5,428	C	8,780	63,451
2008	C	-	41,177	1,234	327	1,785	11,018	C	C	C	7,221	C	12,266	75,028
2009	C	-	35,646	2,636	1,334	2,241	11,807	C	C	C	8,479	C	14,657	76,800
2010	4,206	-	34,902	579	11	1,934	7,089	C	C	-	4,360	C	4,672	57,753
2011	3,210	-	31,282	4,111	133	2,256	7,953	*	C	C	301	C	7,266	56,512
2012	1,873	-	45,633	3,866	225	1,250	7,238	*	C	C	848	C	5,087	66,020
2013	1,405	-	32,444	1,672	124	2,749	6,118	-	C	-	963	C	4,012	49,487
2014	2,479	-	39,094	2,812	40	3,068	8,168	-	C	129	1,183	-	3,472	60,445
2015	2,470	-	44,063	C	156	774	10,113	-	C	2,384	100	-	2,853	62,913
2016	2,743	-	33,139	C	255	667	8,440	312	C	2,801	345	-	8,029	56,731
2017	3,656	-	38,299	C	358	1,610	10,544	0	C	6,210	1,256	-	5,040	66,973
2018	1,449	-	40,427	C	766	1,519	11,753	104	C	3,354	1,157	-	3,994	64,523
2019	4,171	-	38,757	C	962	2,630	10,868	-	C	3,304	996	-	7,536	69,223
2020	4,548	-	47,957	C	726	1,885	10,519	65	C	4,066	688	-	8,330	78,784
2021	3,742	-	31,084	C	1,107	1,700	6,473	-	C	5,078	275	-	8,711	58,170
2022	2,137	-	24,252	C	580	2,056	7,374	-	C	3,866	838	-	5,871	46,974
2023	1,712	-	23,209	C	331	1,666	5,592	C	C	2,923	20	-	6,913	42,366
2024	1,775	-	18,746	C	774	710	2,898	C	C	3,215	130	-	5,810	34,058

[1] Includes—Incluye: BLZ, BOL, CHN, EU(CYP), GTM, HND, LBR, NZL, UNK

TABLE A-3e. Total annual catches (t) of bigeye tuna by longline vessels, and totals for all gears, in the EPO, by vessel flag. 'C' indicates that the catch has been combined with the total in the 'OTR' column. The data for 2021-2024 are preliminary.
TABLA A-3e. Capturas totales anuales (t) de atún patudo por buques de palangre en el OPO, y totales de todas las artes, por bandera del buque. 'C' indica que la captura se ha combinado con el total en la columna 'OTR'. Los datos de 2021-2024 son preliminares.

	CHN	CRI	FRA (PYF)	JPN	KOR	MEX	PAN	TWN	USA	VUT	C + OTR[1]	Total LL	Total PS + LL	OTR[2]
1995	-	13	97	49,016	8,992	-	-	77	74	-	*	58,269	103,590	1,369
1996	-	1	113	36,685	9,983	-	-	95	81	-	*	46,958	108,269	748
1997	-	9	250	40,571	11,376	-	-	256	118	-	*	52,580	116,852	20
1998	-	28	359	35,752	9,731	-	-	314	191	-	*	46,375	90,504	628
1999	-	25	3,652	22,224	9,431	-	-	890	228	-	*	36,450	87,608	538
2000	-	27	653	28,746	13,280	42	14	1,916	162	2,754	11	47,605	142,887	253
2001	2,639	28	684	38,048	12,576	1	80	9,285	147	3,277	1,990	68,755	129,273	19
2002	7,614	19	388	34,193	10,358	-	6	17,253	132	2,995	1,466	74,424	131,845	12
2003	10,066	18	346	24,888	10,272	-	C	12,016	232	1,258	680	59,776	112,828	21
2004	2,645	21	405	21,236	10,729	-	48	7,384	149	407	459	43,483	108,954	194
2005	2,104	23	398	19,113	11,580	-	30	6,441	536	318	151	40,694	108,589	25
2006	709	18	388	16,235	6,732	-	37	6,412	85	960	195	31,771	115,608	40
2007	2,324	15	361	13,977	5,611	-	-	6,057	417	1,013	101	29,876	93,326	44
2008	2,379	16	367	14,908	4,150	-	-	1,852	1,277	790	468	26,207	101,236	28
2009	2,481	13	484	15,490	6,758	-	-	3,396	730	1,032	1,038	31,422	108,221	15
2010	2,490	4	314	15,847	9,244	-	-	5,276	1,356	1,496	1,063	37,090	94,842	2
2011	5,450	-	445	13,399	6,617	-	-	3,957	1,050	694	706	32,318	88,829	-
2012	4,386	3	464	16,323	7,450	-	-	4,999	875	1,063	604	36,167	102,187	27
2013	5,199	-	527	14,258	8,822	-	-	4,162	2,054	604	544	36,170	85,657	99
2014	5,253	9	526	13,634	8,203	-	114	4,511	2,073	913	120	35,356	95,801	170
2015	8,401	8	692	13,079	8,635	-	364	5,181	2,948	2,073	328	41,709	104,622	21
2016	7,052	3	477	10,467	7,692	-	313	6,006	2,090	877	679	35,656	92,387	24
2017	7,093	16	700	8,055	8,749	-	357	6,186	2,700	1,463	331	35,650	102,623	36
2018	6,060	14	897	6,125	6,675	-	415	5,125	2,408	1,841	227	29,787	94,310	24
2019	5,372	23	800	5,656	6,137	-	325	5,868	1,720	1,571	315	27,787	97,010	18
2020	4,048	35	745	5,139	7,633	-	164	5,414	1,405	1,077	299	25,959	104,743	44
2021	3,481	-	906	4,224	7,029	-	41	3,526	1,388	947	163	21,705	79,875	9
2022	2,923	-	1,127	3,652	6,629	-	97	5,128	1,051	256	249	21,106	68,080	87
2023	2,382	-	929	2,648	11,428	-	57	5,056	1,274	700	127	24,601	66,967	174
2024	2,633	-	*	2,028	7,871	-	*	3,890	*	1,218	*	17,640	51,698	*

[1] Includes—Incluye: BLZ, CHL, ECU, EU(ESP), EU(PRT), HND, SLV
[2] Includes gillnets, Handline, Harpoon, pole-and-line, recreational, Trawler, Troll and unknown gears—Incluye red agallera, línea de mano, arpon, caña, artes deportivas, red de arrastre, curricán y desconocidas

TABLE A-4a. Preliminary estimates of the retained catches, in metric tons, of tunas and bonitos caught by purse-seine vessels in the EPO in 2023 and 2024, by species and vessel flag. The data for yellowfin, skipjack, and bigeye tunas have been adjusted to the species composition estimates and are preliminary.
TABLA A-4a. Estimaciones preliminares de las capturas retenidas, en toneladas métricas, de atunes y bonitos por buques cerqueros en el OPO en 2023 y 2024, por especie y bandera del buque. Los datos de los atunes aleta amarilla, barrilete, y patudo fueron ajustados a las estimaciones de composición por especie, y son preliminares.

	YFT	SKJ	BET	PBF	ALB	BKJ	BZX	TUN	Total	%
2023	**Retained catches–Capturas retenidas**									
COL	21,146	21,830	1,712	-	-	9	-	51	44,748	6.0
ECU	53,588	231,535	23,209	-	-	1,535	3	1,770	311,640	42.1
MEX	143,062	12,034	331	3,399	-	3,859	754	3	163,442	22.1
NIC	10,083	8,934	1,667	-	-	1	-	6	20,691	2.8
PAN	35,118	53,570	5,592	-	-	38	-	96	94,414	12.7
USA	4,811	29,843	2,923	3	-	5	97	6	37,688	5.1
VEN	24,089	2,767	20	-	-	8	1	2	26,887	3.6
OTR[1]	6,083	28,371	6,912	-	-	1	-	9	41,376	5.6
Total	297,980	388,884	42,366	3,402	-	5,456	855	1,943	740,886	
2024	**Retained catches–Capturas retenidas**									
COL	8,034	32,886	1,775	-	-	69	-	15	42,779	4.4
ECU	45,369	354,799	18,746	-	-	2,414	-	2,012	423,340	43.1
MEX	157,601	23,176	774	3,531	-	3,568	-	22	188,672	19.2
NIC	6,683	14,822	710	-	-	74	-	52	22,341	2.3
PAN	35,884	105,758	2,898	-	-	441	-	447	145,428	14.8
USA	3,335	50,602	3,215	-	1	55	-	20	57,228	5.8
VEN	33,186	3,934	130	-	-	15	-	-	37,265	3.8
OTR[2]	3,678	54,693	5,810	-	-	11	-	75	64,267	6.6
Total	293,770	640,670	34,058	3,531	1	6,647	-	2,643	981,320	

[1] Includes El Salvador, European Union (Spain) and Peru - This category is used to avoid revealing the operations of individual vessels or companies.
[1] Incluye El Salvador, Perú y Unión Europea (España) - Se usa esta categoría para no revelar información sobre las actividades de buques o empresas individuales.
[2] Includes El Salvador, European Union (Spain) and Peru - This category is used to avoid revealing the operations of individual vessels or companies.
[2] Incluye El Salvador, Perú y Unión Europea (España) - Se usa esta categoría para no revelar información sobre las actividades de buques o empresas individuales.

TABLE A-4b. Preliminary estimates of the landings, in metric tons, of tunas and bonitos caught by purse-seine vessels in the EPO in 2023 and 2024, by year, species and country of landing. The data for yellowfin, skipjack, and bigeye tunas have not been adjusted to the species composition estimates and are preliminary. Landings in a given year may include retained catches from the previous year.

TABLA A-4b. Estimaciones preliminares de las descargas, en toneladas métricas, de atunes y bonitos por buques cerqueros en el OPO en 2023 y 2024, por año, especie y país de descarga. Los datos de los atunes aleta amarilla, barrilete, y patudo no fueron ajustados a las estimaciones de composición por especie, y son preliminares. Las descargas de un año determinado pueden incluir capturas retenidas del año anterior.

	YFT	SKJ	BET	PBF	ALB	BKJ	BZX	TUN	Total	%
2023	**Landings-Descargas**									
COL	20,138	12,285	986	-	-	-	-	-	33,409	4.5
ECU	110,646	317,097	27,820	-	-	1,596	2	1,911	459,072	62.1
MEX	140,853	10,900	246	3,399	-	3,858	754	3	160,013	21.7
PER	1,605	14,227	630	-	-	8	-	63	16,533	2.2
USA	2,890	13,082	1,245	3	-	-	97	-	17,317	2.4
OTR[1]	28,944	20,069	3,365	-	-	-	-	6	52,384	7.1
Total	305,076	387,660	34,292	3,402	-	5,462	853	1,983	738,728	
2024	**Landings-Descargas**									
COL	11,450	27,587	1,604	-	-	16	-	5	40,662	4.1
ECU	103,458	487,923	21,250	-	-	2,906	2	2,589	618,128	62.8
MEX	156,827	21,796	700	3,531	-	3,567	-	18	186,439	18.9
PER	1,784	23,132	741	-	-	8	-	15	25,680	2.6
USA	915	26,964	1,322	-	1	-	-	-	29,202	3.0
OTR[2]	34,599	45,542	3,784	-	-	57	-	35	84,017	8.6
Total	309,033	632,944	29,401	3,531	1	6,554	2	2,662	984,128	

[1] Includes Costa Rica, El Salvador, France (French Polynesia), Guatemala, Kiribati, Marshall Islands, Panama, Philippines, Solomon Islands and Thailand - This category is used to avoid revealing the operations of individual vessels or companies.

[1] Incluye Costa Rica, El Salvador, Filipinas, Francia (Polinesias Francesas), Guatemala, Islas Marshall, Islas Salomón, Kiribati, Panamá y Tailandia - Se usa esta categoría para no revelar información sobre las actividades de buques o empresas individuales.

[2] Includes Costa Rica, El Salvador, China, Guatemala, High Seas, Kiribati and Panama - This category is used to avoid revealing the operations of individual vessels or companies.

[2] Incluye Costa Rica, El Salvador, China, Guatemala, High Seas, Kiribati y Panamá - Se usa esta categoría para no revelar información sobre las actividades de buques o empresas individuales.

TABLE A-5a. Annual retained catches of Pacific bluefin tuna, by gear type and flag, in metric tons, 1995-2023. The data for 2021, 2022 and 2023 are preliminary; 2024 data are not available.
TABLA A-5a. Capturas retenidas anuales de atún aleta azul del Pacífico, por arte de pesca y bandera, en toneladas, 1995-2023. Los datos de 2021, 2022 y 2023 son preliminares; no se dispone de datos de 2024.

PBF	Western Pacific flags—Banderas del Pacífico occidental[1]										EPO flags—Banderas del OPO					Total
	JPN				KOR		TWN			Sub-total	MEX		USA		Sub-total	
	PS	LP	LL	OTR	PS	OTR	PS	LL	OTR		PS	OTR	PS	OTR		
1995	18,909	270	678	7,223	821	-	-	335	2	28,238	11	-	657	294	962	29,200
1996	7,644	94	901	5,359	102	-	-	956	-	15,056	3,700	-	4,639	110	8,449	23,505
1997	13,152	34	1,300	4,354	1,054	-	-	1,814	-	21,708	367	-	2,240	264	2,871	24,579
1998	5,391	85	1,255	4,450	188	-	-	1,910	-	13,279	1	0	1,771	703	2,475	15,754
1999	16,173	35	1,157	5,246	256	-	-	3,089	-	25,956	2,369	35	184	592	3,180	29,136
2000	16,486	102	953	7,031	2,401	-	-	2,780	2	29,755	3,019	99	693	380	4,191	33,946
2001	7,620	180	791	5,614	1,176	10	-	1,839	4	17,234	863	-	292	392	1,547	18,781
2002	8,903	99	841	4,338	932	1	-	1,523	4	16,641	1,708	2	50	625	2,385	19,026
2003	5,768	44	1,237	3,345	2,601	-	-	1,863	21	14,879	3,211	43	22	373	3,649	18,528
2004	8,257	132	1,847	3,855	773	-	-	1,714	3	16,581	8,880	14	-	61	8,955	25,536
2005	12,817	549	1,925	6,363	1,318	9	-	1,368	2	24,351	4,542	-	201	80	4,823	29,174
2006	8,880	108	1,121	4,058	1,012	3	-	1,149	1	16,332	9,806	-	-	96	9,902	26,234
2007	6,840	236	1,762	4,983	1,281	4	-	1,401	10	16,517	4,147	-	42	14	4,203	20,720
2008	10,221	64	1,390	5,505	1,866	10	-	979	2	20,037	4,407	15	-	64	4,486	24,523
2009	8,077	50	1,080	4,814	936	4	-	877	11	15,849	3,019	-	410	162	3,591	19,440
2010	3,742	83	890	3,681	1,196	16	-	373	36	10,017	7,746	-	-	89	7,835	17,852
2011	8,340	63	837	3,754	670	14	-	292	24	13,994	2,731	1	-	343	3,075	17,069
2012	2,462	113	673	2,846	1,421	2	-	210	4	7,731	6,668	1	-	442	7,111	14,842
2013	2,771	8	784	2,848	604	1	-	331	3	7,350	3,154	-	-	820	3,974	11,324
2014	5,456	5	683	3,429	1,305	6	-	483	42	11,409	4,862	-	401	427	5,690	17,099
2015	3,645	8	648	2,086	676	1	-	552	26	7,642	3,082	-	86	411	3,579	11,221
2016	5,095	54	691	2,514	1,024	5	-	454	0	9,837	2,709	-	316	413	3,438	13,275
2017	4,540	49	913	3,491	734	9	-	415	0	10,151	3,643	-	466	483	4,592	14,743
2018	4,049	9	700	1,447	523	12	-	381	3	7,124	2,840	-	12	589	3,441	10,565
2019	4,464	0	1,002	2,043	542	39	-	486	6	8,582	2,249	-	226	533	3,008	11,590
2020	3,960	1	1,416	2,634	567	38	-	1,149	1	9,766	3,285	-	116	860	4,261	14,027
2021	4,198	0	1,512	2,907	422	87	-	1,478	-	10,604	3,027	-	43	1,468	4,538	15,142
2022	4,702	13	1,599	3,798	654	227	-	1,496	1	12,490	3,194	-	198	1,751	5,143	17,633
2023	4,570	24	1,556	3,642	448	220	-	2,117	1	12,578	3,399	-	3	2,071	5,473	18,051

[1] Source: International Scientific Committee, 24th Plenary Meeting, PBFWG workshop report on Pacific Bluefin Tuna, June 2024—Fuente: Comité Científico Internacional, 24ª Reunión Plenaria, Taller PBFWG sobre Atún Aleta Azul del Pacífico, junio de 2024

TABLE A-5b. Reported catches of Pacific bluefin tuna in the EPO by recreational gear, in number of fish, 1995-2024. 2024 data are not available.
TABLA A-5b. Capturas reportadas de atún aleta azul del Pacifico en el OPO por artes deportivas, en número de peces, 1995-2024. No se dispone de datos de 2024.

1995	16,025	**2010**	8,453
1996	2,739	**2011**	31,494
1997	8,338	**2012**	40,012
1998	20,466	**2013**	63,158
1999	36,797	**2014**	27,889
2000	20,669	**2015**	28,661
2001	21,913	**2016**	12,312
2002	33,399	**2017**	16,493
2003	22,291	**2018**	14,072
2004	3,391	**2019**	18,702
2005	5,757	**2020**	37,469
2006	7,473	**2021**	58,823
2007	1,028	**2022**	59,595
2008	10,187	**2023**	80,196
2009	12,138	**2024**	

TABLE A-6. Annual retained catches of albacore in the EPO, by gear and area (north and south of the equator), in metric tons, 1995-2023. The data for 2021, 2022 and 2023 are preliminary; 2024 data are not available.

TABLA A-6. Capturas retenidas anuales de atún albacora en el OPO, por arte y zona (al norte y al sur de la línea ecuatorial), en toneladas, 1995-2023. Los datos de 2021, 2022 y 2023 son preliminares; no se dispone de datos de 2024.

ALB	North—Norte				South—Sur				Total
	LL	LTL[1]	OTR	Subtotal	LL	LTL	OTR	Subtotal	
1995	1,380	7,773	102	9,255	4,805	2	15	4,822	14,077
1996	1,675	8,267	99	10,041	5,956	94	21	6,071	16,112
1997	1,365	6,115	1,019	8,499	8,313	466	0	8,779	17,278
1998	1,730	12,019	1,250	14,999	10,905	12	0	10,917	25,916
1999	2,701	11,028	3,668	17,397	8,932	81	7	9,020	26,417
2000	1,880	10,960	1,869	14,709	7,783	778	3	8,564	23,273
2001	1,822	11,727	1,638	15,187	17,588	516	6	18,110	33,297
2002	1,227	12,286	2,388	15,901	14,062	131	40	14,233	30,134
2003	1,129	17,808	2,260	21,197	23,772	419	3	24,194	45,391
2004	854	20,288	1,623	22,765	17,590	331	0	17,921	40,686
2005	405	13,807	1,741	15,953	8,945	181	7	9,133	25,086
2006	3,671	18,515	408	22,594	10,161	48	119	10,328	32,922
2007	2,708	17,948	1,415	22,071	8,399	19	87	8,505	30,576
2008	1,160	17,137	308	18,605	8,058	0	159	8,217	26,822
2009	91	17,933	996	19,020	11,981	0	213	12,194	31,214
2010	1,134	18,246	892	20,272	13,122	3	247	13,372	33,644
2011	1,833	15,437	426	17,696	14,357	0	222	14,579	32,275
2012	4,583	16,633	1,222	22,438	19,613	35	210	19,858	42,296
2013	6,193	17,398	844	24,435	19,204	0	271	19,475	43,910
2014	3,546	18,178	1,042	22,766	25,685	0	243	25,928	48,694
2015	2,067	15,986	935	18,988	26,872	0	221	27,093	46,081
2016	1,627	13,600	679	15,906	25,150	0	290	25,440	41,346
2017	2,580	8,851	402	11,833	24,012	3	186	24,201	36,034
2018	1,106	10,433	539	12,078	24,653	0	174	24,827	36,905
2019	1,425	10,146	1,517	13,088	19,389	1	212	19,602	32,690
2020	2,911	9,884	327	13,122	17,072	0	127	17,199	30,321
2021	1,368	6,629	312	8,309	30,071	2	19	30,092	38,401
2022	1,810	12,080	652	14,542	29,999	14	88	30,101	44,643
2023	1,376	4,305	578	6,259	28,413	3	15	28,431	34,690

[1] Includes pole-and-line—Incluye caña

TABLE A-7. Estimated numbers of sets, by set type and vessel capacity category, and estimated retained catches, in metric tons, of yellowfin, skipjack, and bigeye tuna by purse-seine vessels in the EPO. The data for 2023 and 2024 are preliminary. The data for yellowfin, skipjack, and bigeye tunas have been adjusted to the species composition estimate and are preliminary.

TABLA A-7. Números estimados de lances, por tipo de lance y categoría de capacidad de buque, y capturas retenidas estimadas, en toneladas métricas, de atunes aleta amarilla, barrilete, y patudo por buques cerqueros en el OPO. Los datos de 2023 y 2024 son preliminares. Los datos de los atunes aleta amarilla, barrilete, y patudo fueron ajustados a la estimación de composición por especie, y son preliminares.

	Number of sets—Número de lances			Retained catch—Captura retenida		
	Vessel capacity—Capacidad del buque		Total	YFT	SKJ	BET
	≤363 t	>363 t				
DEL	**Sets associated with dolphins Lances asociados a delfines**					
2009	0	10,910	10,910	178,291	2,683	1
2010	0	11,646	11,646	170,028	1,365	0
2011	0	9,604	9,604	134,926	4,387	2
2012	0	9,220	9,220	133,825	2,122	0
2013	0	10,736	10,736	157,432	4,272	0
2014	0	11,382	11,382	167,780	4,413	3
2015	0	11,020	11,020	160,595	5,608	2
2016	0	11,219	11,219	146,526	3,179	4
2017	0	8,863	8,863	112,533	1,656	1
2018	0	9,774	9,774	147,859	2,456	1
2019	0	9,680	9,680	153,649	3,696	28
2020	0	9,773	9,773	150,263	1,705	63
2021	0	9,887	9,887	158,256	2,585	0
2022	0	10,614	10,614	177,458	2,874	0
2023	0	10,328	10,328	198,411	9,584	0
2024	0	10,554	10,554	195,076	12,035	0
OBJ	**Sets associated with floating objects Lances asociados a objetos flotantes**					
2009	2,142	7,077	9,219	36,147	157,023	75,889
2010	2,432	6,399	8,831	37,850	114,659	57,059
2011	2,538	6,921	9,459	42,176	171,193	55,587
2012	3,067	7,610	10,677	37,487	177,055	65,035
2013	3,081	8,038	11,119	35,112	194,372	48,337
2014	3,860	8,777	12,637	46,049	199,696	59,797
2015	3,457	9,385	12,842	43,603	206,515	60,975
2016	4,214	10,377	14,591	58,673	248,190	55,269
2017	4,544	11,148	15,692	67,167	224,422	65,443
2018	4,954	11,871	16,825	66,122	213,626	63,815
2019	4,885	10,591	15,476	52,862	226,375	68,553
2020	3,363	8,788	12,151	44,461	191,399	78,208
2021	4,002	11,167	15,169	66,542	227,028	57,391
2022	4,520	13,394	17,914	90,837	241,855	46,737
2023	4,634	12,630	17,264	74,129	319,153	42,167
2024	3,494	11,715	15,209	62,395	458,923	33,808

TABLE A-7. (continued)
TABLA A-7. (continuación)

	Number of sets—Número de lances			Retained catch—Captura retenida		
	Vessel capacity—Capacidad del buque		Total	YFT	SKJ	BET
	≤363 t	>363 t				
NOA	**Sets on unassociated schools Lances sobre cardúmenes no asociados**					
2009	3,822	4,109	7,931	22,319	70,817	909
2010	2,744	3,885	6,629	43,131	31,168	693
2011	2,840	5,182	8,022	29,749	100,455	923
2012	2,996	5,369	8,365	26,705	87,038	985
2013	3,064	4,156	7,220	25,643	79,916	1,150
2014	2,428	3,369	5,797	20,237	57,360	645
2015	3,116	6,201	9,317	41,529	116,784	1,936
2016	2,300	5,101	7,401	36,919	86,192	1,458
2017	2,016	4,960	6,976	31,280	98,681	1,529
2018	1,925	4,163	6,088	25,000	72,739	707
2019	2,064	5,948	8,012	21,802	117,334	642
2020	1,883	4,575	6,458	24,023	102,857	513
2021	1,678	4,803	6,481	28,617	96,911	779
2022	1,301	3,459	4,760	23,366	52,062	237
2023	850	3,435	4,285	25,440	60,147	199
2024	1,065	6,538	7,603	36,299	169,712	250
ALL	**Sets on all types of schools Lances sobre todos tipos de cardumen**					
2009	5,964	22,096	28,060	236,757	230,523	76,799
2010	5,176	21,930	27,106	251,009	147,192	57,752
2011	5,378	21,707	27,085	206,851	276,035	56,512
2012	6,063	22,199	28,262	198,017	266,215	66,020
2013	6,145	22,930	29,075	218,187	278,560	49,487
2014	6,288	23,528	29,816	234,066	261,469	60,445
2015	6,573	26,606	33,179	245,727	328,907	62,913
2016	6,514	26,697	33,211	242,118	337,561	56,731
2017	6,560	24,971	31,531	210,980	324,759	66,973
2018	6,879	25,808	32,687	238,981	288,821	64,523
2019	6,949	26,219	33,168	228,313	347,405	69,223
2020	5,246	23,136	28,382	218,747	295,961	78,784
2021	5,680	25,857	31,537	253,415	326,524	58,170
2022	5,821	27,467	33,288	291,661	296,791	46,974
2023	5,484	26,393	31,877	297,980	388,884	42,366
2024	4,559	28,807	33,366	293,770	640,670	34,058

TABLE A-8. Types of floating objects involved in sets by vessels of >363 t carrying capacity, 2009-2024. The 2023 and 2024 data are preliminary.

TABLA A-8. Tipos de objetos flotantes sobre los que realizaron lances buques de >363 t de capacidad de acarreo, 2009-2024. Los datos de 2023 and 2024 son preliminares.

OBJ	Flotsam Naturales		FADs Plantados		Unknown Desconocido		Total
	No.	%	No.	%	No.	%	
2009	322	4.5	6,728	95.1	27	0.4	7,077
2010	337	5.3	6,038	94.3	24	0.4	6,399
2011	563	8.1	6,342	91.6	16	0.2	6,921
2012	286	3.8	7,321	96.2	3	< 0.1	7,610
2013	274	3.4	7,759	96.5	5	0.1	8,038
2014	283	3.2	8,490	96.7	4	< 0.1	8,777
2015	273	2.9	9,093	96.9	19	0.2	9,385
2016	278	2.7	10,070	97.0	29	0.3	10,377
2017	271	2.4	10,877	97.6	0	0	11,148
2018	322	2.7	11,549	97.3	0	0	11,871
2019	216	2.0	10,373	97.9	2	< 0.1	10,591
2020	166	1.9	8,622	98.1	0	0	8,788
2021	260	2.3	10,907	97.7	0	0	11,167
2022	413	3.1	12,980	96.9	1	< 0.1	13,394
2023	375	3.0	12,253	97.0	2	< 0.1	12,630
2024	297	2.5	11,417	97.5	1	< 0.1	11,715

TABLE A-9. Reported nominal longline fishing effort (E; 1000 hooks) and catch (C; metric tons) of yellowfin, skipjack, bigeye, Pacific bluefin, and albacore tunas only, by flag, in the EPO. 2024 data are not available.
TABLA A-9. Esfuerzo de pesca palangrero nominal reportado (E; 1000 anzuelos), y captura (C; toneladas métricas) de atunes aleta amarilla, barrilete, patudo, aleta azul del Pacífico, y albacora solamente, por bandera, en el OPO. No se dispone de datos de 2024.

LL	CHN		JPN		KOR		FRA(PYF)		TWN		USA		OTR[1]
	E	C	E	C	E	C	E	C	E	C	E	C	C
1995	-	-	129,598	69,435	54,979	12,778	1,776	559	2,910	1,639	828	180	562
1996	-	-	103,654	52,298	40,290	14,121	2,087	931	5,830	3,553	510	182	185
1997	-	-	96,383	59,325	30,493	16,663	3,464	1,941	8,720	5,673	464	215	752
1998	-	-	106,568	50,167	51,817	15,089	4,724	2,858	10,586	5,039	1,008	406	1,176
1999	-	-	80,958	32,886	54,269	13,294	5,512	4,446	23,247	7,865	1,756	469	1,157
2000	-	-	79,311	45,216	33,585	18,759	8,090	4,382	18,152	7,809	737	204	4,868
2001	13,056	5,162	102,219	54,775	72,261	18,201	7,445	5,086	41,920	20,060	1,438	238	15,612
2002	34,889	10,398	103,920	45,401	96,273	14,370	943	3,238	78,018	31,773	613	138	10,258
2003	43,289	14,548	101,227	36,187	71,006	15,551	11,098	4,101	74,460	28,328	1,314	262	11,595
2004	15,889	4,033	76,824	30,936	55,861	14,540	13,757	3,030	49,979	19,535	1,049	166	9,193
2005	16,896	3,681	65,081	25,712	15,798	12,284	13,356	2,515	38,536	12,229	2,397	557	5,244
2006	588	969	56,525	21,432	27,472	7,892	11,786	3,220	38,134	12,375	234	121	10,027
2007	12,226	2,624	45,972	20,514	10,548	6,037	9,672	3,753	22,244	9,498	2,689	436	6,424
2008	11,518	2,984	44,547	21,375	3,442	4,256	10,255	3,017	12,544	4,198	6,322	1,369	9,231
2009	10,536	3,435	41,517	21,492	18,364	7,615	10,686	4,032	13,904	6,366	5,141	852	11,731
2010	11,905	3,590	47,807	21,017	25,816	10,477	8,976	3,139	24,976	10,396	8,879	1,480	11,400
2011	37,384	9,983	52,194	18,682	25,323	7,814	9,514	3,192	21,065	9,422	7,359	1,233	7,616
2012	55,508	14,462	55,587	22,214	20,338	8,286	8,806	3,589	20,587	11,924	5,822	986	14,237
2013	70,411	18,128	48,825	19,097	31,702	10,248	9,847	3,303	19,198	11,722	10,765	2,127	9,754
2014	78,851	24,282	40,735	17,235	22,695	9,132	10,572	3,291	17,047	10,435	11,276	2,168	6,874
2015	99,131	25,559	35,290	16,046	22,394	9,879	13,661	4,509	15,334	11,274	13,868	3,089	10,924
2016	66,405	25,756	30,910	13,242	23,235	9,457	13,677	3,954	20,941	11,432	11,313	2,372	6,236
2017	82,461	27,341	27,961	10,617	27,540	10,525	11,641	3,425	24,164	11,811	15,266	3,266	6,093
2018	83,023	27,024	24,608	8,686	19,443	8,474	13,258	4,300	31,735	9,985	13,607	2,876	7,998
2019	65,298	18,652	18,472	8,342	17,655	8,556	12,620	4,209	34,930	12,170	11,117	2,012	6,843
2020	56,607	15,620	17,987	7,351	23,284	10,427	14,253	3,906	43,643	11,778	9,384	1,898	6,816
2021	84,812	27,299	15,266	6,176	19,704	9,699	15,748	5,092	28,693	8,032	8,123	1,692	4,770
2022	75,160	26,649	12,943	5,704	18,304	9,208	16,449	5,541	31,431	9,875	7,214	1,402	1,495
2023	30,837	24,528	7,900	3,547	5,131	14,416	14,638	5,431	28,786	10,659	8,425	1,777	1,434

[1] Includes the catches of—Incluye las capturas de: BLZ, CHL, COK, CRI, ECU, EU(ESP), GTM, HND, MEX, NIC, PAN, EU(PRT), SLV, VUT

TABLE A-10. Numbers and well volumes, in cubic meters, of purse-seine and pole-and line vessels of the EPO tuna fleet. The data for 2023 and 2024 are preliminary. (* The data provided for pole and line vessels for these years are reported combined under total catch (OTR; Table A-2a) because there is no information available by individual vessel; therefore, the total number of PL vessels and well volume is not available.)
TABLA A-10. Número y volumen de bodega, en metros cúbicos, de buques cerqueros y cañeros de la flota atunera del OPO. Los datos de 2023 y 2024 son preliminares. (* Los datos de buques cañeros de estos años se presentan combinados bajo captura total (OTR; Tabla A-2a) porque no se dispone de información por buque individual; por lo tanto, no se dispone del número total de buques cañeros ni del volumen de bodega).

	PS		LP		Total	
	No.	Vol. (m^3)	No.	Vol. (m^3)	No.	Vol. (m^3)
1995	175	123,798	20	1,784	195	125,582
1996	180	130,774	17	1,646	197	132,420
1997	194	147,926	23	2,127	217	150,053
1998	202	164,956	22	2,216	224	167,172
1999	208	178,724	14	1,642	222	180,366
2000	205	180,679	12	1,220	217	181,899
2001	204	189,088	10	1,259	214	190,347
2002	218	199,870	6	921	224	200,791
2003	214	202,381	3	338	217	202,719
2004	218	206,473	3	338	221	206,811
2005	220	212,419	4	498	224	212,917
2006	225	225,166	4	498	229	225,664
2007	227	225,359	4	380	231	225,739
2008	219	223,804	4	380	223	224,184
2009	221	224,632	4	380	225	225,012
2010	202	210,025	3	255	205	210,280
2011	208	213,237	3	339	211	213,576
2012	209	217,687	4	464	213	218,151
2013	203	212,087	3	268	206	212,355
2014	226	230,379	2	226	228	230,605
2015	244	248,428	1	125	245	248,553
2016	250	261,474	*	*	250	261,474
2017	254	263,018	*	*	254	263,018
2018	261	263,666	*	*	261	263,666
2019	261	265,085	*	*	261	265,085
2020	242	241,331	*	*	242	241,331
2021	236	253,323	*	*	236	253,323
2022	239	253,071	*	*	239	253,071
2023	246	261,296	*	*	246	261,296
2024	238	260,573	*	*	238	260,573

TABLE A-11a. Estimates of the numbers and well volume (cubic meters) of purse-seine (PS) and pole-and-line (LP) vessels that fished in the EPO in 2023, by flag and gear. Each vessel is included in the total for each flag under which it fished during the year but is included only once in the "Grand total"; therefore, the grand total may not equal the sums of the individual flags.
TABLA A-11a. Estimaciones del número y volumen de bodega (metros cúbicos) de buques cerqueros (PS) y cañeros (LP) que pescaron en el OPO en 2023 por bandera y arte de pesca. Se incluye cada buque en los totales de cada bandera bajo la cual pescó durante el año, pero solamente una vez en el "Total general"; por consiguiente, los totales generales no equivalen necesariamente a las sumas de las banderas individuales.

Flag Bandera	Gear Arte	Well volume —Volumen de bodega (m^3)					Total	
		<401	401-800	801-1300	1301-1800	>1800	No.	Vol. (m^3)
		Number—Número						
COL	PS	1	2	7	3	-	13	14,590
ECU	PS	34	35	25	7	8	109	85,275
EU(ESP)	PS	-	-	-	-	4	4	9,330
MEX	PS	4	4	21	24	-	53	63,389
NIC	PS	-	-	2	1	1	4	6,099
PAN	PS	-	2	6	8	5	21	30,035
PER	PS	-	2	-	-	-	2	1,143
SLV	PS	-	-	-	1	2	3	6,202
USA	PS	9	-	1	8	5	23	25,386
VEN	PS	-	-	7	6	1	14	19,847
Grand total—Total general	PS	48	45	69	58	26	246	
Well volume—Volumen de bodega (m^3)								
Grand total—Total general	PS	12,359	26,196	78,474	88,806	55,461		261,296

- : none—ninguno

TABLE A-11b. Estimates of the numbers and well volumes (cubic meters) of purse-seine (PS) vessels that fished in the EPO in 2024, by flag and gear. Each vessel is included in the total for each flag under which it fished during the year but is included only once in the "Grand total"; therefore, the grand total may not equal the sums of the individual flags.
TABLA A-11b. Estimaciones del número y volumen de bodega (metros cúbicos) de buques cerqueros (PS) que pescaron en el OPO en 2024, por bandera y arte de pesca. Se incluye cada buque en los totales de cada bandera bajo la cual pescó durante el año, pero solamente una vez en el "Total general"; por consiguiente, los totales generales no equivalen necesariamente a las sumas de las banderas individuales.

Flag Bandera	Gear Arte	Well volume —Volumen de bodega (m^3)					Total	
		<401	401-800	801-1300	1301-1800	>1800	No.	Vol. (m^3)
		Number—Número						
COL	PS	2	2	7	3	-	14	14,860
ECU	PS	33	36	27	9	8	113	91,171
EU(ESP)	PS	-	-	-	-	4	4	9,330
MEX	PS	3	4	20	23	-	50	61,043
NIC	PS	-	-	2	1	1	4	6,099
PAN	PS	-	-	6	8	6	20	31,002
PER	PS	-	5	-	-	-	5	2,686
SLV	PS	-	-	-	1	2	3	6,202
USA	PS	1	-	1	8	5	15	23,233
VEN	PS	-	-	3	6	1	10	14,947
Grand total—Total general	PS	39	47	66	59	27	238	
Well volume—Volumen de bodega (m^3)								
Grand total—Total general	PS	11,215	27,280	75,006	89,931	57,141		260,573

- : none—ninguno

TABLE A-12. Minimum, maximum, and average capacity, in thousands of cubic meters, of purse-seine and pole-and-line vessels at sea in the EPO during 2014-2023 and in 2024, by month.
TABLA A-12. Capacidad mínima, máxima, y media, en miles de metros cúbicos, de los buques cerqueros y cañeros en el mar en el OPO durante 2014-2023 y en 2024, por mes.

Month Mes	2014-2023			2024
	Min	Max	Ave.-Prom.	
1	86.9	130.4	109.3	116.4
2	154.2	192.3	179.6	180.8
3	147.9	189.7	171.7	164.1
4	151.2	200.8	172.5	160.2
5	150.6	196.9	174.1	165.7
6	156.3	198.6	176.7	152.1
7	161.4	200.4	174.0	155.8
8	107.6	148.7	121.6	116.7
9	102.2	142.2	119.1	105.4
10	141.7	188.9	169.4	153.9
11	93.5	135.9	115.4	99.8
12	56.3	90.4	66.7	67.1
Ave.-Prom.	125.8	167.9	145.8	136.5

B. YELLOWFIN TUNA

For the full version of the analyses herein, see documents SAC-16-02, SAC-16-03, SAC-16 INF-T and SAC-16 INF-U.

Yellowfin are distributed across the Pacific Ocean, but the bulk of the catch is made in the eastern and western regions. Purse-seine catches in the vicinity of the western boundary of the eastern Pacific Ocean (EPO) at 150ºW are relatively low, but have been increasing, mainly in sets on floating objects (Figure A-1a and A-1b, Tables A-1, A-2). Most of the catch in the eastern Pacific Ocean (EPO) is taken in purse-seine sets associated with dolphins and floating objects (Figure B-1). Tagging studies of yellowfin throughout the Pacific indicate that they tend to stay within 1,800 km of their release positions. This regional fidelity, along with the geographic variation in phenotypic and genotypic characteristics of yellowfin shown in some studies, suggests that there might be multiple stocks of yellowfin in the EPO and throughout the Pacific Ocean. This spatial heterogeneity makes the assessment of yellowfin tuna in the EPO challenging.

The purse-seine catches of yellowfin tuna were about 294,000 t in 2024, which is about 20% higher than the average for the previous 10 years (Figure B-1), and slightly lower than the 2023 catches. Catches from other gears (mainly longline) are about 5% of the total catches. The catch of yellowfin on floating-object sets peaked in 2022 at 91,000 t, which was the highest since 1975 (increase of ~50% from 2021 to 2022, in bias-adjusted weight), then decreased to 74,000 t in 2023 and 63,000 in 2024, returning to levels seen previous to the peak (average of about 60,000 from 2017-2021). The peak catches on 2022 were a concern due to the simultaneous peak in the number of floating objects sets, which decreased since then (Figure B-2). The increase in yellowfin catches in the floating-object fishery in 2022 may also be a consequence of the strong La Niña events in 2021 and 2022. The analysis of changes in yellowfin tuna catch of small fish in the purse-seine floating-object fishery relative to El Niño Southern Oscillation (ENSO) events suggested that there is positive impact of La Niña events on yellowfin recruitment into the fishery (SAC-16-INF-T, Figure B-3). The increase of 26% in 2023 (to about 198,000) and 24% in 2024 (195,000) catches in purse-seine sets associated with dolphins from the average of the previous five years (2018-2022) are consitent with an increase in recruitment two years before, as this fishery catches larger and older yellowfin tuna than the floating object fishery. The meaning of those increases was also evaluated in the 2025 benchmark assessment.

The previous 2020 benchmark assessment (SAC-11-07) and external reviews (YFT-02-Rep, RVDTT-01, RVMTT-01) highlighted that uncertainty about the stock-structure of yellowfin in the EPO needs to be addressed in the assessment. The 2020 benchmark assessment considered a set of overarching hypotheses concerning stock structure, but due to the practical need for an assessment of the whole EPO, the assessment model was focused on the data for the core dolphin associated fishery area with catch included for the whole EPO. A review of all available information indicated that at least two stocks may be exploited by the EPO fisheries, roughly associated with epi- and meso-pelagic biogeochemical provinces (SAC-14-06), and that the boundaries between the stocks may vary dynamically. The external review concluded that there is evidence of spatial heterogeneity, but there was insufficient information to determine how to define areas for the assessment. Analysis of tagging data indicates that movement of yellowfin is limited (Schaefer and Fuller, 2022) and that isolation by distance may be occurring even within the area of distribution of dolphin associated fisheries, which was previously thought could be modelled as one group (SAC-14-06).

In 2024, exploratory stock assessments models were fit to an index of abundance derived from the data for the dolphin associated purse seine sets for the EPO. The models could not fit the length frequency data associated with the EPO-wide index because it was composed of fish from different areas that have different sizes. The catches from the core fishing area for purse-seine sets associated with dolphins (south of 20°N, north of 5°N and east of 125°W) show fish of intermediate size. To the north of that area, off Mexico, the fish sizes in the catches are smaller. To the west and south of the core area, the fish in the catches are larger. Further investigation indicated that those patterns are persistent over time and across gears (SAC-15-03). One of the main limitations of the exploratory models was that spatial definitions of fisheries were constrained to be rectangles defined along latitude and longitude lines. In the 2025 benchmark assessment, irregular areas with homogeneous length composition were delineated using a newly developed flexible methodology based on cluster analysis. These areas were used to define fisheries and spatial domains for several models.

Given the uncertainty in stock structure, two hypotheses were used to develop models for the 2025 benchmark assessment:

- **Regional dynamics**: one stock with spatial dynamics among regions. The differences among regions may be due to spatial structure, movement, catchability/selectivity/availability and/or different exploitation rates. This hypothesis was implemented in the benchmark assessment with an EPO-wide areas-as-fleets model, where catches taken from the three regions and areas within were treated as separate fisheries and the differences in size composition were modeled with different selectivity curves. Note that a three-region spatial model was also implemented, but movement rates were estimated to be low so it was equivalent to independent stocks.
- **Independent stocks**: it is unlikely that the fish of different regions would be completely independent but given the estimation in the spatial model of movement rates to be very low, independent models for different regions are justified. In addition, modelling the regions independently will allow for understanding of the dynamics in different regions without influence from data outside the region. Two separate assessments were done. One for a northeast region (NE) that combines region 1 and region 2 in Figure B-4, for simplicity, and is where most of the yellowfin catches are taken and another for region 3, which encompasses the south and west of the EPO (SW).

Four configurations representing the spatial-structure hypotheses in the 2025 benchmark assessment: 1) EPO, 2) SW, 3) NE, and 4) NE-short. The NE-short models were the same as the NE models, but started in 2006 instead of 1984, to address patterns in the data. One risk analysis was done for each spatial configuration, with eighteen models each, with a total of 72 models. A "base" scenario was built with new assumptions of growth, natural mortality and reproductive biology based on results of recent research. The uncertainty in biological parameters (growth, low and high, and natural mortality, low and high) and effort creep (increase in the catchability of the indices of abundance of 1% a year) was represented by alternative scenarios. Three values of steepness of the Beverton-Holt stock recruitment curve (1.0, 0.9, 0.8) are considered for the third level hypothesis. In the risk analyses, equal weight was used for level 2 hypotheses and expert judgement was used for level 3 (steepness). Indices of abundance and standardized length composition were obtained using spatiotemporal models fit to data from the purse-seine fishery associated with dolphins (to fit EPO, NE, NE-short) or longline fishery (SW). The models incorporated new information on growth, reproductive biology, and natural mortality, some derived from the IATTC Regional Tuna Tagging Program (RTTP). The indices were key to provide the relative trends in abundance but the information on absolute scale came from the length composition data.

Recruitment had two peaks in all models for all four spatial structure assumptions (Figure B-5a), but the timing differed. For the SW model the first peak occurred in 1998, while in the others it occured in 1999. The second peak was in 2021. The EPO and NE models estimate a regime shift in recruitment to a lower level after the first peak, while the SW model does not. The SW models also estimated high recruitment in 2015-2017. Recruitment appears to be related to environmental conditions connected to the El Niño - La Niña system, but the relationship is more complex than what it can be represented by a simple index such as ONI (Figure B-6).

Spawning biomass generally follows the recruitment trends, with a 2-3 year delay, and since 2010 are diametric for the NE and SW regions (Figure B-6). The strong cohorts of 1998 and 1999 in the NE and SW regions apper as large spawning biomasses in 2001 and 2002 in the two regions, respectively. The NE (and NE_short) spawning biomass is estimated to be about twice the level of that estimated for the SW. EPO-wide models have difficulty fitting data with incompatible trends and estimate larger and more uncertain biomass levels than the NE and SW combined.

Fishing mortality is higher for older fish (Figure B-7) and has been generally higher after 2000, but without any obvious trends except for a consistent increase in small fish in the SW region reflecting the increasing effort in the floating object fishery. The fishing mortality is lower for the EPO models, which is a consequence of its biomass being estimated to be higher than the sum of the biomasses for the NE and SW regions. The fishing mortality on the intermediate aged yellowfin (9-12 quarters of age) is low in the SW since the unassociated catches are lower and the purse-seine fishery associated with dolphins generally catches larger yellowfin. The fishing mortality on the youngest yellowfin (1-4 quarters of age) has steadily increased following the expansion of the floating object fishery in the mid 1990's. After 2015 the fishing mortality of this age group surpasses the 5-8 age class. The trends in fishing mortality are similar between the NE and the NE_short models, indicating that starting the model later does not change the perception of the effects of fishing in recent years. For those two hypotheses, there is a general increase in fishing mortality in all age classes after the year 2006, declining after 2015, with the lowest at the start of the covid19 pandemic, in 2020. After that, the fishing mortality increases, particularly for older yellowfin. The increase in fishing mortality noticed in the last five years in the NE area is not shared by the EPO model. This may be due to the influence of the SW area, which has stable fishing mortality followed by a sharp decline in 2023. This indicates that using an EPO-wide model may underestimate and mask regional trends in fishing mortality.

Impacts of the different types of fisheries in the EPO, NE and NE_short models are similar (Figure B-8). The longline fisheries have the smallest impact, while the purse-seine fisheries associated with dolphins have the greatest impact during most of the modelled period. The unassociated fisheries had the second largest impact in the early years, but in the 1990s the impact of the floating-object fisheries started to increase and surpassed that of the unassociated fisheries around 2008. For the SW models, the impact of the different purse seine set type has changed considerably over time. The longline fishery and the purse-seine associated with dolphins had the largest impact until mid-1990's, when there was an expansion of the floating object fishery, which steadily increased its impact and became the fishery with the largest impact in this region, larger than all other fisheries combined. The longline fishery has decreased both its effort and its impact on yellowfin in that area. The fishery associated with dolphins has slowly increased its absolute impact in this region, but in proportion it has stayed stable since the year 2000.

The spawning biomass ratio for all four spatial-structure hypotheses has been above the limit reference point (Figure B-9) for all the assessment periods. The spawning biomass is estimated to be above the staff's proposed MSY proxy target reference point of $30\%S_{\_d}$ (SAC-15-05) (and the biomass corresponding to MSY) for most of the assessment period, with the exceptions of some years for NE and NE_short (Figure B-10). The stock(s) is estimated to be currently well above the spawning biomass that corresponds to MSY (S_{MSY}) and the proxy *30%S_* with low probability of being below these (Table B-1, Figure B-11). The fishing mortality is estimated to be well below the level corresponding to MSY and the MSY proxy $F_{30\%}$ with low probability of being above these (Table B-1, Figure B-12). The assessment estimates zero probability that the spawning biomass or fishing mortality limit reference points have been breached (Table B-1, Figure B-13). The EPO models are the most optimistic. The most pessimistic models are those with low natural mortality (Figures B-11 and B-12). Some of these models estimate that the spawning biomass is below the $S_{30\%}$ level and the fishing mortality is above the $F_{30\%}$ level. The high natural mortality levels are generally the most optimistic. The estimates of the SBR (the ratio of the spawning biomass to the virgin spawning biomass) corresponding to MSY are low (generally below 20%) even though the highest fishing mortality is on older yellowfin. The value is higher with lower steepness of the stock-recruitment relationship and lower natural mortality.

Future work to improve the assessment should focus on the key uncertainties: spatial structure, growth, natural mortality, and information about absolute abundance. This assessment showed that different areas in the EPO may have different depletion levels. The values used for natural mortality and the reliance on size composition data to inform absolute abundance remain key sources of uncertainty. Growth, especially at older ages, relied on a few high-quality tag returns. All four of these sources of uncertainty could be reduced by a comprehensive tagging program, which could allow for the application of newly developped spatiotemporal model approach to derive estimates of absolute abundance from tagging data, as done for skipjack tuna (SAC-15-04).

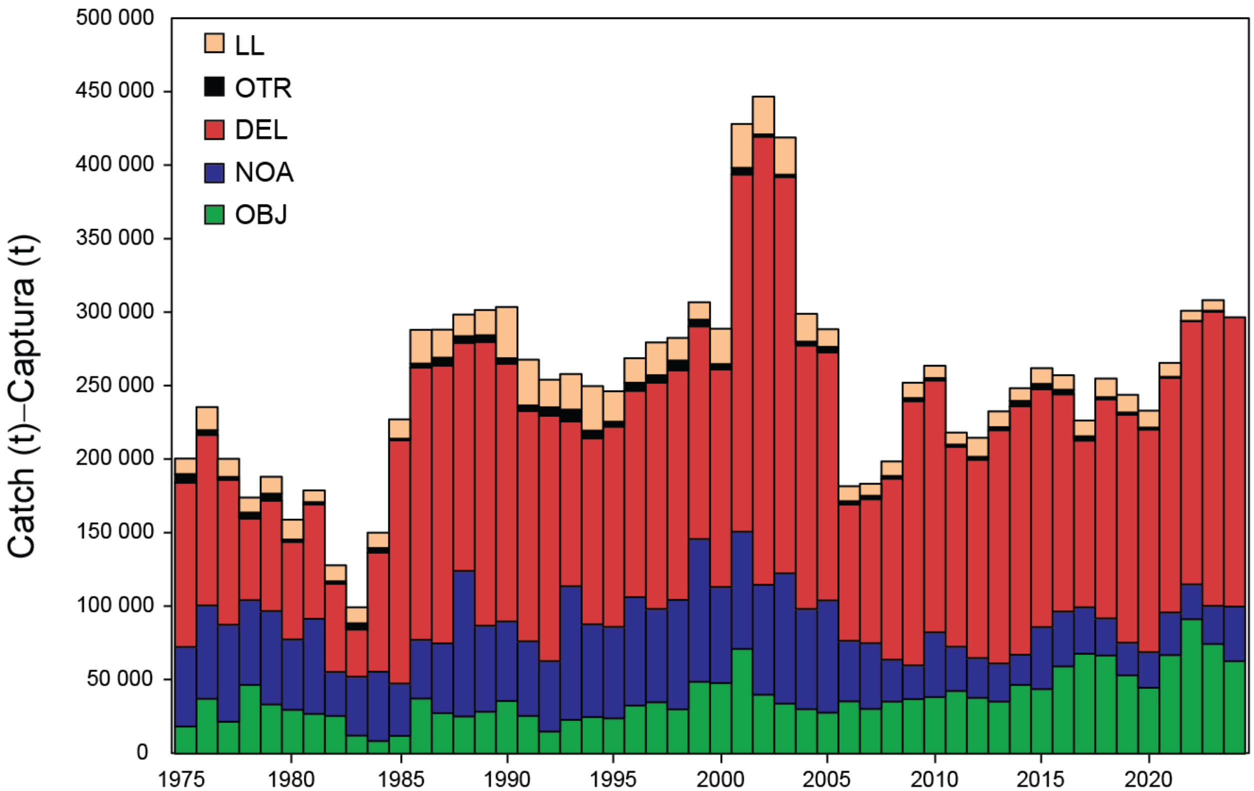


FIGURE B-1. Total catches (retained catches plus discards) for the purse-seine fisheries, by set type (DEL, NOA, OBJ), and retained catches for the longline (LL) and other (OTR) fisheries, of yellowfin tuna in the eastern Pacific Ocean, 1975-2024. The purse-seine catches are adjusted to the species composition estimate obtained from sampling the catches. The data for 2023 and 2024 are preliminary.

FIGURA B-1. Capturas totales (capturas retenidas más descartes) en las pesquerías de cerco, por tipo de lance (DEL, NOA, OBJ), y capturas retenidas de las pesquerías de palangre (LL) y otras (OTR), de atún aleta amarilla en el Océano Pacífico oriental, 1975-2024. Se ajustan las capturas de cerco a la estimación de la composición por especie obtenida del muestreo de las capturas. Los datos de 2023 y 2024 son preliminares.

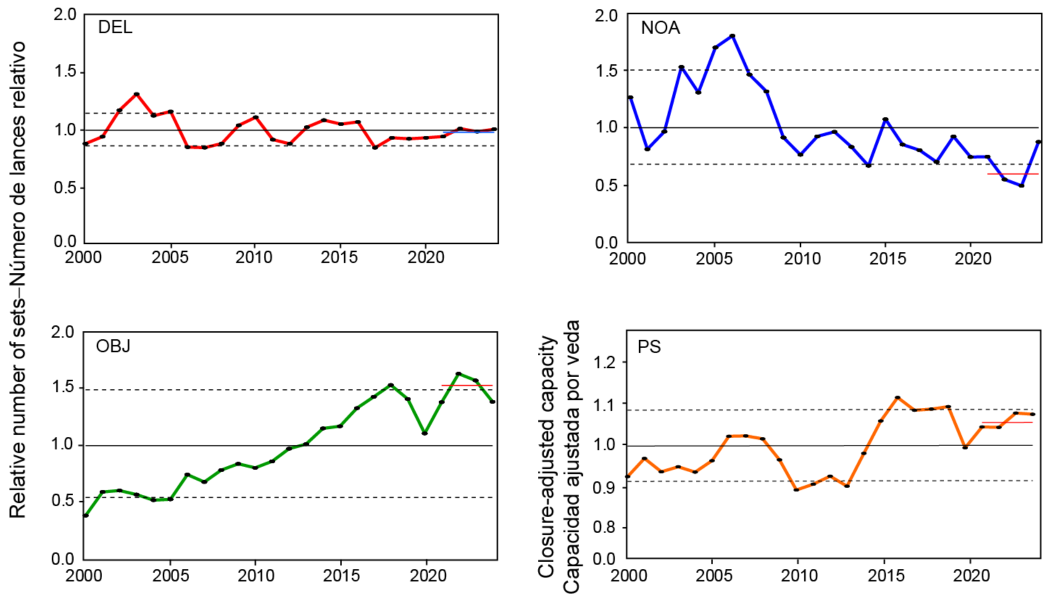


FIGURE B-2. Indicators of total effort in the EPO for 2000-2023, based on annual total number of sets, by type and purse-seine closure-adjusted capacity. The dashed horizontal lines are the 10th and 90th percentiles, the solid horizontal line is the mean. The red dashed lines mark the *status quo* levels (average conditions in 2017-2019).

FIGURA B-2. Indicadores del esfuerzo total en el OPO para 2000-2023, basados en número total anual de lances, por tipo, y capacidad ajustada por veda de cerco. Las líneas horizontales de trazos representan los percentiles de 10 y 90%, y la línea horizontal sólida el promedio. Las líneas discontinuas rojas marcan los niveles de *statu quo* (condiciones promedio en 2017-2019).

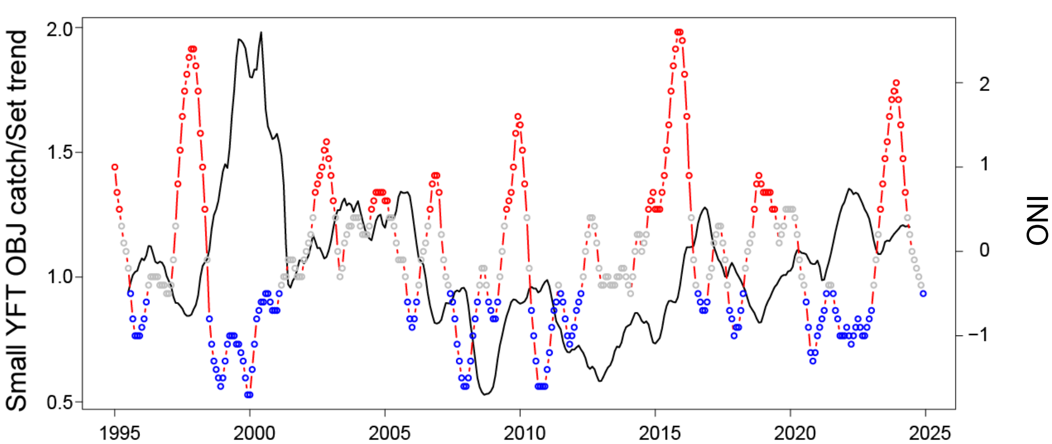


FIGURE B-3. Small yellowfin tuna monthly CPUE trend data overlaid with the Oceanic Niño Index (ONI). The colors of the points of ONI correspond to the El Niño (red), La Niña (blue), or Neutral (grey) phase ([SAC-16 INF-T](SAC-16 INF-T)).

FIGURA B-3. Datos de tendencia de la CPUE mensual del atún aleta amarilla pequeño superpuestos con el índice Niño Oceánico (ONI). Los colores de los puntos del ONI corresponden a las fases de El Niño (rojo), La Niña (azul) o neutras (gris) ([SAC-16 INF-T](SAC-16 INF-T)).

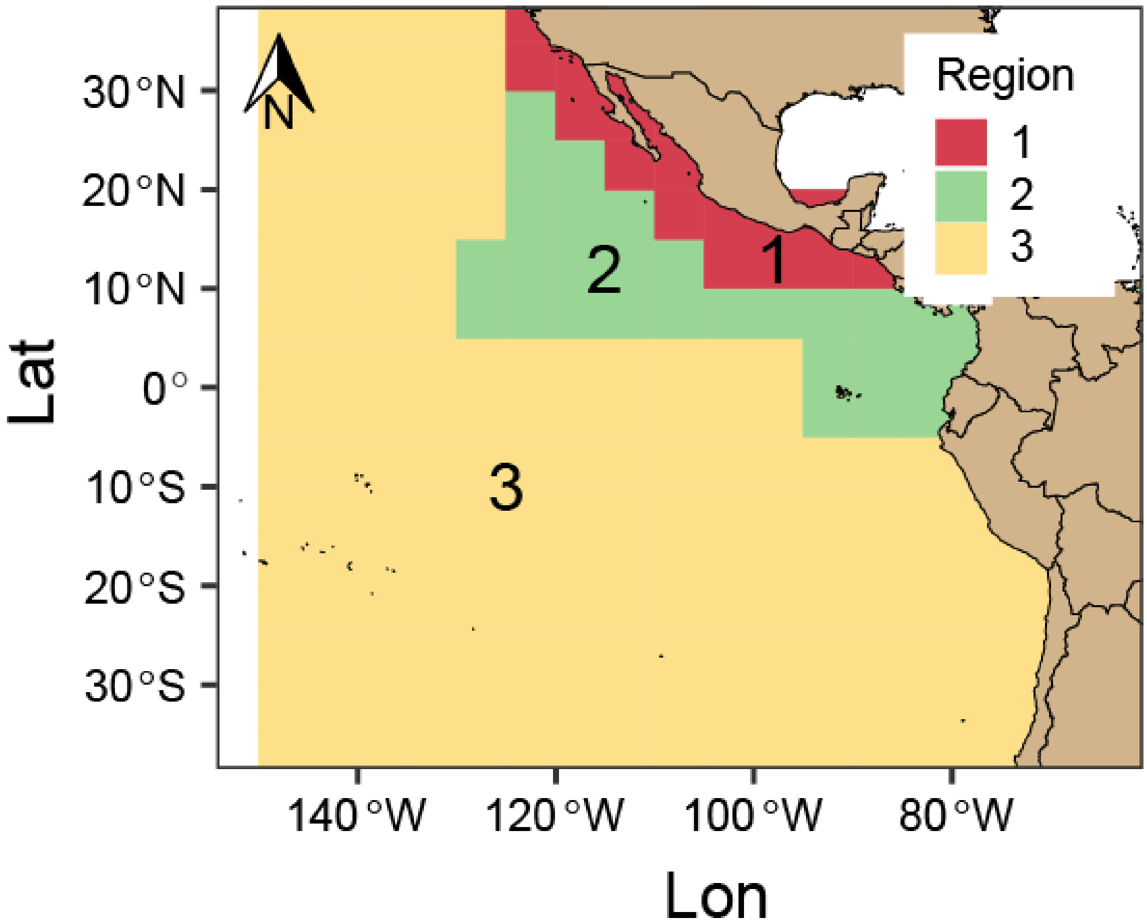


FIGURE B-4. Regional divisions obtained using cluster analysis of length composition data from the purse-seine fishery associated with dolphins. The EPO models consider all regions, the NE and NE_short models include regions 1 and 2, the SW model comprised only region 3. Further subdivisions in areas were made within each region based on the cluster analysis results, which were treated as different fisheries.
FIGURA B-4. Divisiones regionales obtenidas usando análisis de conglomerados de datos de composición por talla de la pesquería cerquera asociada a delfines. Los modelos del OPO consideran todas las regiones, los modelos NE y NE_short incluyen las regiones 1 y 2, el modelo SO comprende solo la región 3. Se hicieron subdivisiones adicionales en áreas dentro de cada región con base en los resultados del análisis de conglomerados, que fueron tratadas como pesquerías diferentes.

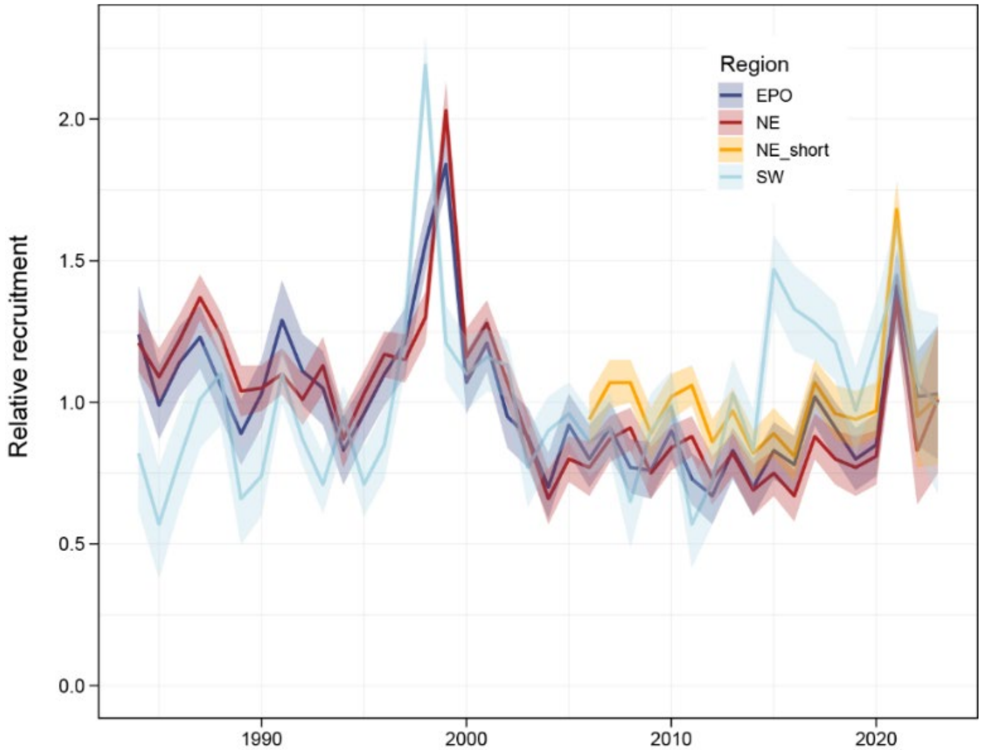


FIGURE B-5a. Relative recruitment. Comparison of multi-model estimates of median relative annual recruitment and 80% confidence interval of yellowfin tuna for each hypothesis of spatial structure. The multi-model estimates include all level 2 and level 3 uncertainty scenarios.

FIGURA B-5a. Reclutamiento relativo. Comparación de las estimaciones de múltiples modelos de la mediana del reclutamiento anual relativo y del intervalo de confianza del 80% del atún aleta amarilla para cada hipótesis de estructura espacial. Las estimaciones de múltiples modelos incluyen todos los escenarios de incertidumbre de nivel 2 y 3.

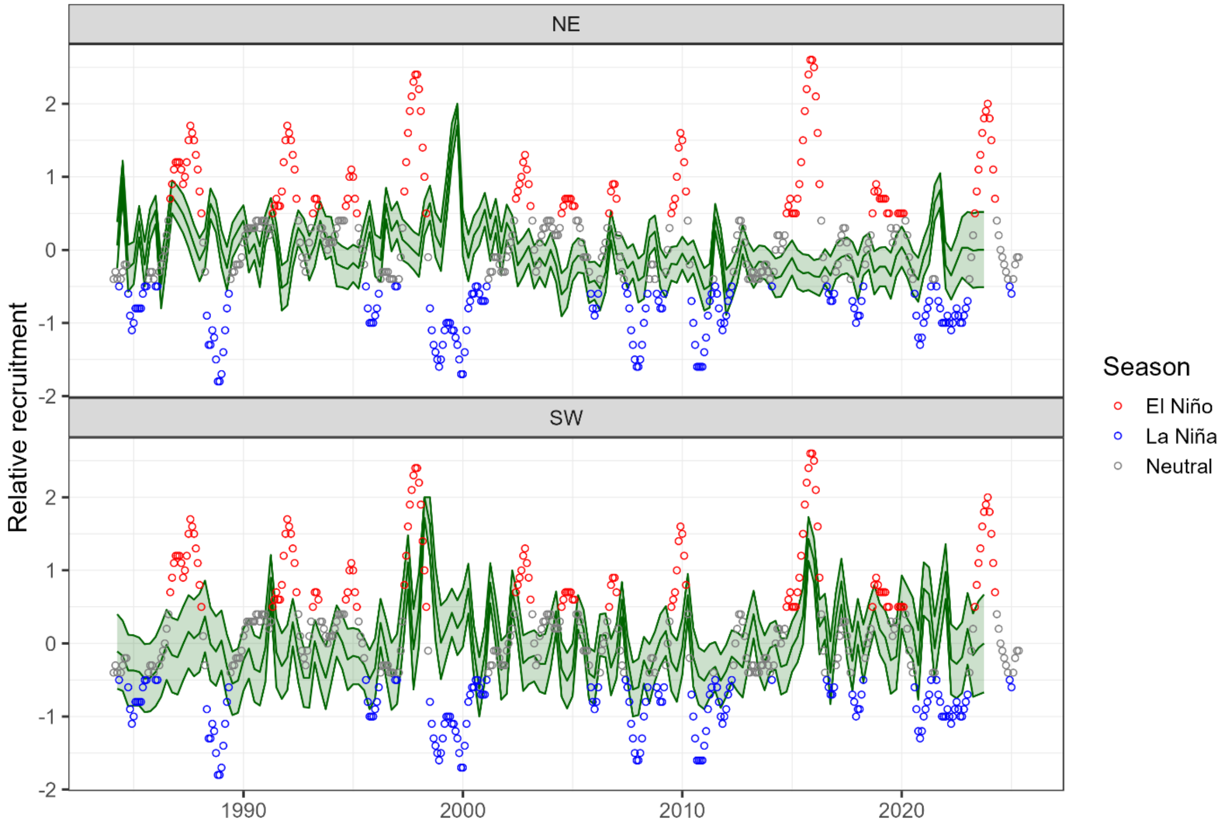


FIGURE B-5b. Relative recruitment. Quarterly estimates centered at 0 overlaid with the Oceanic Niño Index (ONI) for the NE (upper) and SW (lower) models. The colors of the points of ONI correspond to the El Niño (red), La Niña (blue), or Neutral (grey) phase.

FIGURA B-5b. Reclutamiento relativo. Reclutamientos trimestrales centrados en cero superpuestos con el índice Niño Oceánico (ONI). Los colores de los puntos del ONI corresponden a las fases de El Niño (rojo), La Niña (azul) o neutras (gris).

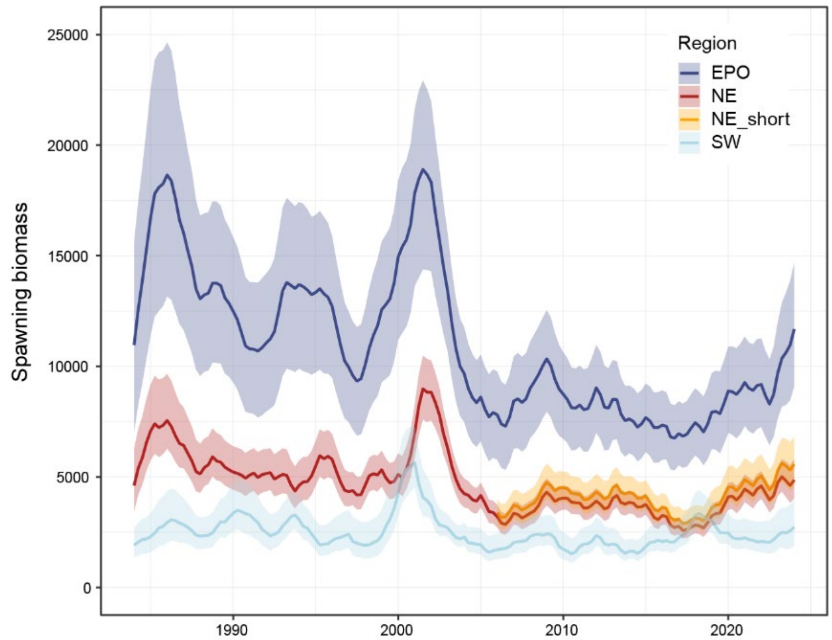


FIGURE B-6. Comparison of multi-model estimated spawning biomass of yellowfin tuna for each hypothesis of spatial structure with 80% confidence intervals.
FIGURA B-6. Comparación de la biomasa reproductora del atún aleta amarilla estimada en múltiples modelos para cada hipótesis de estructura espacial con intervalos de confianza del 80%.

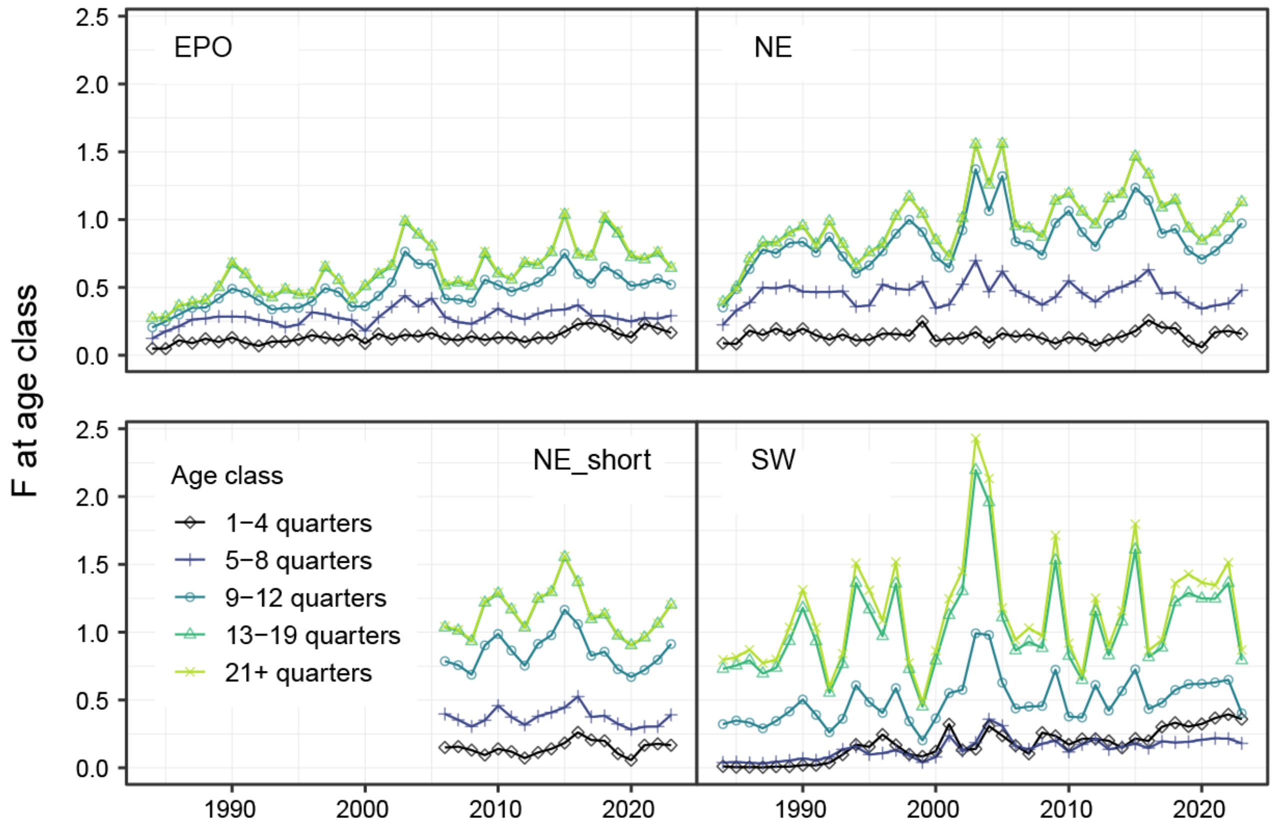


FIGURE B-7. Annual fishing mortality at age (sum of the four quarterly estimates within a year) of yellowfin by age group for each hypothesis of spatial structure (level 1). The values for each age group are weighted across level 2 and level 3 hypotheses.

FIGURA B-7. Mortalidad por pesca anual por edad (suma de las cuatro estimaciones trimestrales dentro de un año) de aleta amarilla por grupo de edad para cada hipótesis de estructura espacial (nivel 1). Los valores para cada grupo de edad están ponderados entre las hipótesis de nivel 2 y nivel 3

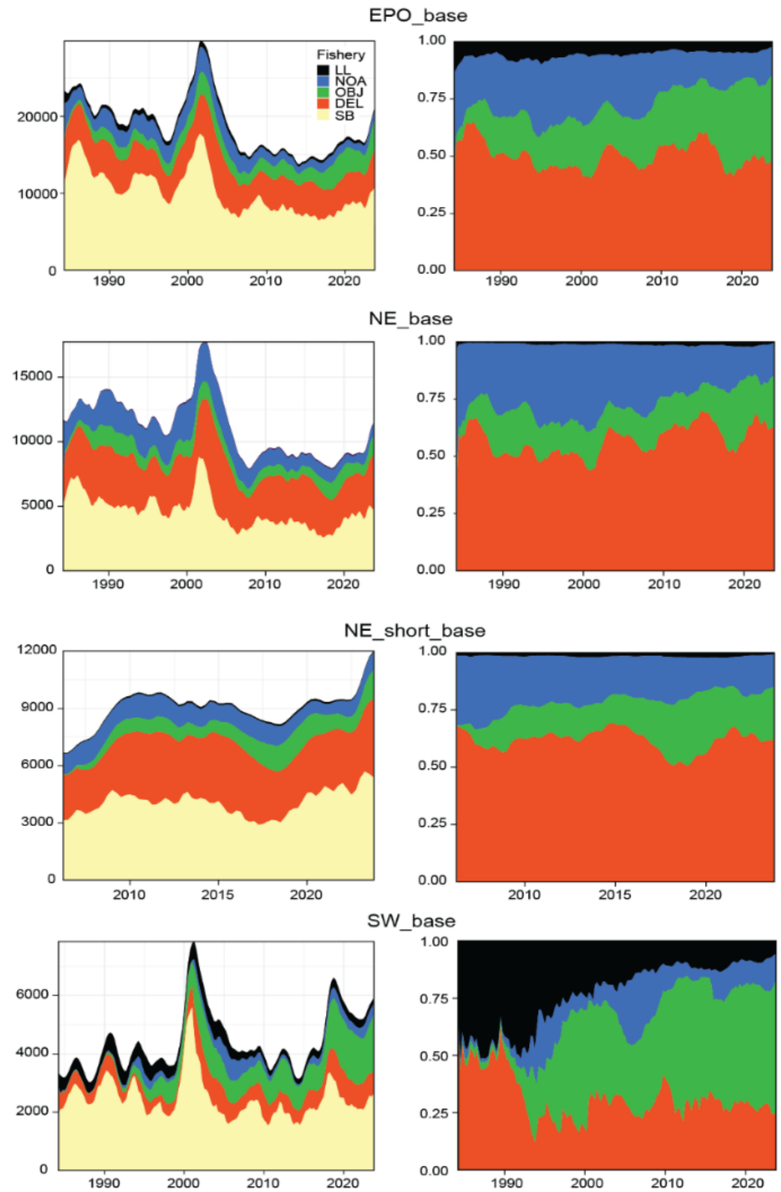


FIGURE B-8. Impact of the different fishing methods on the spawning biomass. Left panels: comparison of spawning biomass trajectory of a simulated population of yellowfin tuna that was never exploited (colored area) and that predicted by the stock assessment model (SB, yellow shaded area), and the impact of each fishing method (purse-seine on floating objects OBJ, also includes sorting discards and pole and line, purse-seine associated with dolphins DEL, purse-seine unassociated NOA and longline LL fisheries) for each stock structure hypothesis calculated from the base reference models with steepness of 1. Right panels: Proportional impacts.

FIGURA B-8. Impacto de los diferentes métodos de pesca en la biomasa reproductora. Paneles de la izquierda: comparación de la trayectoria de la biomasa reproductora de una población simulada de aleta amarilla que nunca fue explotada (área coloreada) y la predicha por el modelo de evaluación (SB, área sombreada en amarillo), y el impacto de cada método de pesca (cerco sobre objetos flotantes OBJ, también incluye descartes y caña, cerco asociado a delfines DEL, cerco no asociado NOA y pesquerías de palangre LL) para cada hipótesis de estructura de la población calculada a partir de los modelos de referencia base con inclinación de 1. Paneles de la derecha: impactos proporcionales.

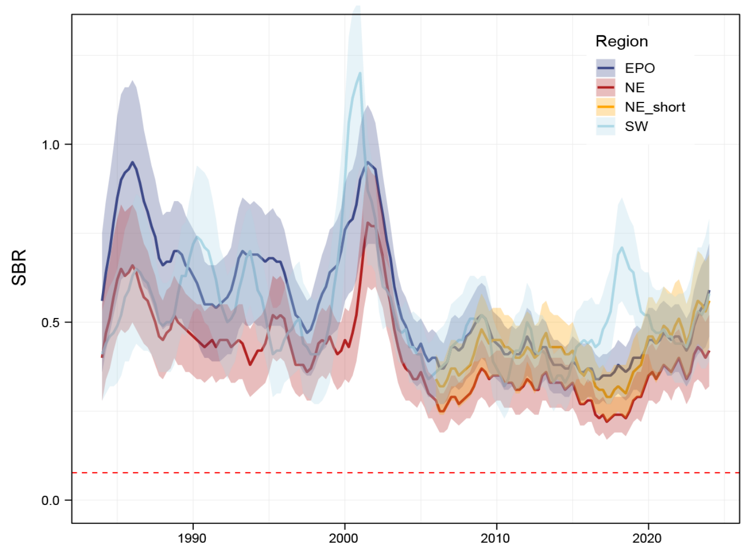


FIGURE B-9. Comparison of multi-model estimated spawning biomass ratio (spawning biomass over equilibrium virgin spawning biomass) of yellowfin tuna for each hypothesis of spatial structure with 80% confidence intervals. The red dashed line (at 0.077) indicates the SBR at the limit reference point S_{LIMIT}.
FIGURA B-9. Comparación del cociente de biomasa reproductora del atún aleta amarilla (biomasa reproductora sobre biomasa reproductora virgen de equilibrio) estimado en múltiples modelos para cada hipótesis de estructura espacial con intervalos de confianza del 80%. La línea roja discontinua (en 0.077) indica el SBR en el punto de referencia límite $S_{\text{LÍMITE}}$.

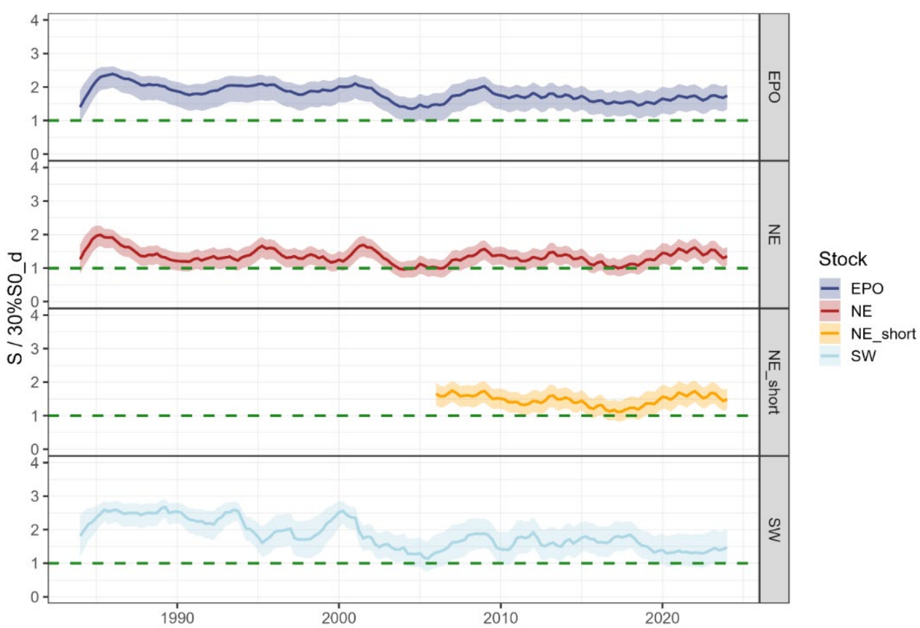


FIGURE B-10. Comparison of multi-model estimates of the ratio of S to $30\%S_{\_d}$ of yellowfin tuna for each hypothesis of stock structure.
FIGURA B-10. Comparación de estimaciones de múltiples modelos de la relación entre S y $30\%S_{\_d}$ del atún aleta amarilla para cada hipótesis de estructura de la población.

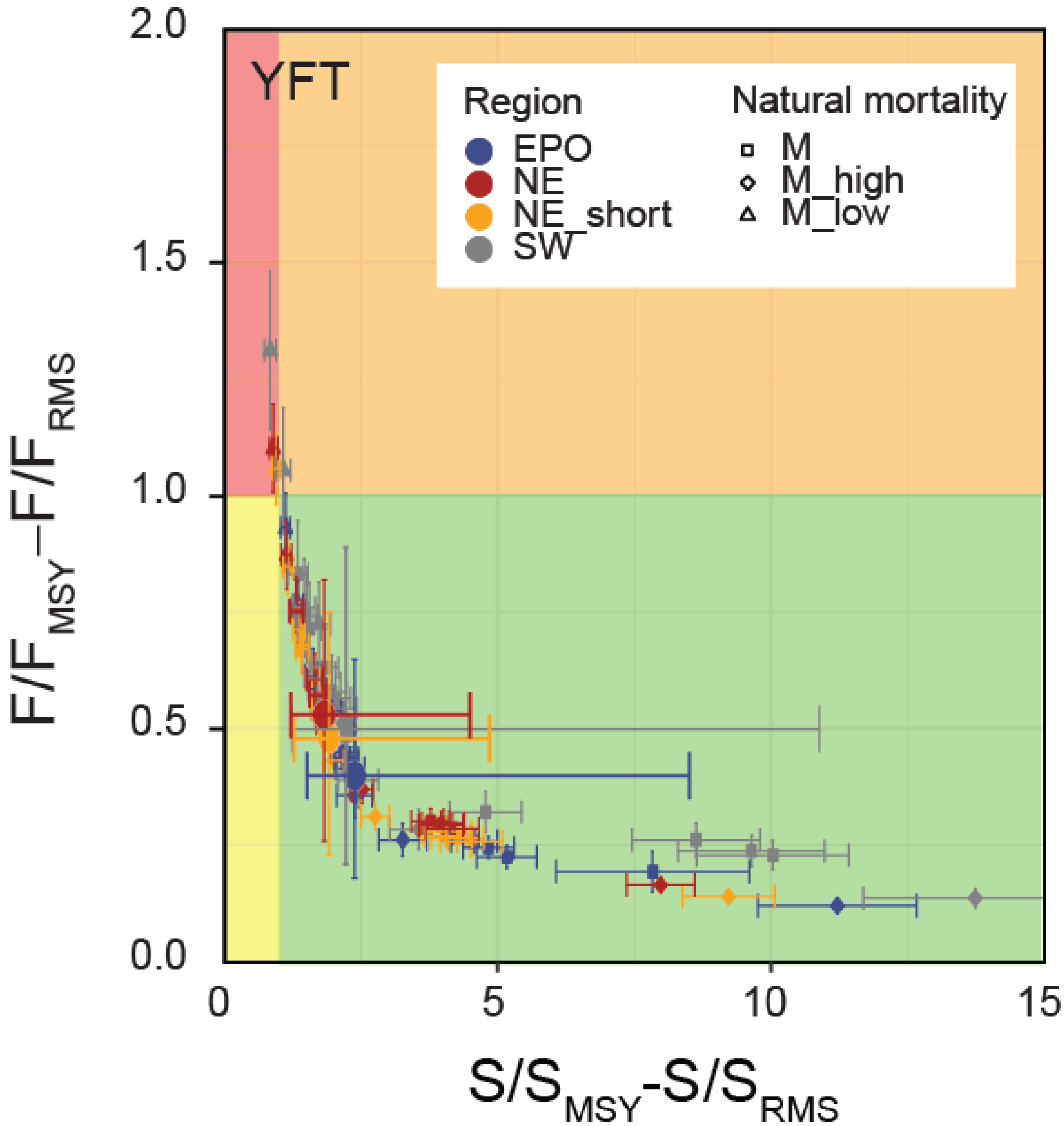


FIGURE B-11. Kobe plot of the most recent estimates of spawning biomass (*S*) and fishing mortality (*F*) relative to their target reference points (S_{MSY_d} and F_{MSY}) for each hypothesis of spatial structure. Each dot is based on the average *F* over the most recent three years, 2021-2023, and the *S* for the first quarter of 2024 and the error bars represent the 80% confidence interval of model estimates. The larger dots represent the combined result for each spatial structure hypothesis.

FIGURA B-11. Gráfica de Kobe de las estimaciones más recientes de biomasa reproductora (*S*) y mortalidad por pesca (*F*) en relación con sus puntos de referencia objetivo (S_{RMS_d} y F_{RMS}) para cada hipótesis de estructura espacial. Cada punto se basa en la *F* promedio de los tres años más recientes, 2021-2023, y la *S* del primer trimestre de 2024, y las barras de error representan el intervalo de confianza del 80% de las estimaciones del modelo. Los puntos más grandes representan el resultado combinado para cada hipótesis de estructura espacial

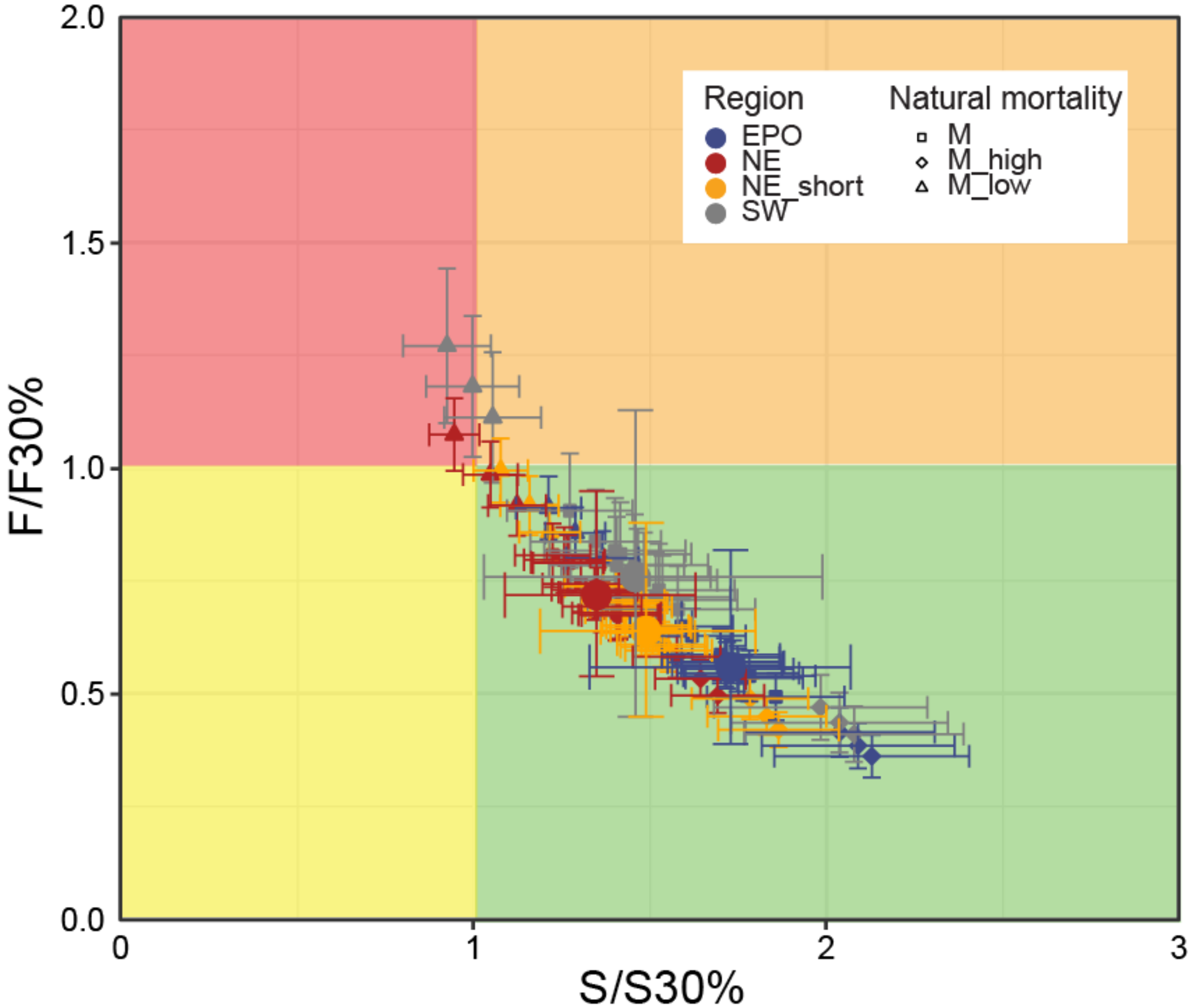


FIGURE B-12. Kobe plot of the most recent estimates of spawning biomass (*S*) and fishing mortality (*F*) relative to their proxy target reference points ($30\%S_{\_d}$ and $F_{30\%S\_d}$) for each hypothesis of spatial structure. Each dot is based on the average *F* over the most recent three years, 2021-2023, and the *S* for the first quarter of 2024 and the error bars represent the 80% confidence interval of model estimates. The larger dots represent the combined result for each spatial structure hypothesis.

FIGURA B-12. Gráfica de Kobe de las estimaciones más recientes de biomasa reproductora (*S*) y mortalidad por pesca (*F*) relativas a sus puntos de referencia objetivo sustitutos ($30\%S_{\_d}$ y$F_{30\%S_d}$) para cada hipótesis de estructura espacial. Cada punto se basa en la *F* promedio de los tres años más recientes, 2021-2023, y la *S* del primer trimestre de 2024, y las barras de error representan el intervalo de confianza del 80% de las estimaciones del modelo. Los puntos más grandes representan el resultado combinado para cada hipótesis de estructura espacial.

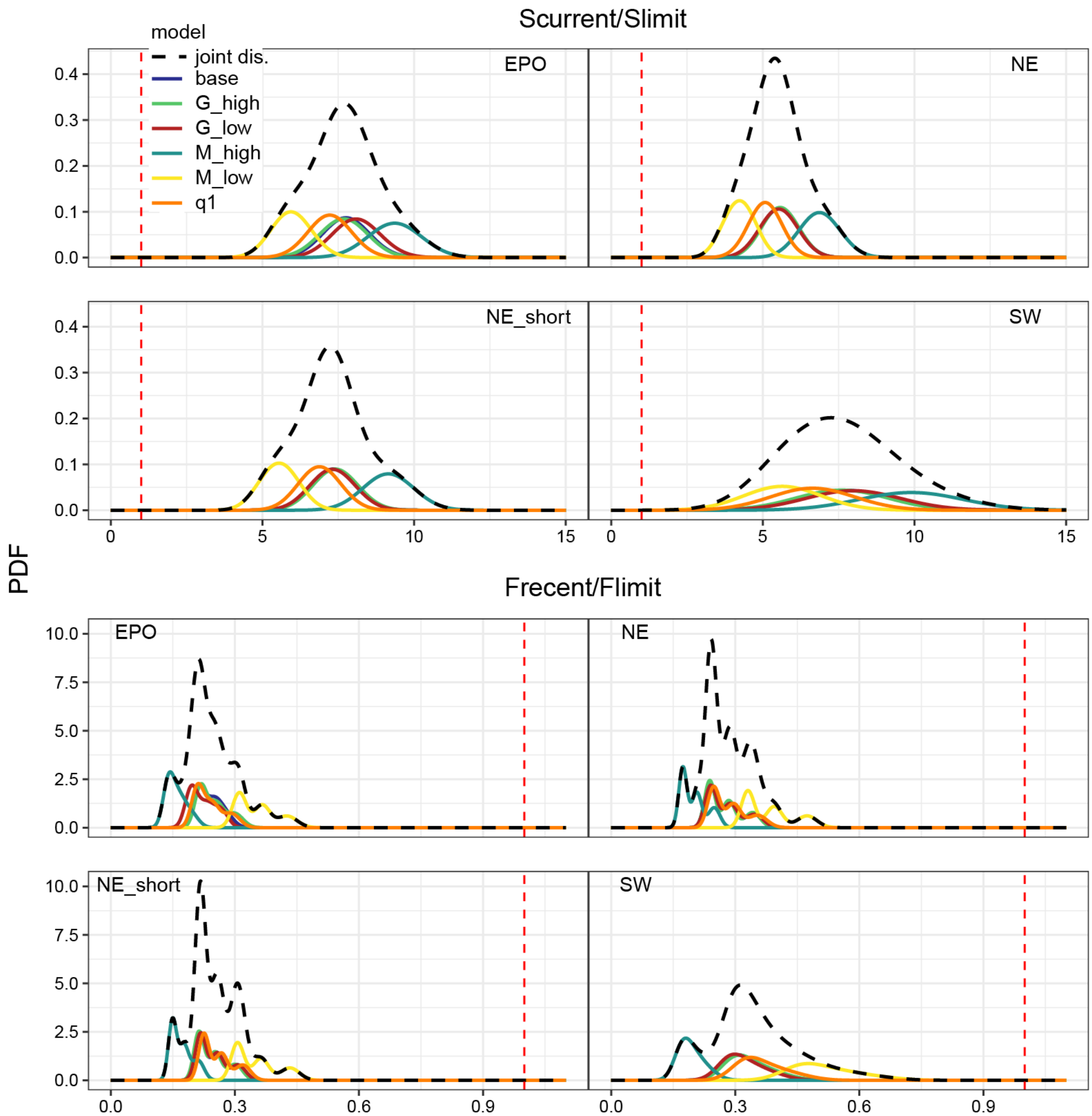


FIGURE B-13. The joint probability distributions for spawning biomass (S) in the first quarter of 2024 and average fishing mortality (F) in 2021-2023 relative to their limit reference points (S_{Limit} and F_{Limit}). The distributions are provided for each of the four spatial structure hypotheses separated into different components (level 2 hypotheses). The level 3 hypotheses (steepness values) were integrated out.

FIGURA B-13. Las distribuciones de probabilidad conjunta para la biomasa reproductora (S) en el primer trimestre de 2024 y la mortalidad por pesca (F) promedio en 2021-2023 en relación con sus puntos de referencia límite ($S_{Límite}$ y$F_{Límite}$). Las distribuciones se proporcionan para cada una de las cuatro hipótesis de estructura espacial separadas en distintos componentes (hipótesis de nivel 2). Las hipótesis de nivel 3 (valores de inclinación) se integraron fuera.

TABLE B-1. Management quantities for yellowfin tuna in the EPO for each spatial structure hypothesis. The medians (or expected values *) and probabilities were obtained from the join probability distributions across models.

TABLA B-1. Cantidades de ordenación para el atún aleta amarilla en el OPO para cada hipótesis de estructura espacial. Las medianas (o valores esperados *) y probabilidades fueron obtenidas de las distribuciones de probabilidad conjunta en todos los modelos.

	EPO	**NE**	**NE_short**	**SW**
SRMS/S0 *	0.180	0.189	0.194	0.162
SRMS_d/S0_d *	0.190	0.192	0.201	0.170
$F_{actual}/F_{30\%S0\_d}$	0.559	0.718	0.643	0.757
$p(F_{actual} > F_{30\%S0\_d})$	0.002	0.059	0.020	0.161
F_{actual}/F_{RMS}	0.397	0.532	0.484	0.502
$p(F_{actual} > F_{RMS})$	0.004	0.034	0.031	0.075
$F_{actual}/F_{LÍMITE}$	0.232	0.272	0.243	0.330
$p(F_{actual} > F_{LÍMITE})$	0.000	0.000	0.000	0.000
$S_{actual}/30\%S0_{d}$	1.73	1.35	1.49	1.46
$p(S_{actual} < 30\%S0_{d})$	0.0000588	0.044	0.004	0.081
$S_{(actual)\ (/)\ S(RMS\_d)}$	2.38	1.82	1.91	2.22
$p(S_{actual} < S_{RMS\_d})$	0.000	0.000	0.000	0.000
$S_{actual}/S_{LÍMITE}$	7.67	5.43	7.23	7.48
$p(S_{actual} < S_{LÍMITE})$	0.000	0.000	0.000	0.000

C. SKIPJACK TUNA

Skipjack tuna are distributed in tropical waters across the Pacific Ocean. In the eastern Pacific Ocean (EPO), the majority of catch is taken by the purse seine fishery. Since 1990 the purse-seine fishery associated with floating objects has become the dominant fishery type (Figure C-1).

A benchmark stock assessment for skipjack tuna in the EPO was conducted using an integrated statistical age-structured catch-at-length model in Stock Synthesis. This assessment represents a significant improvement from the initial interim assessment conducted in 2022. It reflects major advancements in the assessment methodologies and incorporates new data sets, including tagging data collected through the Regional Tuna Tagging Program in the EPO.

Several data sources are available to fit the model, including data from sixteen defined fisheries and five “surveys”. The fisheries are classified by gear type (purse-seine, longline) and purse-seine set type, which includes dolphin-associated (DEL), floating-object associated (OBJ), and unassociated (NOA) sets, as well as by geographical area of operation. The "surveys” data include: a) catch-per-set indices for purse-seine sets, by set type (OBJ, NOA), where the relationship between catch-per-set and abundance remains uncertain; b) an index based on recently developed echosounder buoy data; c) absolute biomass from a spatiotemporal Petersen-type model applied to tag-recapture data; and d) an index of relative biomass from a tagging biomass model that uses a flexible effort assumption. A reference model is developed based on the most plausible assumptions and sensitivity analyses are conducted by changing the assumptions of the reference model. There is substantial uncertainty about several model assumptions and sensitivity analyses are conducted to determine if the management advice is robust to the uncertainty, especially concerning model assumptions about growth and selectivity. There is also uncertainty about the reliability of different data sources, and there is conflict in the information they provide about absolute abundance. Sensitivity analyses are conducted to determine if the management advice is robust to the use of the different data sources. The diagnostics indicate that a data conflict exists. However, the management results were robust to the model assumptions about growth and selectivity, as well as to the inclusion or exclusion of the index of abundance and length-composition data sets.

MSY-based quantities cannot be estimated because the tradeoff between growth and natural mortality, in combination with the assumption that recruitment is independent of stock size, implies fish should be caught at the youngest ages to maximize yield, implying that the optimal fishing mortality should be infinite. Therefore, a conservative proxy for the target biomass of SBR = 0.3 based on values for bigeye and yellowfin, and the fishing mortality corresponding to that biomass, are proposed as the target reference points (SAC-14-09; SAC-14 INF-O). The reference model estimated that the 2023 exploitation rate was below *status quo* (average level of 2017-2019; Figure C-2). Only one of the sensitivity analyses, which removed the ECHO index, estimated exploitation rates that exceeded the *status quo* in 2023 slightly (Table C-1). The reference model and most of the sensitivity analyses estimate that the current biomass is above the target reference point and the fishing mortality is below the target fishing mortality (Figure C-3, Table C-1). Only the pessimistic model that excluded the echosounder buoy index estimates that the stock is below the proxy target and only when based on the static definition (Table C-1). None of these scenarios estimate that the stock is below the limit reference point (Table C-1).

A risk assessment conducted herein incorporates both the reference and seventeen sensitivity models to provide management advice, treating all models with equal weight. The risk analysis reveals unimodal probability distributions for key management metrics, indicating: a) a 4% probability that the spawning biomass at the start of 2024 was below 30% of the unexploited level, according to the dynamic SBR ($dSBR_{MSY\ proxy}$), b) zero probability that average fishing mortality during 2021-2023 exceeded the level associated with the target biomass ($F_{MSY\ proxy}$), and c) less than 1% probability that the spawning biomass at the start of 2024 was below the limit reference point (S_{limit}) (Figure C-4).

The improvement of the stock assessment for skipjack and future management advice will continue to strongly rely on the implementation of a comprehensive tagging program.

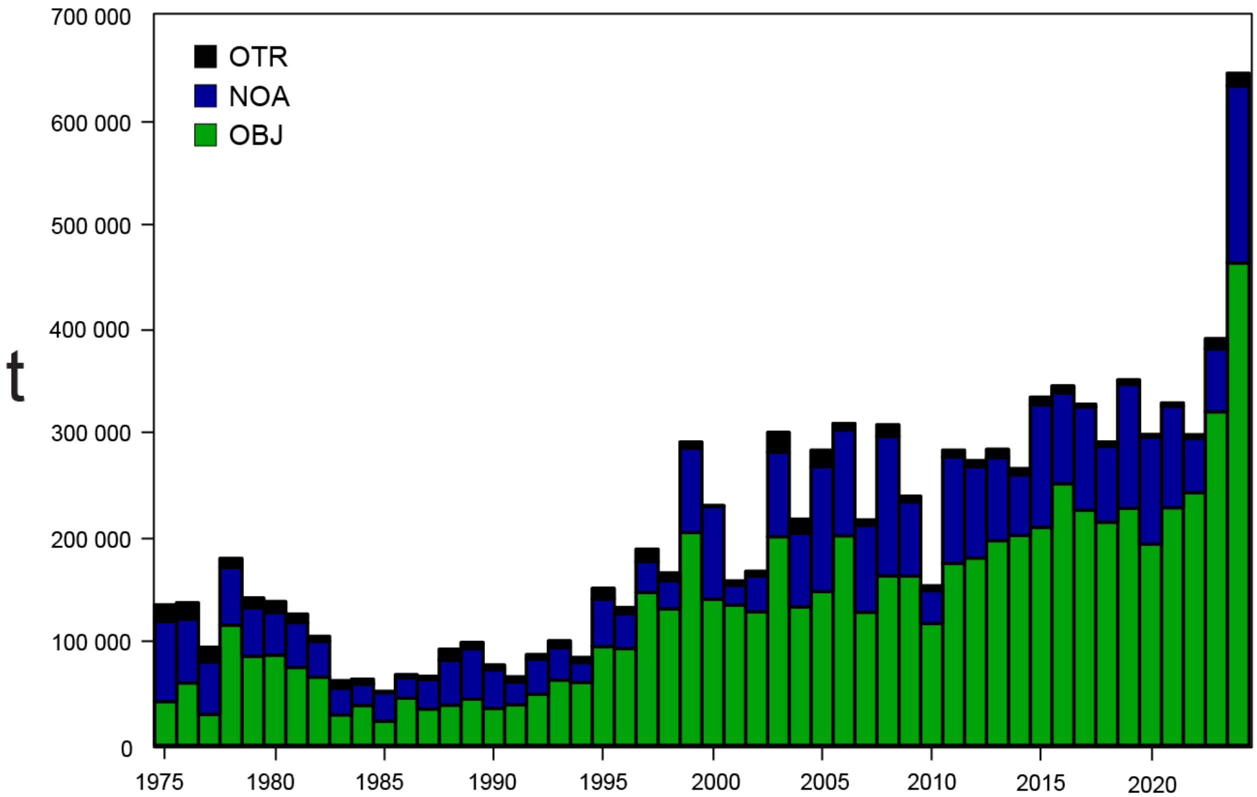


FIGURE C-1. Total catches (retained catches plus discards) for the purse-seine fisheries, by set type (NOA, OBJ) and retained catches for the other (OTR) fisheries, of skipjack tuna in the eastern Pacific Ocean, 1975-2023. The purse-seine catches are adjusted to the species composition estimate obtained from sampling the catches. The 2020 catch data are preliminary.

FIGURA C-1. Capturas totales (capturas retenidas más descartes) en las pesquerías de cerco, por tipo de lance (NOA, OBJ), y capturas retenidas de las otras pesquerías (OTR), de atún barrilete en el Océano Pacífico oriental, 1975-2023. Se ajustan las capturas de cerco a la estimación de la composición por especie obtenida del muestreo de las capturas. Los datos de captura de 2020 son preliminares.

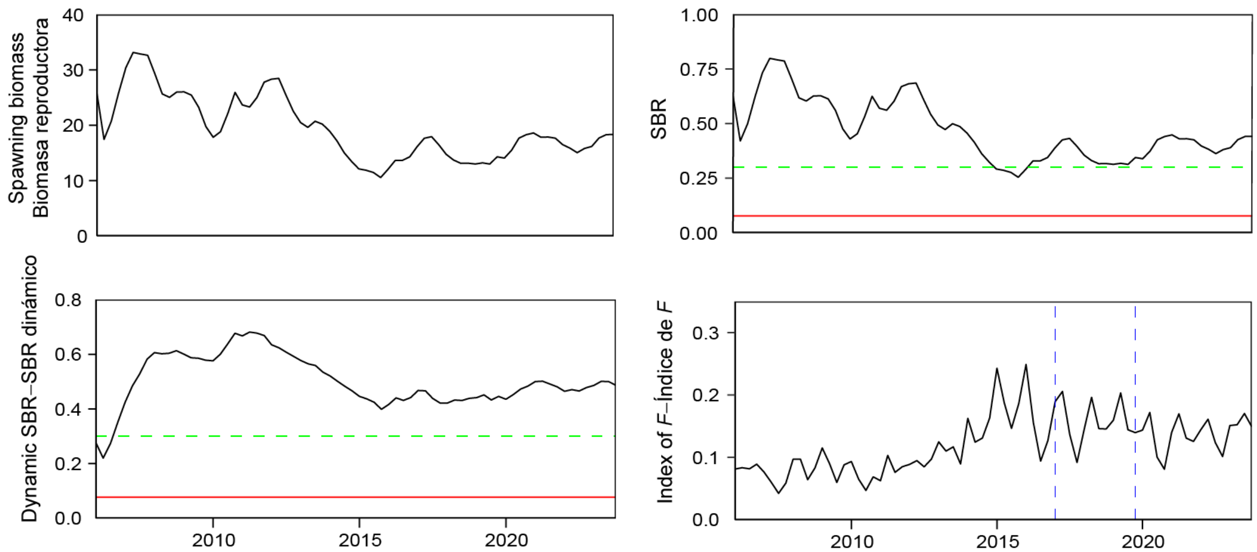


FIGURE C-2. Spawning biomass, spawning biomass ratio, dynamic spawning biomass ratio, and an index of quarterly exploitation rate for the reference model. The green dashed horizontal line is the target biomass reference point (SBR = 0.3) and the red horizontal dashed line is the limit biomass reference point (SBR = 0.077). The two vertical lines represent the *status quo* period (2017-2019).

FIGURA C-2. Biomasa reproductora, cociente de biomasa reproductora, cociente de biomasa reproductora dinámica y un índice de la tasa de explotación trimestral para el análisis de sensibilidad que supone que la edad de un pez de 37 cm es 3 trimestres. La línea horizontal verde discontinua es el punto de referencia objetivo de la biomasa (SBR = 0.3) y la línea horizontal roja discontinua es el punto de referencia límite de la biomasa (SBR = 0.077). Las dos líneas verticales representan el periodo de *statu quo* (2017-2019).

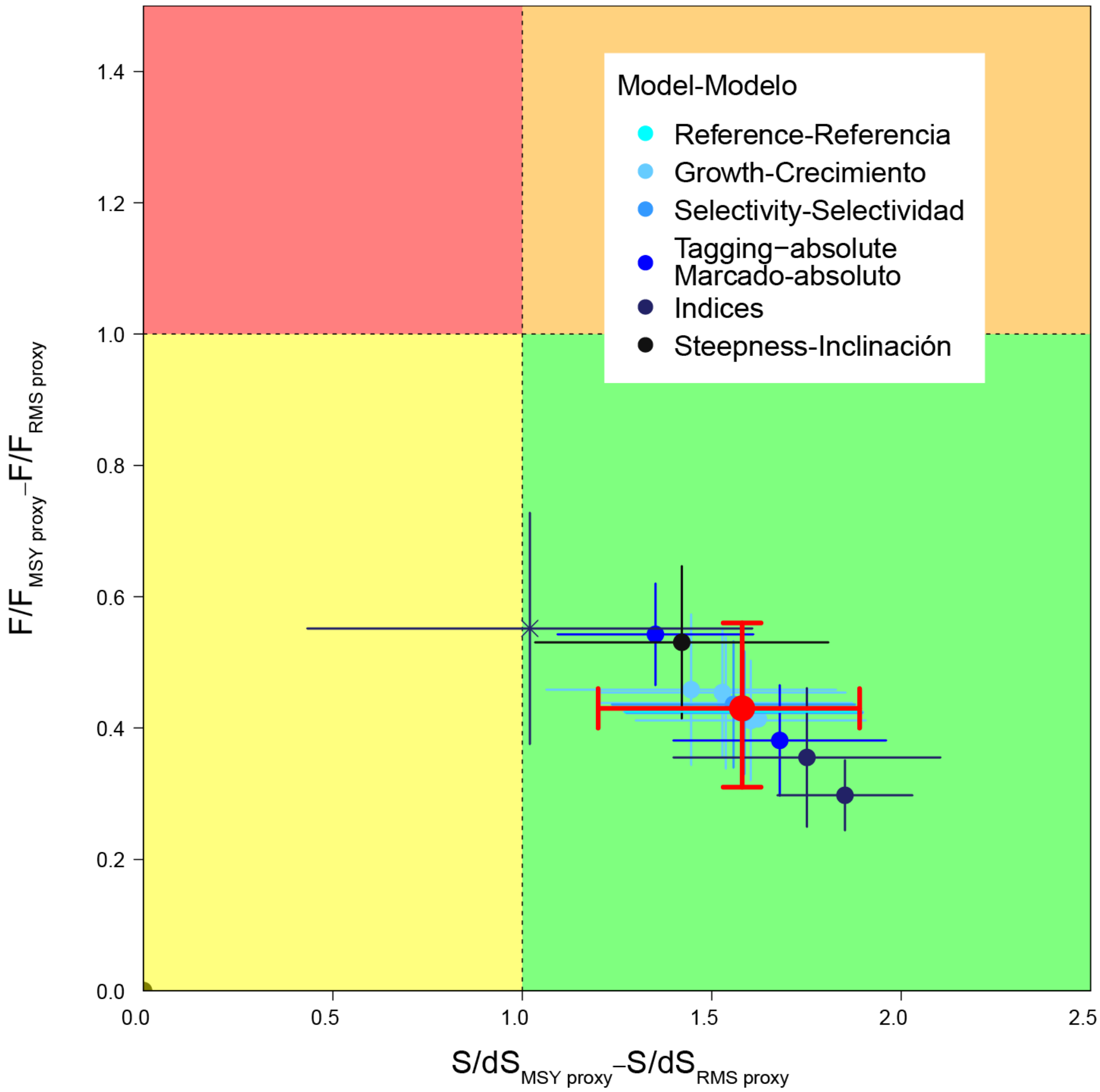


FIGURE C-3. Kobe plot showing the stock status estimates from all the models. The red dot and error bars represent weighted values across all eighteen models. The deep indigo cross and error bars represent the estimates from the model in which the ECHO index was removed.

FIGURA C-3. Gráfica de Kobe que muestra las estimaciones de la condición de la población de todos los modelos. El punto rojo y las barras de error representan los valores ponderados de los 18 modelos. La cruz azul oscuro y las barras de error representan las estimaciones del modelo en el que se eliminó el índice ECO.

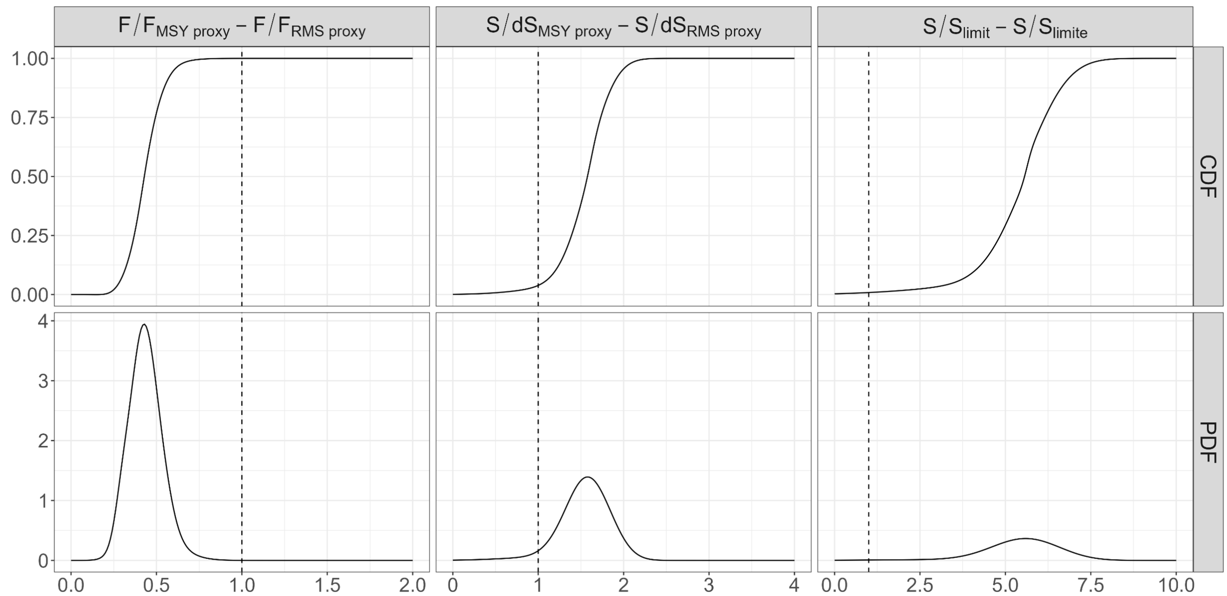


FIGURE C-4. The joint probability and cumulative distributions for spawning biomass (*S*) in the first quarter of 2024 and fishing mortality (*F*) in 2021-2023 relative to their reference points ($F_{\text{MSY proxy}}$, d$S_{\text{MSY proxy}}$, S_{limit}).

FIGURA C-4. Las distribuciones acumuladas y de probabilidad conjunta para la biomasa reproductora (*S*) en el primer trimestre de 2024 y la mortalidad por pesca (*F*) en 2021-2023 con respecto a sus puntos de referencia ($F_{\text{RMS sust.}}$, d$S_{\text{RMS sust.}}$, $S_{\text{límite}}$).

TABLE C-1. Estimates of spawning biomass (SB), spawning biomass ratio (SBR) and dynamic spawning biomass ratio (dSBR) at the beginning of 2024, average recruitment over the model time period (except the 4th quarter of 2023) as a ratio of the estimated virgin recruitment for all of the models, average exploitation rate in 2022 as a ratio of the *status quo*, average exploitation rate in 2023 as a ratio of the *status quo*, and current fishing mortality (the average *F* over the most recent three years, 2021-2023) as a ratio of the fishing mortality corresponding to $B_{\text{MSY proxy}} = 0.3B_0$. R_{ave}/R_0 is a check to make sure the SBR based on B_0 is not biased due to the bias correction for recruitment residuals (this will affect the plots of SBR that are plotted with confidence intervals). The dSBR is adjusted by the ratio R_{ave}/R_0. The red highlighting and text indicate where SBR or dSBR are below the proxy target reference point (0.3) and when the *status quo* fishing mortality (average of 2017-2019) has been exceeded.

TABLA C-1. Estimaciones de biomasa reproductora (SB), cociente de biomasa reproductora (SBR), cociente de biomasa reproductora dinámica (dSBR), reclutamiento promedio a lo largo del periodo del modelo (excepto el cuarto trimestre de 2023) como razón del reclutamiento virgen estimado para todos los modelos, tasa promedio de explotación en 2022 como razón del *statu quo*, tasa promedio de explotación en 2023 como razón del *statu quo*, y mortalidad por pesca actual como razón de la mortalidad por pesca correspondiente a $B_{\text{objetivo}} = 0.3B_0$. R_{prom}/R_0 es una comprobación para asegurarse de que el SBR basado en B_0 no esté sesgado debido a la corrección del sesgo por los residuales de reclutamiento (esto afectará a las gráficas de SBR que se trazan con intervalos de confianza). El dSBR se ajusta por la razón R_{prom}/R_0. Las celdas y el texto en rojo indican los casos en que el SBR o dSBR están por debajo del punto de referencia objetivo sustituto (0.3) y cuando se ha rebasado la mortalidad por pesca del *statu quo* (promedio de 2017-2019).

ID	Model	SB_{cur}	SBR_{cur}	$dSBR_{cur}$	R_{av}/R_0	F_{2022}/F_{sq}	F_{2023}/F_{sq}	$F_{cur}/FB_{\text{MSY proxy}}$
	Reference model	17809	0.43	0.47	0.95	0.85	0.85	0.42
a1	Eatimating L_{inf}	17873	0.43	0.48	0.95	0.85	0.85	0.42
a2	L_{inf} = 78 cm	16769	0.42	0.46	0.95	0.85	0.85	0.45
a3	L_{inf} = 88 cm	18181	0.43	0.48	0.96	0.85	0.84	0.41
a4	Estimating L_{cv}	14055	0.41	0.43	1.01	0.82	0.82	0.46
a5	L_{cv} = 0.03	18926	0.43	0.49	0.94	0.86	0.85	0.41
a6	L_{cv} = 0.09	16612	0.42	0.46	0.97	0.84	0.84	0.44
a7	Estimating growth shape parameter	17814	0.43	0.48	0.95	0.85	0.85	0.42
b1	Constant longline selectivity after 78 cm	17873	0.43	0.48	0.95	0.85	0.85	0.42
b2	Constant longline selectivity after 83 cm	17818	0.43	0.48	0.95	0.85	0.85	0.42
b3	Constant longline selectivity after 88 cm	17826	0.43	0.48	0.95	0.85	0.85	0.42
b4	F9 asymptotic selectivity, fixed longline selectivity and no fit for longline size composition	17263	0.42	0.47	0.96	0.85	0.85	0.44
c1	Using the most precise tagging-based absolute index and upweight by ten times	13357	0.37	0.41	0.95	0.90	0.87	0.54
c2	Using four tagging-based absolute indices with low CVs and weight by one	20018	0.46	0.50	0.96	0.83	0.83	0.38
d1	No tagging-based absolute index	21849	0.47	0.53	0.96	0.83	0.83	0.36
d2	No echosounder buoy index	8543	0.22	0.31	0.96	1.00	1.07	0.55
d3	Including longline survey index and size composition	24444	0.50	0.56	0.95	0.80	0.85	0.30
e1	Steepness = 0.75	18420	0.39	0.43	0.92	0.85	0.84	0.53

D. BIGEYE TUNA

For the full version of this analysis, see document SAC-15-02.

Bigeye tuna are distributed in tropical and temperate waters across the Pacific Ocean. In the eastern Pacific Ocean (EPO), the majority of catch before 1993 was taken by longline fisheries that target large bigeye (Figure D-1). Due to the expansion of purse-seine fisheries associated with floating objects, purse-seine fisheries that catch small bigeye have replaced longline fisheries as the dominant fishery type for EPO bigeye since 1996. A workplan to improve the stock assessments for tropical tunas was executed and an external review for data used in stock assessments and an external review of modelling aspects for stock assessments were completed.

In the last benchmark assessment, the overarching hypothesis for bigeye tuna aimed to explain the apparent regime shift in recruitment estimates that coincided with the expansion of the floating-object fishery in the EPO. However, the degree of the regime shift in recruitment estimates from the new assessment models is reduced greatly, from 140% to 20% for the base reference model. As such, this overarching hypothesis is not included in this benchmark assessment. This significant decrease of the regime shift in recruitment results from the combination of changes made to the assessment model. Among these changes the most influential in reducing the regime shift are adding one more time block to the selectivity of longline fishery fleets in 2011, improving the CPUE standardization model, and using the Lorenzen natural mortality curve for juvenile bigeye. The reference models in this benchmark assessment address three major uncertainties within a hierarchical framework: (1) the misfit to the length-composition data for the longline fishery that is assumed to have asymptotic selectivity; (2) the degree of effort creep in the longline fishery; and (3) the steepness of the stock-recruitment relationship.

Level 1 hypothesis: Four models are included to address the misfit to the composition data for the longline fishery that is assumed to have asymptotic selectivity: (1) ignore the issue (Fix); (2) estimate the growth curve with a prior on L_{inf} (Gro); (3) estimate a dome-shape selectivity curve for the longline fishery that is assumed to have asymptotic selectivity (Sel); and (4) estimate the scaler of the natural mortality vector (Mrt). Additionally, a model where growth rather than natural mortality is sex-specific is explored to address the misfit, but it is not included for this hypothesis due to its worse misfit compared to the model where the issue is ignored (Fix). The four reference models are equally weighted. The decision to equally weight the four models is made based on the outcome of the two risk analysis workshops organized by the IATTC (WSRSK-01-RPT and WSRSK-02-RPT).

Level 2 hypothesis: Three levels of annual increasing rate of the longline catchability for bigeye are included to address the uncertainty in effort creep. Considering that bigeye is the main target species of the Japanese longline fishery in the EPO, its catchability in this fishery is expected to increase owing to advancements in fishing skill and technology. The review panel suggests considering a 1% annual increase in the catchability of bigeye in the longline fishery (RVMTT-01-RPT). Based on this recommendation, three annual increases in longline catchability (0%, 1%, and 2%) are considered to address this uncertainty, each equally weighted.

Level 3 hypothesis: Three steepness values (1.0, 0.9, and 0.8) are included to address the uncertainty in the shape of the stock-recruitment relationship. The three steepness values are weighted based on expert judgement from the risk analysis for the last benchmark assessment (SAC-11 INF-F).

The results from the thirty-three converged reference models show that (1) the recruitment shift is not apparent in this benchmark assessment (Figure D-2); (2) all models show a decreasing trend in spawning biomass while the scale of the spawning biomass varies dramatically among models (Figure D-3); (3) since 2021, the fishing mortality on both juvenile and adult bigeye has decreased significantly (Figure D-4).

Regarding management quantities, the thirty-three converged reference models estimate that (1) the spawning biomass of bigeye at the beginning of 2024 ranges from 45% to 292% of the spawning biomass at dynamic MSY; (2) the fishing mortality of bigeye in 2021-2023 ranges from 42% to 136% of the fishing mortality at MSY; (3) the spawning biomass of bigeye at the beginning of 2024 ranges from 134% to 346% of the spawning biomass at the limit level; and (4) the fishing mortality of bigeye in 2021-2023 ranges from 35% to 80% of the fishing mortality at the limit level.

The estimates from the thirty-three converged reference models are combined in a risk analysis framework to provide management advice. The overall results of the risk analysis show unimodal probability distributions for management quantities. The shift from a bimodal to unimodal pattern in the distributions likely results from resolving the regime shift in recruitment in this benchmark assessment. The risk analysis indicates that there is a (1) 46.6% probability that the spawning biomass at the beginning of 2024 is below the target reference point (S_{MSY_d}) (Figure D-6); (2) 24.7% probability that the fishing mortality in 2021-2023 is above the target reference point (F_{MSY}) (Figure D-6); (3) 58.5% probability that the fishing mortality in 2017-2019 (the *status quo* period) was above the target reference point (F_{MSY}) (Figure D-7); (4) 0.2% probability that the spawning biomass at the beginning of 2024 is below the limit reference point (S_{Limit}) (Figure D-8); and (5) 0.1% probability that the fishing mortality in 2021-2023 is above the limit reference point (F_{Limit}) (Figure D-8). The weighted 10-year projection under the current fishing mortality suggests there is a 50% probability that the spawning biomass ratio at the beginning of 2034 will be above 0.27 (Figure D-9).

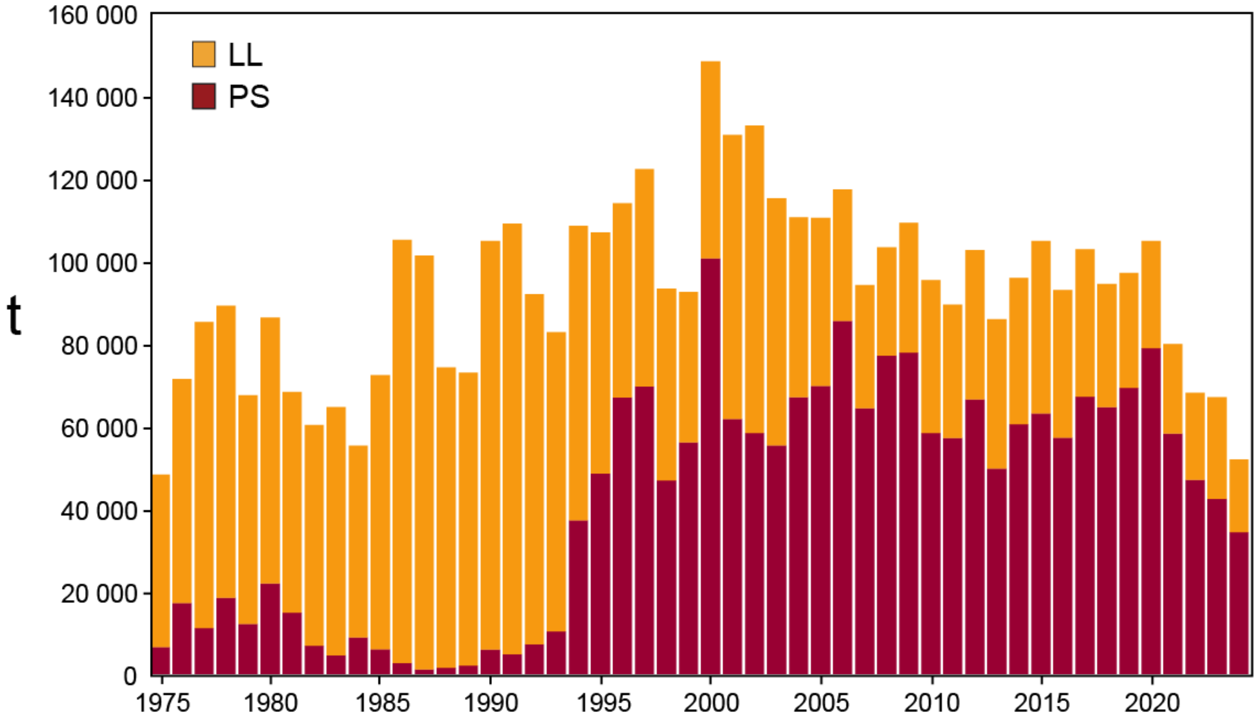


FIGURE D-1. Total catches (retained catches plus discards) by the purse-seine (PS) fisheries, and retained catches by the longline (LL) fisheries, of bigeye tuna in the eastern Pacific Ocean, 1975-2023. The purse-seine catches are adjusted to the species composition estimate obtained from sampling the catches. 2020 and 2021 data are preliminary.
FIGURA D-1. Capturas totales (capturas retenidas más descartes) de las pesquerías de cerco (PS), y capturas retenidas de las pesquerías de palangre (LL), de atún patudo en el Océano Pacífico oriental, 1975-2023. Se ajustan las capturas de cerco a la estimación de la composición por especie obtenida del muestreo de las capturas. Los datos de 2020 y 2021 son preliminares.

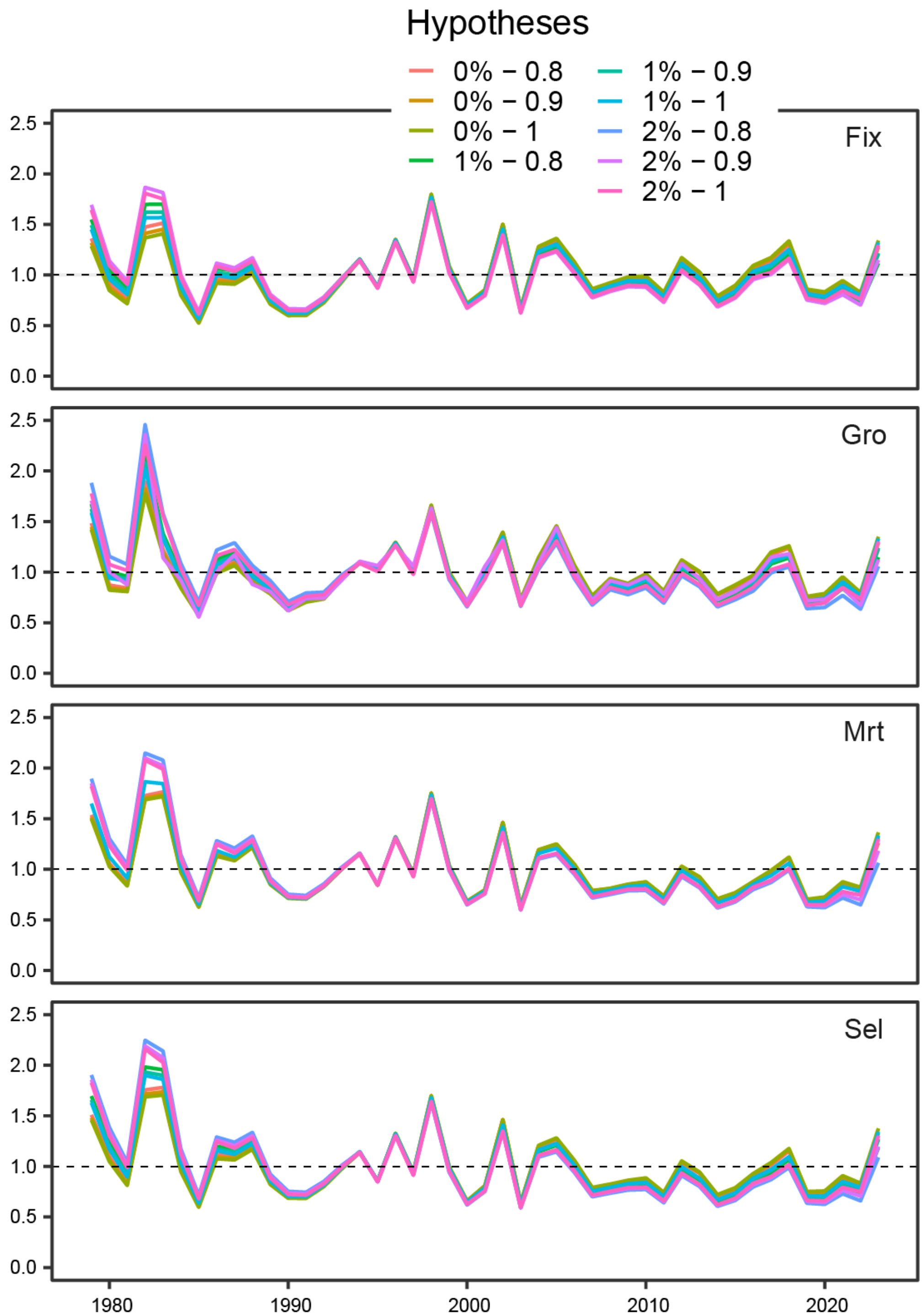


FIGURE D-2. Comparison of estimated relative annual recruitment of bigeye tuna between 1979 and 2023.
FIGURA D-2. Comparación del reclutamiento anual relativo estimado del atún patudo entre 1979 y 2023.

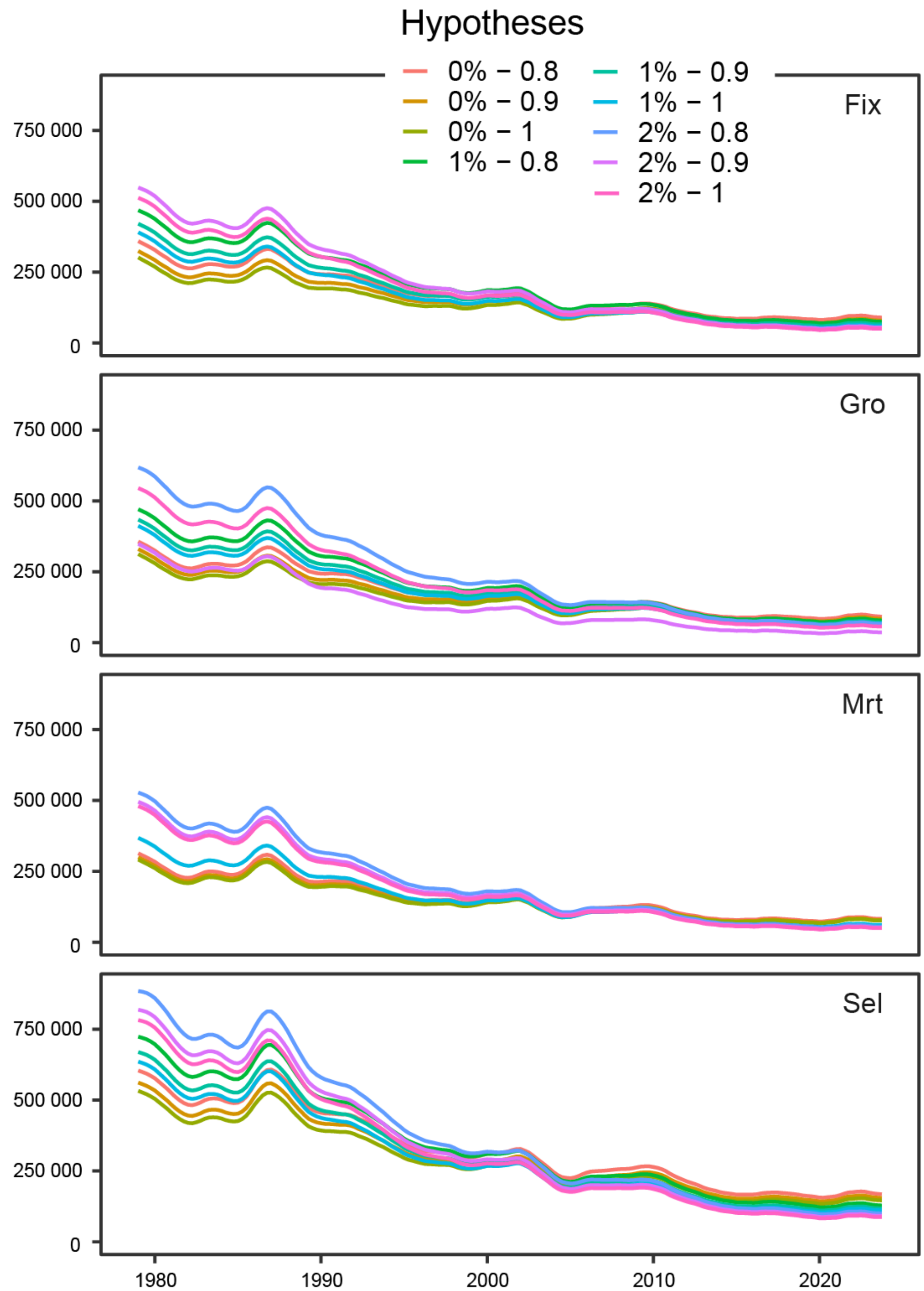


FIGURE D-3. Comparison of estimated spawning biomass of bigeye tuna between 1979 and 2023.
FIGURA D-3. Comparación de la biomasa reproductora estimada del atún patudo entre 1979 y 2023.

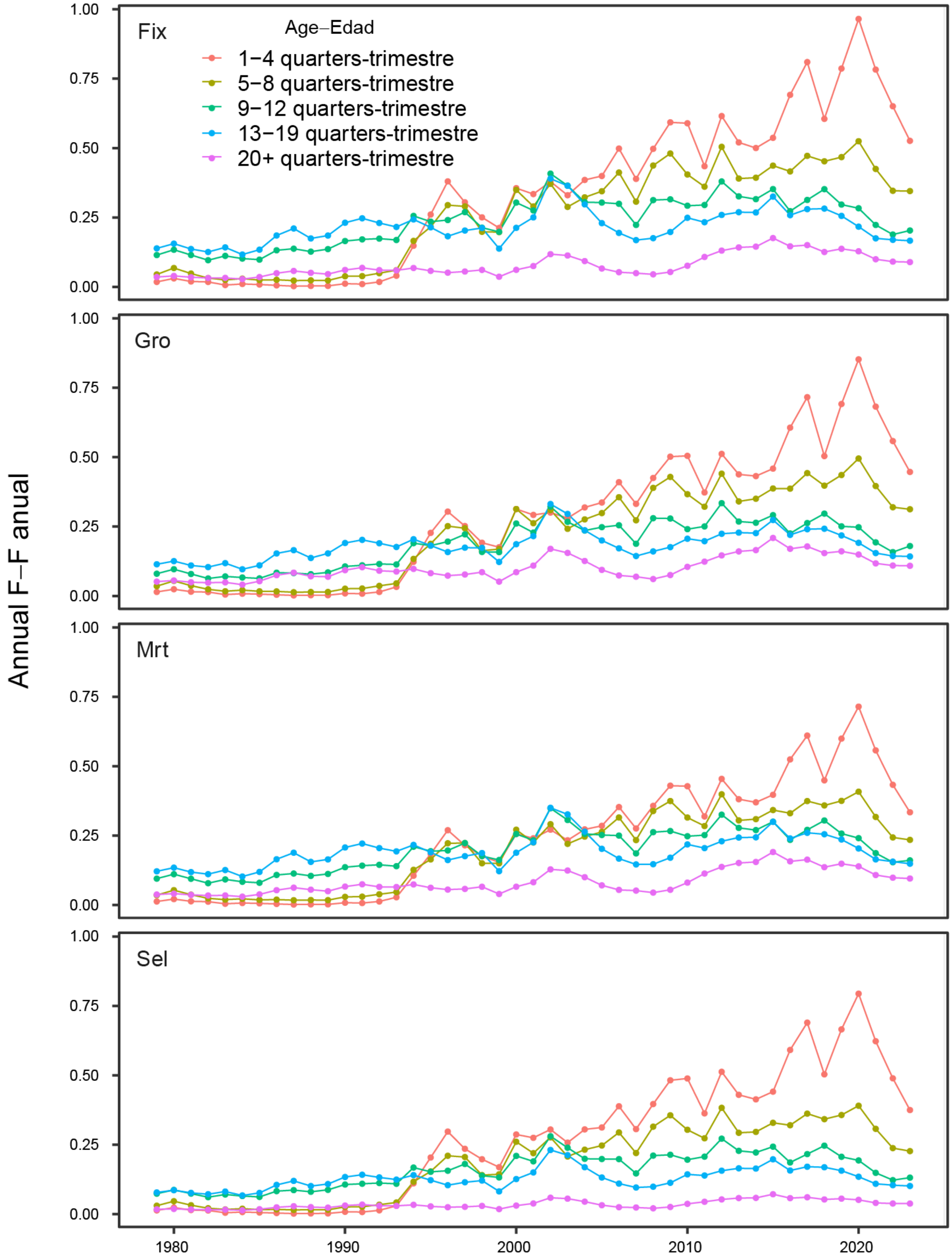


FIGURE D-4. Comparison of average annual fishing mortality, by age groups, of bigeye tuna between 1979 and 2023. The values for each model and age group are weighted across the second- and third-level hypotheses.
FIGURA D-4. Comparación de la mortalidad por pesca anual promedio, por grupos de edad, del atún patudo entre 1979 y 2023. Los valores para cada modelo y grupo de edad se ponderan en las hipótesis de segundo y tercer nivel.

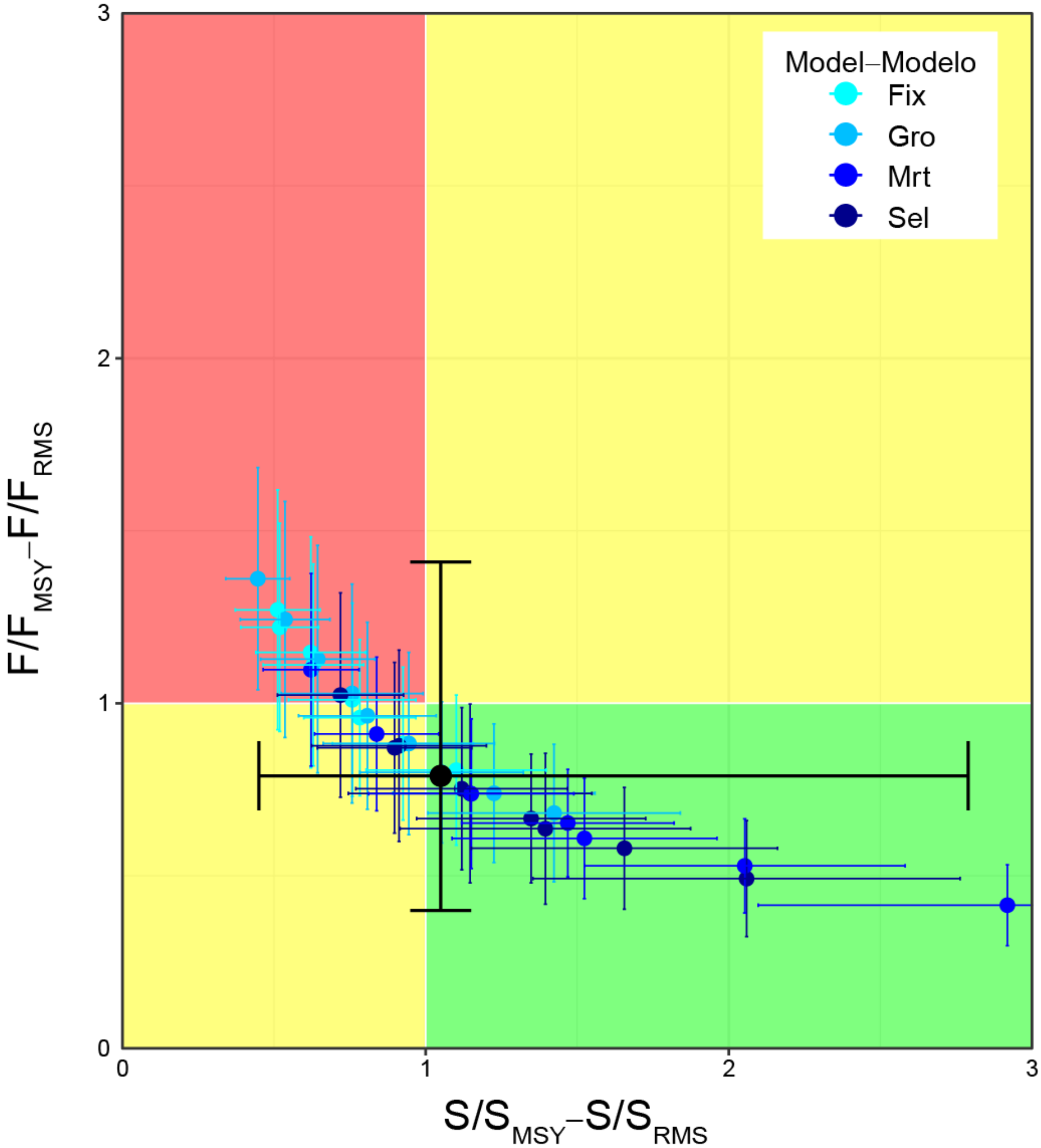


FIGURE D-5. Kobe plot of the most recent estimates of spawning biomass (*S*) and fishing mortality (*F*) relative to their MSY reference points (*SMSY_d* and *FMSY*) from the thirty-three reference models. Each dot is based on the average *F* over the most recent three years, 2021-2023, and the error bars represent the 95% confidence interval of model estimates. The black dot and error bars represent the medium and 95% confidence interval of combined values, respectively.

FIGURA D-5. Gráfica de Kobe de las estimaciones más recientes de biomasa reproductora (*S*) y mortalidad por pesca (*F*) con respecto a sus puntos de referencia de RMS (*SRMS_d* y *FRMS*) de los 33 modelos de referencia. Cada punto se basa en la *F* promedio de los últimos tres años, 2021-2023, y las barras de error representan el intervalo de confianza del 95% de las estimaciones de los modelos. El punto negro y las barras de error representan el intervalo de confianza medio y del 95% de los valores combinados, respectivamente.

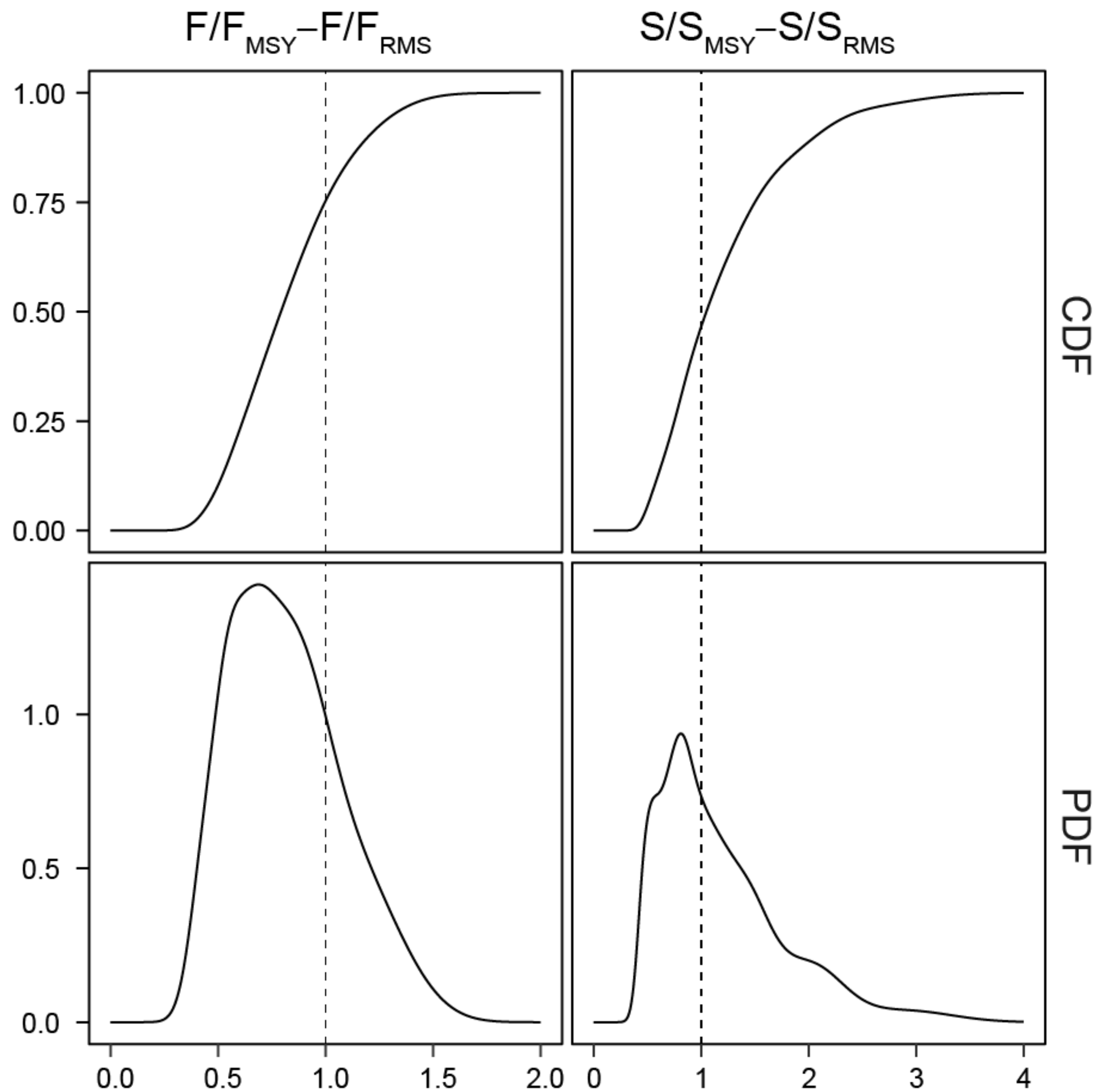


FIGURE D-6. The joint probability and cumulative distribution functions for spawning biomass (S) in the first quarter of 2024 and fishing mortality (F) in 2021-2023 relative to their MSY reference points (S_{MSY_d} and F_{MSY}).
FIGURA D-6. Funciones de distribución acumulada y de probabilidad conjunta para la biomasa reproductora (*S*) en el primer trimestre de 2024 y la mortalidad por pesca (*F*) en 2021-2023 en relación con sus puntos de referencia de RMS (*SRMS_d y FRMS*).

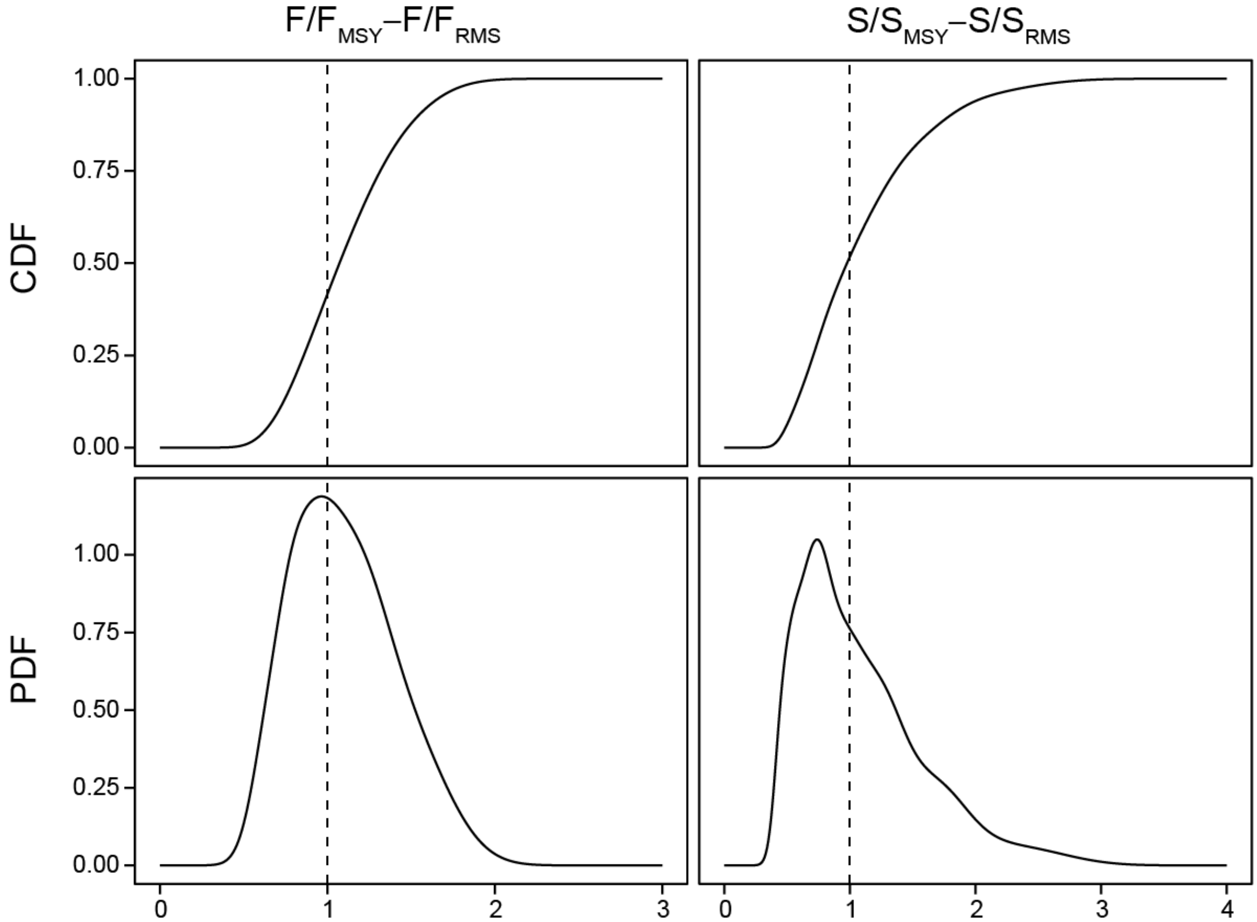


FIGURE D-7. The joint probability and cumulative distribution functions for spawning biomass (*S*) in the first quarter of 2020 and fishing mortality (*F*) in 2017-2019 relative to their MSY reference points (S_{MSY_d} and F_{MSY}).
FIGURA D-7. Funciones de distribución acumulada y de probabilidad conjunta para la biomasa reproductora (*S*) en el primer trimestre de 2020 y la mortalidad por pesca (*F*) en 2017-2019 en relación con sus puntos de referencia de RMS (*SRMS_d y FRMS*).

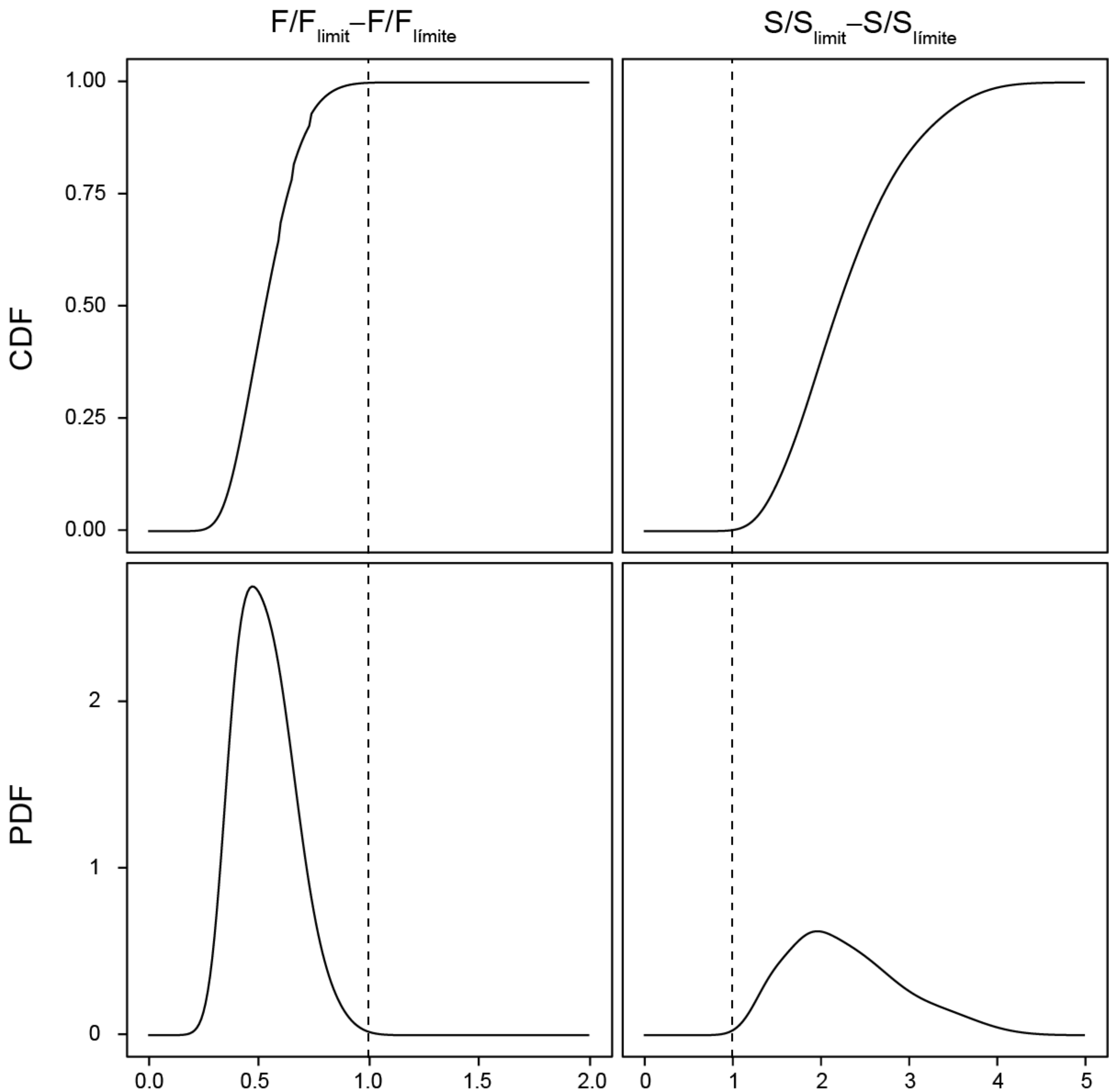


FIGURE D-8. The joint probability and cumulative distribution functions for spawning biomass (S) in the first quarter of 2024 and fishing mortality (F) in 2021-2023 relative to their limit reference points (S_{Limit} and F_{Limit}).
FIGURA D-8. Funciones de distribución acumulada y de probabilidad conjunta para la biomasa reproductora (*S*) en el primer trimestre de 2024 y la mortalidad por pesca (*F*) en 2021-2023 en relación con sus puntos de referencia límite ($S_{Límite}$ y $F_{Límite}$).

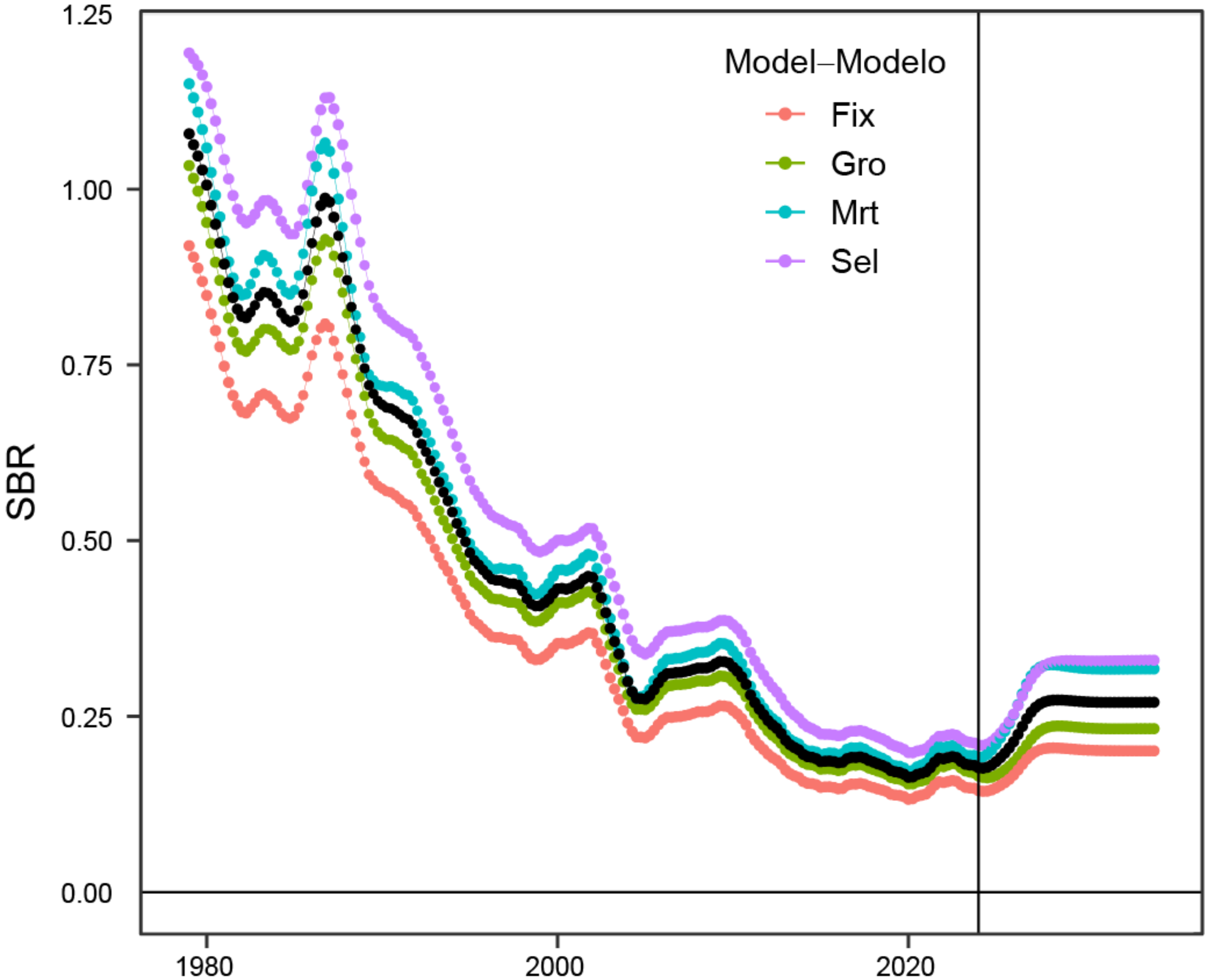


FIGURE D-9. The 10-year (2024-2033) projection of spawning biomass ratio under average recruitment and current fishing mortality. The color dots represent weighted values across the second- and third-level hypotheses and the black dots represent the weighted values across all thirty-three reference models.

FIGURA D-9. Proyección a 10 años (2024-2033) del cociente de biomasa reproductora bajo reclutamiento promedio y mortalidad por pesca actual. Los puntos de colores representan los valores ponderados en las hipótesis de segundo y tercer nivel y los puntos negros representan los valores ponderados en los 33 modelos de referencia.

E. PACIFIC BLUEFIN TUNA

Tagging studies have shown that there is exchange of Pacific bluefin between the eastern and western Pacific Ocean. Larval, post larval, and early juvenile bluefin have been caught in the western Pacific Ocean (WPO), but not in the eastern Pacific Ocean (EPO), so it is likely that there is a single stock of bluefin in the Pacific Ocean (or possibly two stocks in the Pacific Ocean, one spawning in the vicinity of Taiwan and the Philippines and the other spawning in the Sea of Japan).

Most of the commercial catches of bluefin in the EPO are taken by purse seiners. Nearly all of the purse-seine catches have been made west of Baja California and California, within about 100 nautical miles of the coast, between about 23°N and 35°N. Ninety percent of the catch is estimated to have been between about 60 and 100 cm in length, representing mostly fish 1 to 3 years of age. Aquaculture facilities for bluefin were established in Mexico in 1999, and some Mexican purse seiners began to direct their effort toward bluefin during that year. During recent years, most of the catches have been transported to holding pens, where the fish are held for fattening and later sale to sashimi markets. Lesser amounts of bluefin are caught by recreational, gillnet, and longline gear. Bluefin have been caught in the EPO during every month of the year, but most of the fish are taken from May through October.

Bluefin are exploited by various gears in the WPO from Taiwan to Hokkaido, Japan. Age-0 fish, about 15 to 30 cm in length, are caught by the Japanese troll fishery during July-October south of Shikoku Island and south of Shizuoka Prefecture. During November-April, age-0 fish about 35 to 60 cm in length are taken in troll fisheries south and west of Kyushu Island. Age-1 and older fish are caught by purse seining, mostly during May-September, between about 30°-42°N and 140°-152°E. Bluefin of various sizes are also caught by traps, gillnets, and other gear, especially in the Sea of Japan. Additionally, small amounts of bluefin are caught near the southeastern coast of Japan by longlining. The Chinese Taipei small-scale longline fishery, which has expanded since 1996, takes bluefin tuna more than 180 cm in length from late April to June, when they are aggregated for spawning in the waters east of the northern Philippines and Taiwan.

The high-seas longline fisheries are directed mainly at tropical tunas, albacore, and billfishes, but small amounts of Pacific bluefin are caught by these fisheries. Small amounts of bluefin are also caught by Japanese pole-and-line vessels on the high seas.

Tagging studies, conducted with conventional and archival tags, have revealed a great deal of information about the life history of bluefin. Some fish apparently remain their entire lives in the WPO, while others migrate to the EPO. These migrations begin mostly during the first and second years of life. The first- and second-year migrants are exposed to various fisheries before beginning their journey to the EPO. Then, after crossing the ocean, they are exposed to commercial and recreational fisheries off California and Baja California. Eventually, the survivors return to the WPO.

Bluefin more than about 50 cm in length are most often found in waters where the sea-surface temperatures (SSTs) are between 17° and 23°C. Fish 15 to 31 cm in length are found in the WPO in waters where the SSTs are between 24° and 29°C. The survival of larval and early juvenile bluefin is undoubtedly strongly influenced by the environment. Conditions in the WPO probably influence recruitment, and thus the portions of the juvenile fish there that migrate to the EPO, as well as the timing of these migrations. Likewise, conditions in the EPO probably influence the timing of the return of the juvenile fish to the WPO.

The total catches of bluefin have fluctuated considerably during the last 50 years (Figure E-1). The consecutive years of above-average catches (mid-1950s to mid-1960s) and below-average catches (early 1980s to early 1990s) could be partially due to consecutive years of above-average and below-average recruitments. The estimated impact of the fisheries on the bluefin population for the entire time period modeled (1952-2012) is substantial (Figure E-2). The WPO fisheries have had a greater impact than the EPO fisheries, and their impact increased starting in 1980s only leveling off in 2000s.

A benchmark stock assessment was carried out by the Pacific Bluefin Working Group of the International Scientific Committee for Tuna and Tuna-like Species in the North Pacific Ocean (ISC) in 2024. The assessment was conducted with Stock Synthesis, an integrated statistical age-structured stock assessment model.

The base-case model results show that: (1) spawning stock biomass (SSB) fluctuated throughout the assessment period (fishing years 1983-2022); (2) the SSB steadily declined from 1996 to 2010; (3) the SSB has rapidly increased since 2011; (4) fishing mortality decreased from a level producing about 1% of spawner-per-recruit (SPR) in 2004-2009 to a level producing 23.6% of SPR in 2020-2022; and (5) SSB in 2022 increased to 23.2% of SSB0, achieving the second rebuilding target by WCPFC and IATTC in 2021, and (6) the probability that it is above 20%SSB0 is 75.9%, which is greater than the 60% defined in resolution C-18-02. Based on the model diagnostics, the estimated biomass trend throughout the assessment period is considered robust. The SSB in 2022 was estimated to be 144,483 t, more than 10 times of its historical low in 2010. An increase in immature fish (0-3 years old) is observed in 2016-2019, likely resulting from reduced fishing mortality on this age group. This led to a substantial increase in SSB after 2019. No biomass-based or fishing mortality limit or target reference points have been adopted to evaluate whether Pacific bluefin is overfished.

Historical recruitment estimates have fluctuated since 1983 without an apparent trend. Currently, stock projections assume that future recruitment will fluctuate around the historical (1983-2020 FY) average recruitment level. Previously, no significant autocorrelation was found in recruitment estimates, supporting the use in the projections of recruitment sampled at random from the historical time series. In addition, now that SSB has recovered to 23.2%SSB0, the PBFWG considers the assumption that the future recruitment will fluctuate within the historical range to be reasonable. The PBFWG also confirmed that the distributions of historical recruitment from the updated long-term model (1952-2022) and the present base-case model (1983-2022) are comparable.

Resolution C-18-02 states that the Commission recognizes that the management objective of the IATTC is to maintain or restore fish stocks at levels capable of producing MSY, and shall implement a provisional rebuilding plan by adopting an 1) initial (first) rebuilding target of $SSB_{med,\ 1952\text{-}2014}$ (the median point estimate for 1952-2014) to be achieved by 2024 with at least 60% probability and 2) a second rebuilding target of 20%SSB0 to be achieved within 10 years of reaching the initial rebuilding target or by 2034, whichever is earlier, with at least 60% probability. The IATTC has adopted resolutions to restrict the catch of bluefin tuna in the EPO (e.g. C-16-08, C-18-01, C-20-02, C-21-05). Resolution C-18-02 also requires that no later than the IATTC meeting in 2020, taking into account the outcomes of the Joint IATTC-WCPFC NC Working Group, the Commission shall consider and develop candidate reference points and harvest control rules. These candidate reference points and harvest control rules will be forwarded to the Joint IATTC-WCPFC NC Working Group and ISC for consideration and potential inclusion in a management strategy evaluation to be completed by the ISC. This task has still not been accomplished.

SSB of PBF reached its initial rebuilding target (SSBMED = 6.3%SSB0) in 2017, 7 years earlier than originally anticipated by the RFMOs, and its second rebuilding target (20%SSB0) in 2021. Resolution C-23-01 provided a harvest control rule to be applied based on the results of stock assessments and SSB projections from the year in which the stock has achieved the second rebuilding target to the year a long-term harvest strategy based on an MSE process is implemented.

a. If the SSB projection indicates that SSB will be below 20%SSB0 with a probability of 60%, management measures shall be modified to increase the SSB to at least 20%SSB0 with 60% probability. For this purpose, the IATTC scientific staff is requested to collaborate with the ISC to provide information on possible management measures to achieve 60% that the stock is above 20%SSB0 after 10 years of the latest stock assessment.

b. If the SSB projection indicates that SSB will be greater than 20%SSB0 with a probability of 60%, management measures should be adjusted so long as any changes maintain SSB greater than 20%SSB0 with a probability of 60%. For this purpose, the IATTC scientific staff is requested to collaborate with the ISC to provide information on possible management under which the stock is maintained above 20%SSB0 with a probability of 60%.

c. Any adjustments to management measures shall be considered in cooperation between the IATTC and WCPFC taking into account historical and future projected proportional fishery impacts on SSB between fisheries in the EPO and fisheries in the WCPO. For this purpose, the IATTC scientific staff is requested to collaborate with the ISC to provide relevant information, including projected proportional fishery impact of potential management measures changes.

d. This harvest control rule will be reviewed and modified, as necessary, if depletion estimates across the time-series have been adjusted due to changes in assumptions and/or settings of the stock assessment model.

Management Strategy Evaluation (MSE) has been completed for Pacific bluefin. The sixteen Harvest Control Rules (HCRs) tested in the MSE were put forward by the Pacific bluefin Joint Working Group (JWG). Each HCR used the same simplified version of the stock assessment model as the estimation model, but varied in the HCR's target fishing mortality and the location of the control points. The HCRs were tested using twenty different operating models based on the stock assessment model and were evaluated based on several performance metrics.The JWG has not agreed on their preferred HCR.

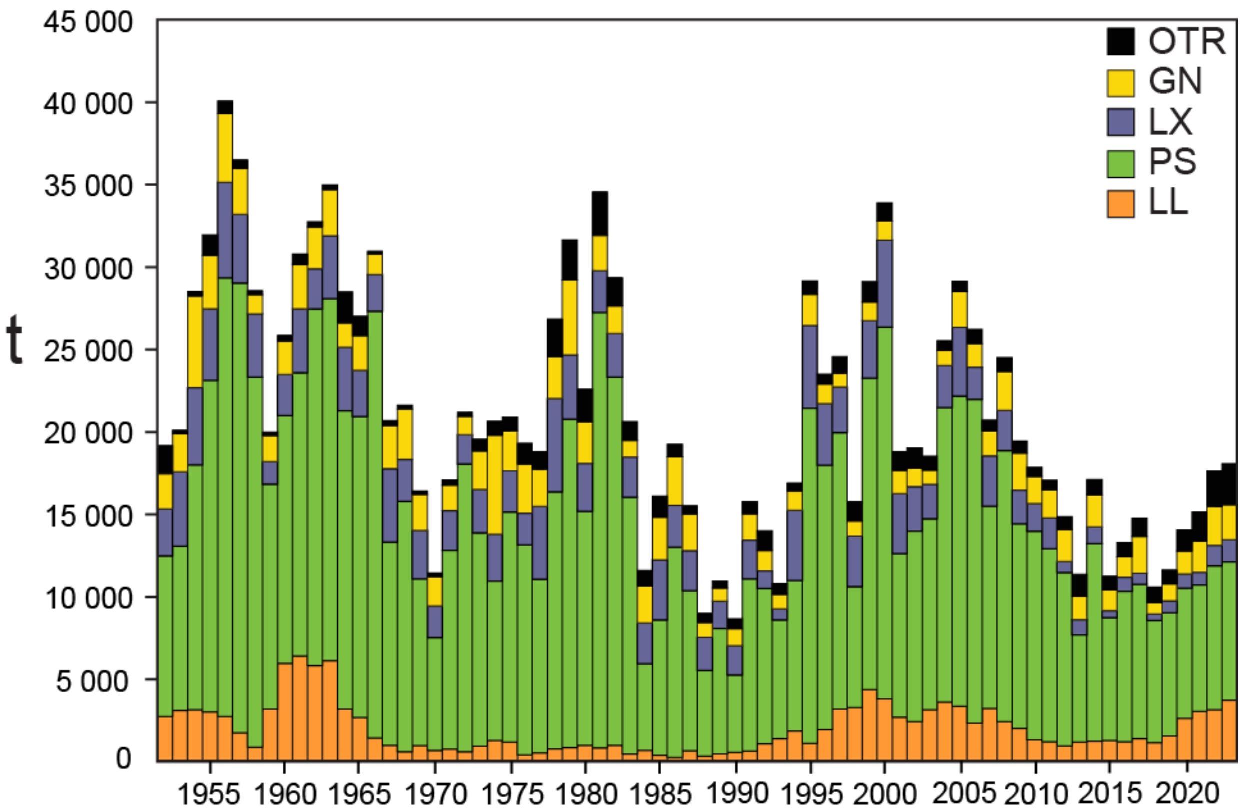


FIGURE E-1. Retained catches of Pacific bluefin tuna, by gear, 1952-2023. GN: gillnet; LL: longline; LX: hook and line; OTR: other; PS: purse seine.
FIGURA E-1. Capturas retenidas de atún aleta azul del Pacífico, por arte, 1952-2023. GN: red agallera; LL: palangre; LX: sedal y anzuelo; OTR: otras; PS: red de cerco.

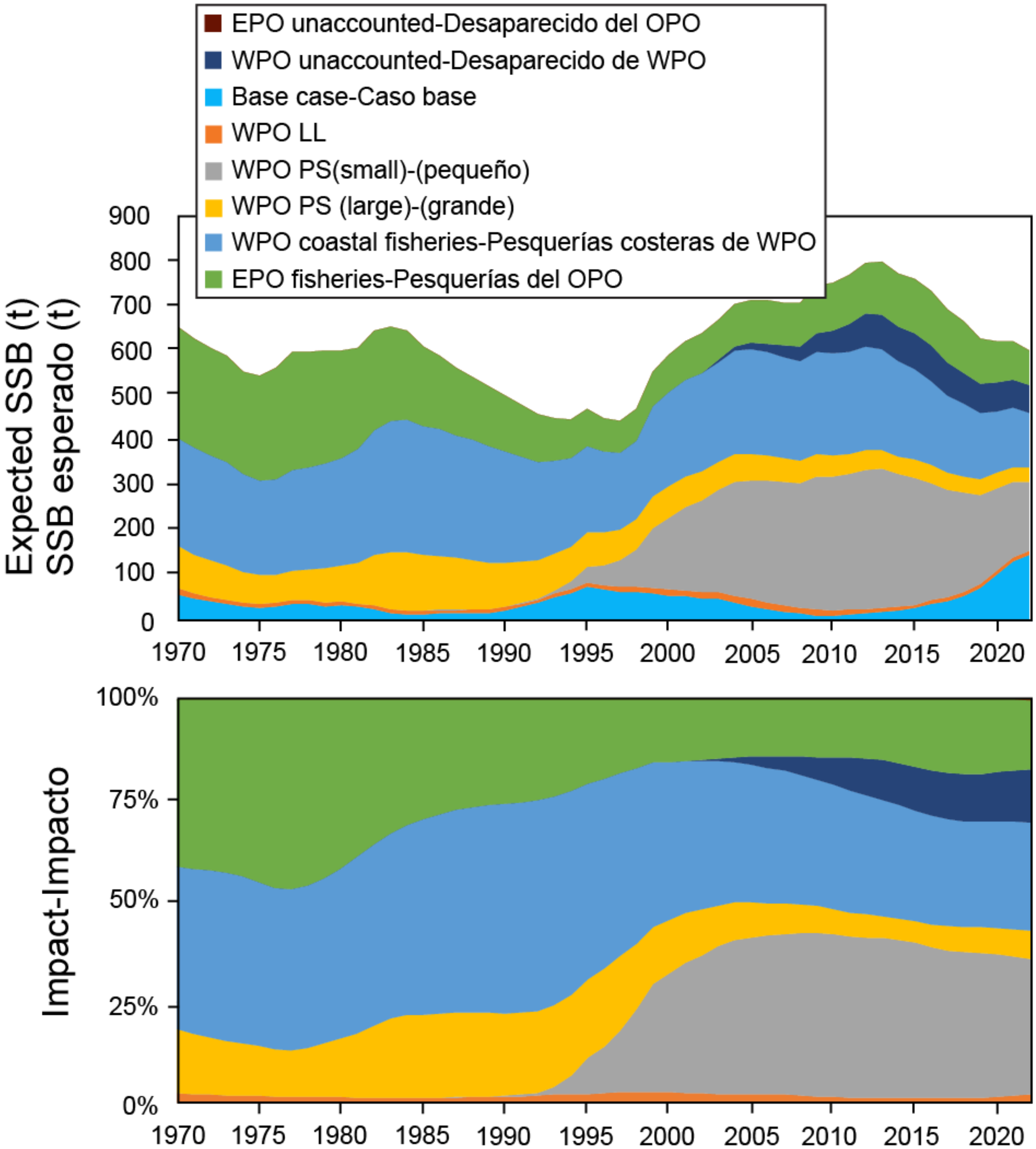


FIGURE E-2. Estimates of the impact on the Pacific bluefin tuna population of fisheries in the EPO and in the WPO (upper panel). The dashed line represents the estimated hypothetical unfished spawning biomass, and the solid line the estimated actual spawning biomass. The shaded areas indicate the impact attributed to each fishery. The lower panel presents the proportion of impact attributed to the EPO and WPO. (Figure from the draft Executive Summary of ISC 2022 stock assessment; subject to change and approval by the ISC Plenary.)

FIGURA E-2. Estimaciones del impacto sobre la población de atún aleta azul del Pacífico de las pesquerías en el OPO y en el WPO (panel superior). La línea de trazos representa la biomasa reproductora no pescada hipotética estimada, y la línea sólida la biomasa reproductora real estimada. Las áreas sombreadas indican el impacto atribuido a cada pesquería. El panel inferior ilustra la proporción del impacto atribuida al OPO y al WPO. (Figura del borrador de resumen ejecutivo de la evaluación de 2022 del ISC; sujeta a cambio y aprobación por la plenaria del ISC.)

F. ALBACORE TUNA

There are two stocks of albacore in the Pacific Ocean, one in the northern hemisphere and the other in the southern hemisphere. Albacore are caught by longline gear in most of the North and South Pacific, but not often between about 10°N and 5°S, by trolling gear in the eastern and central North and South Pacific, and by pole-and-line gear in the western North Pacific. In the North Pacific, about 40% of the catch is taken by pole-and-line and troll fisheries that catch smaller, younger albacore, and about 50% was taken by longline. In the South Pacific, almost all the albacore is taken by longline. The total annual catches of South Pacific albacore ranged from about 25,000 t to 50,000 t during the 1980s and 1990s but increased after that and peaked at about 94,500 t in 2017, declining slightly after that. During 2020-2022, the annual albacore catch in the south Pacific averaged about 80,000 t (Figure F-1a), of which about 32.6% was taken in the eastern Pacific Ocean (EPO). The total annual catches of North Pacific albacore increased from about 55,000 t in 1993 to about 126,000 t in 1999 (Figure F-1b). They then declined in the early 2000s then recovered in the early 2010s. Since 2012 catches have declined from about 92,000 t to about 50,000 t in 2022. The catches averaged about 56,000 t in 2020-2022, of which 21.4% was taken in the EPO. Those declines in catches coincide with decline in effort in the north EPO (Figure F-2).

Juvenile and adult albacore are caught mostly in the Kuroshio Current, the North Pacific Transition Zone, and the California Current in the North Pacific and in the Subtropical Convergence Zone in the South Pacific, but spawning occurs in tropical and subtropical waters, centering around 20ºN and 20ºS latitudes. North Pacific albacore are believed to spawn between March and July in the western and central Pacific.

The movements of North Pacific albacore are strongly influenced by oceanic conditions, and migrating albacore tend to concentrate along oceanic fronts in the North Pacific Transition Zone. Most of the catches are made in water temperatures between about 15º and 19.5ºC. Details of the migration remain unclear, but juvenile fish (2- to 5-year-olds) are believed to move into the eastern Pacific Ocean (EPO) in the spring and early summer, and return to the western and central Pacific, perhaps annually, in the late fall and winter, where they tend to remain as they mature. This pattern may be complicated by sex-related movements of large adult fish (fork length (FL) >125 cm), which are predominately male, to areas south of 20°N. The significance of such movements for the demographic dynamics of this stock are uncertain at present.

Less is known about the movements of albacore in the South Pacific Ocean. The juveniles move southward from the tropics when they are about 35 cm long, and then eastward along the Subtropical Convergence Zone to about 130°W. When the fish approach maturity they return to tropical waters, where they spawn. Recoveries of tagged fish released in areas east of 155°W were usually made at locations to the east and north of the release site, whereas those of fish released west of 155°W were usually made at locations to the west and north of the release site.

The most recent published stock assessments for the South and North Pacific stocks of albacore are from 2024 and 2023, respectively. The assessments indicate that it is not likely that either stock is overfished or that overfishing is taking place.

South Pacific albacore

In collaboration with the IATTC, the Pacific Community (SPC) conducted a benchmark stock assessment for South Pacific albacore tuna in 2024. This assessment is based on a spatially-explicit stock assessment model in which the South EPO is included as a single area with multiple fishery fleets using an areas-as-fleets approach. Structural uncertainty in natural mortality and steepness were explored in this benchmark assessment using a Monte Carlo ensemble model approach with 100 models.

Based on the ensemble of models, the estimated reference points for albacore tuna in the South Pacific are:

1. The median depletion for the recent period ($SB_{2019\text{-}2022}/SB_{F=0}$) is 0.48 with a 10th to 90th percentile interval of 0.36 to 0.62.
2. All models in the uncertainty ensemble had $SB_{2019\text{-}2022}/SB_{F=0}$ > 0.2, the limit reference point for WCPFC key tuna stocks.

3. The median recent spawning biomass is well above the MSY level (median $SB_{2019\text{-}2022}/SB_{MSY}$ is 3.02 with a 10th to 90th percentile interval 2.04 to 5.21).
4. The median recent fishing mortality as a ratio of that corresponding the MSY ($F_{2019\text{-}20122}/F_{MSY}$) is 0.18 with a 10th to 90th percentile interval of 0.06 to 0.44.

In summary, the benchmark assessment suggests that the South Pacific albacore stock is healthy and the recent fishing mortality is much lower than the fishing mortality at MSY. For albacore in the south EPO, the spawning biomass ratio in 2022 (spawning biomass divided by dynamic spawning biomass in an unfished condition) is estimated to be slightly below 0.5. The staff will continue collaborating with the Pacific Community to monitor the stock status of South Pacific albacore tuna by using stock status indicators and conducting another benchmark assessment with the SPC in 3-4 years.

Finally, it should be noted that a process has been initiated in coordination with WCPFC towards the establishment in the near future of a joint working group for South Pacific albacore, taking into consideration the very positive precedent of the work done in the IATTC-WCPFC Joint Working Group for Pacific bluefin tuna.

North Pacific albacore

A new stock assessment for north Pacific albacore was completed in 2023 by the Albacore Working Group (ALBWG) of the International Scientific Committee for Tuna and Tuna-like Species in the north Pacific Ocean (ISC) (SAC-14 INF-R). The north Pacific albacore tuna stock has been exploited for a long time, the catches were the highest in 1976 (about 127,000 t) and the lowest in 1991 (about 37,000 t). During the assessment period (1994-2018), the highest catches were in 1999 (about 119,000 t) and the lowest in 2019 and 2021 (about 43,000 t). About 2/3 of the catches come from surface fisheries (troll and pole-and-line) that harvest mainly juveniles, and the rest from longline fisheries that harvest mainly adults.

The assessment was done using the "best model" approach. The working group concluded that the stock was not experiencing overfishing and was probably not overfished (Figure F-2, Table F-1). The SSB_{2021} was estimated to be approximately 54% (95% CI: 40 – 68%) of $SSB_{current,\ F=0}$ and 1.8 (95% CI: 1.3 – 2.3) times greater than the estimated threshold reference point (Table ES1). The estimated current fishing intensity ($F_{2018\text{-}2020}$) was estimated to be $F59_{\%SPR}$ (95% CI: $F72_{\%SPR}$ – $F46_{\%SPR}$) and was lower than both the $F45_{\%SPR}$ target reference point and the average fishing intensity during 2002 – 2004 (Table F1).

Based on the results of the new stock assessment for north Pacific albacore, the working group concludes that:

1. The stock is likely not overfished relative to the threshold ($30\%SSB_{current,\ F=0}$) and limit ($14\%SSB_{current,\ F=0}$) reference points adopted by the WCPFC and IATTC, and
2. The stock is likely not experiencing overfishing relative to the target reference point ($F45_{\%SPR}$).

The current IATTC conservation and management measures for north Pacific albacore (Resolutions C-05-02, C-13-03 and C-18-03) are based on maintaining the fishing effort below the 2002-2004 levels. The effort levels in eastern Pacific Ocean for 2019-2021 were 56% and 59% of those in 2002-2004, for vessel-days and number of vessels respectively, and are showing a declining trend in the last 10 years (Figure F-2).

In 2022, the Commission adopted the objectives, the target, threshold, and limit reference points, the acceptable level of risk of breaching the limit reference point and the monitoring method for the stock (IATTC Resolution C-22-04) following the completion of the Management Strategy Evaluation (MSE) for the stock by the ALBWG (ISC/21/ANNEX/11). Also, under that resolution, the Commission adopted a harvest control rule with those elements in 2023. The overarching objective is to ensure the sustainability of the North Pacific albacore tuna stock and current fisheries supported by the stock in the EPO. To reach the overarching objective, the following management objectives were established (C-22-04):

1. Maintain Spawning Stock Biomass (SSB) above the Limit Reference Point, with a probability of at least 80% over the next 10 years.
2. Maintain depletion of total biomass around historical (2006-2015) average depletion over the next 10 years.

3. Maintain fishing intensity (F) at or below the target reference point with a probability of at least 50% over the next 10 years.
4. To the extent practicable, management changes (e.g., catch and/or effort) should be relatively gradual between years.

The reference points adopted are:

1. Target reference point (TRP) of F45%SPR, which is the fishing intensity level that results in the stock producing 45% SPR.
2. Threshold reference point (ThRP, $SSB_{threshold}$) of $30\%SSB_{current,F=0}$, which is 30% of the dynamic unfished spawning stock biomass.
3. Limit reference point (LRP) of $14\%SSB_{current, F=0}$, which is 14% of the dynamic unfished spawning stock biomass.

The acceptable level of risk of breaching the LRP based on the most current estimate of SSB shall be no greater than 20%. The resolution further stated that if the LRP is breached, a rebuilding plan should be adopted.

In 2023, the Commission adopted the harvest control rules that apply to all fisheries harvesting albacore in the Convention Area north of the equator (IATTC resolution C-23-02). The harvest control rule parameters produce a relationship between stock status and fishing intensity with the minimum allowed fishing intensity equal to $F_{87\%}$ (Figure F-4), which is the fishing intensity level that results in the stock producing 87% of spawning potential ratio. The harvest control rules also state that if $SSB_{current}/SSB_{current, F=0}$ is above the LRP and below $SSB_{threshold}$, the maximum increase or decrease in catch or effort between the three-year management periods shall be 20%. In the year following the relevant ISC stock assessment, the IATTC will recommend adjustment to the existing Resolution for North Pacific Albacore to ensure fishing intensity is at or below the level set forth by this HCR using the latest ISC stock assessment. Changes to fishing intensity in accordance with the harvest control parameters shall apply between assessments starting the year after the stock assessment was completed, until the year following the next stock assessment that provides an estimate of unfished SSB.

In 2024, the ALBWG produced two documents for North Pacific Albacore. The first one develops the criteria to identify exceptional circumstances that would result in suspending or modifying the application of the adopted harvest strategy, and potentially may require updated MSE simulation work (SAC-15 INF-S). In 2025, one minor change was made from the previous version of the exceptional circumstances per ISC25 plenary's request. The second one provides scientific advice on interpreting the fishing intensity metric from the harvest strategies in terms of catch and effort management measures (SAC-15 INF-T). The ALBWG recommends that changes in fishing intensity required by the NPALB harvest strategy can potentially be translated into changes in catch for the management of all fleet groups, and changes in effort for the management of surface fleet groups and two Japanese longline fleets that likely target north Pacific albacore. Effort management is less precise than catch management in terms of changing the fishing intensity for surface fleet groups.

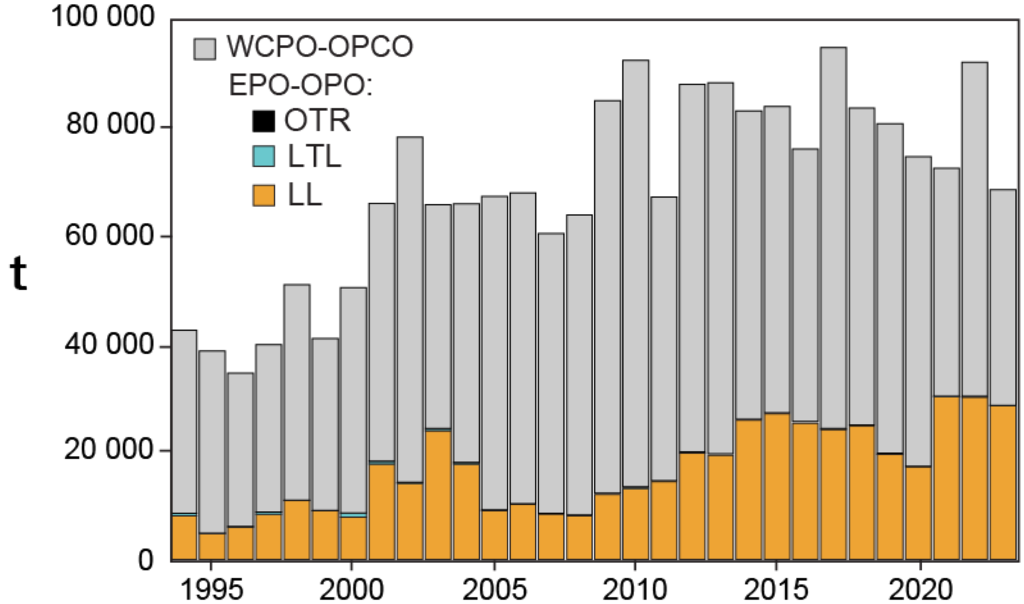


FIGURE F-1a. Retained catches of south Pacific albacore, by region. EPO catches broken down by gear: LL: longline; LTL: troll; OTR: other
FIGURA F-1a. Capturas retenidas de albacora del Pacífico sur, por región. Capturas del OPO desglosadas por arte: LL: palangre; LTL: curricán; OTR: otro.

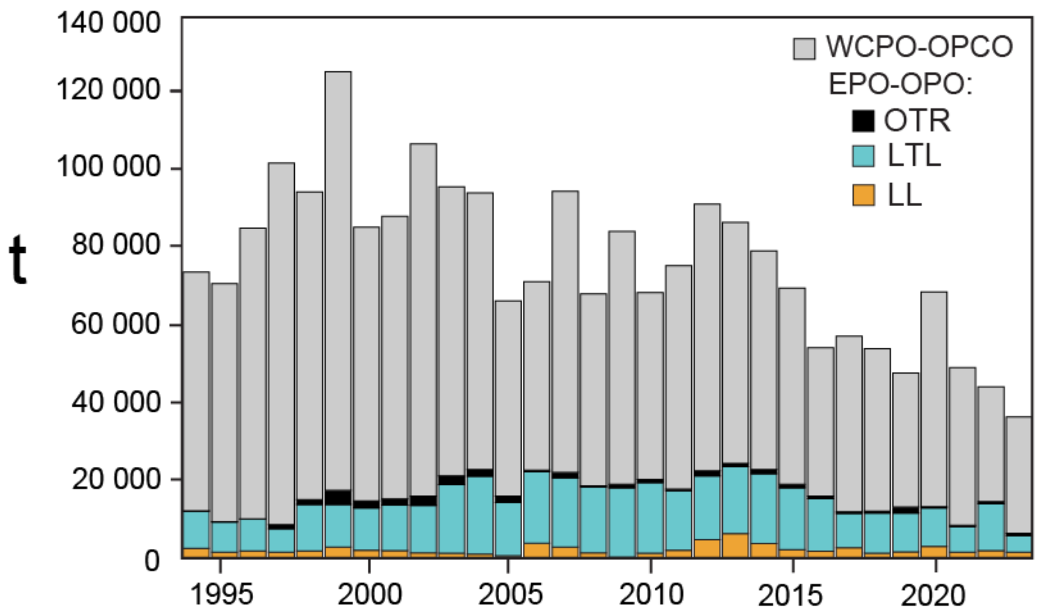


FIGURE F-1b. Retained catches of north Pacific albacore, by region. EPO catches broken down by gear: LL: longline; LTL: troll; OTR: other.
FIGURA F-1b. Capturas retenidas de albacora del Pacífico norte, por región. Capturas del OPO desglosadas por arte: LL: palangre; LTL: curricán; OTR: otro.

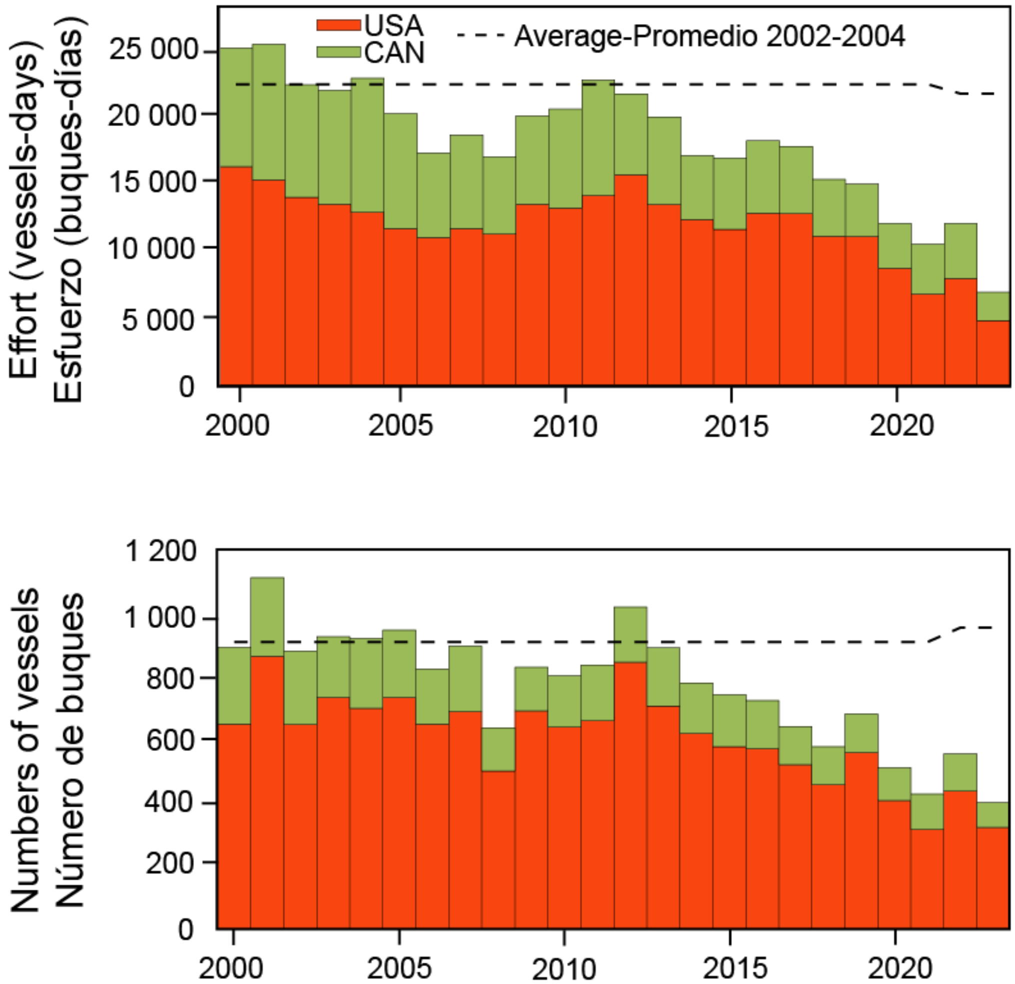


FIGURE F-2. Effort in vessel-days and number of vessels for the north Pacific albacore tuna in the eastern Pacific Ocean.
FIGURA F-2. Esfuerzo en días de buque y número de buques para el atún albacora del Pacífico norte en el Océano Pacífico oriental.

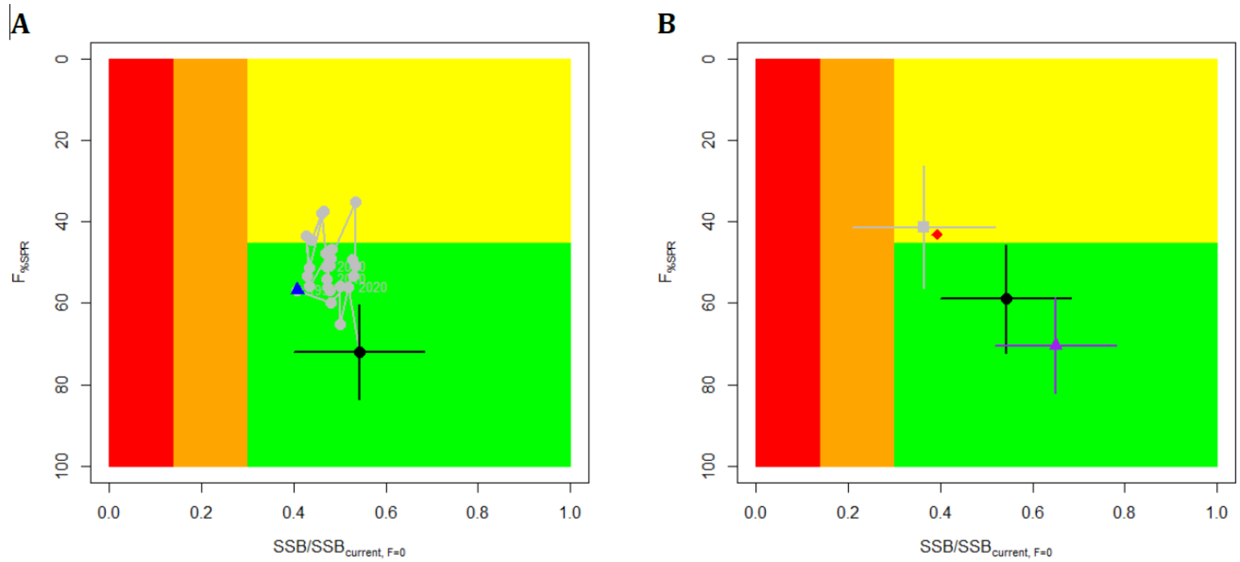


FIGURE F-3. Stock status phase plot showing the status of the north Pacific albacore stock relative to the biomass-based threshold (30%$SSB_{current,\ F=0}$) and limit (14%$SSB_{current,\ F=0}$) reference points, and fishing intensity-based target reference point ($F45_{\%SPR}$) over the modeling period (1994 – 2021). Blue triangle indicates the start year (1994) and black circle with 95% confidence intervals indicates the terminal year (2021). (**B**) Stock status plot showing current stock status and 95% confidence intervals of the base case model (black circle), an important sensitivity run of CV = 0.06 for L_{inf} in the growth model (gray square), an important sensitivity run with an estimated growth model (purple triangle), and a model representing an update of the 2020 base case model to 2023 data (red diamond). 95% confidence intervals are not shown for the update of the 2020 base case model (red diamond) because the model did not have a positive definite Hessian matrix and uncertainty estimates were unreliable. Red zones in both panels indicate female SSBs falling below the limit reference point while the orange zones indicate female SSBs between the threshold and limit reference points. Green zones indicate female SSBs above the threshold reference point and fishing intensity levels below the target reference point. Yellow areas indicate female SSBs above the threshold reference point and fishing intensity levels above the target reference point. The Fs in this figure are indicators of fishing intensity based on spawning potential ratio (SPR) and calculated as %SPR.

FIGURA F-3. Gráfica de fase de la condición de la población que muestra la condición de la población de atún albacora del Pacífico norte en relación con los puntos de referencia umbral (30%SSBactual, F=0) y límite (14%SSBactual, F=0) basados en la biomasa, y el punto de referencia objetivo basado en la intensidad de pesca (F45%SPR) durante el periodo del modelo (1994-2021). El triángulo azul indica el año inicial (1994) y el círculo negro con intervalos de confianza del 95% indica el año final (2021). (**B**) Gráfica de la condición de la población que muestra la condición actual de la población y los intervalos de confianza del 95% del modelo de caso base (círculo negro), un análisis de sensibilidad importante de CV = 0.06 para L_{inf} en el modelo de crecimiento (cuadrado gris), un análisis de sensibilidad importante con un modelo de crecimiento estimado (triángulo morado) y un modelo que representa una actualización del modelo de caso base de 2020 a los datos de 2023 (diamante rojo). No se muestran los intervalos de confianza del 95% para la actualización del modelo de caso base de 2020 (diamante rojo) porque el modelo no tenía una matriz hessiana positiva definida y las estimaciones de incertidumbre no eran fiables. Las zonas rojas de ambos paneles indican las SSB de las hembras por debajo del punto de referencia límite, mientras que las zonas anaranjadas indican las SSB de las hembras entre los puntos de referencia umbral y límite. Las zonas verdes indican las SSB de las hembras por encima del punto de referencia umbral y los niveles de intensidad de pesca por debajo del punto de referencia objetivo. Las áreas amarillas indican las SSB de las hembras por encima del punto de referencia umbral y los niveles de intensidad de pesca por encima del punto de referencia objetivo. Las F de esta figura son indicadores de la intensidad de pesca basados en la razón de potencial de desove (SPR) y calculados como %SPR.

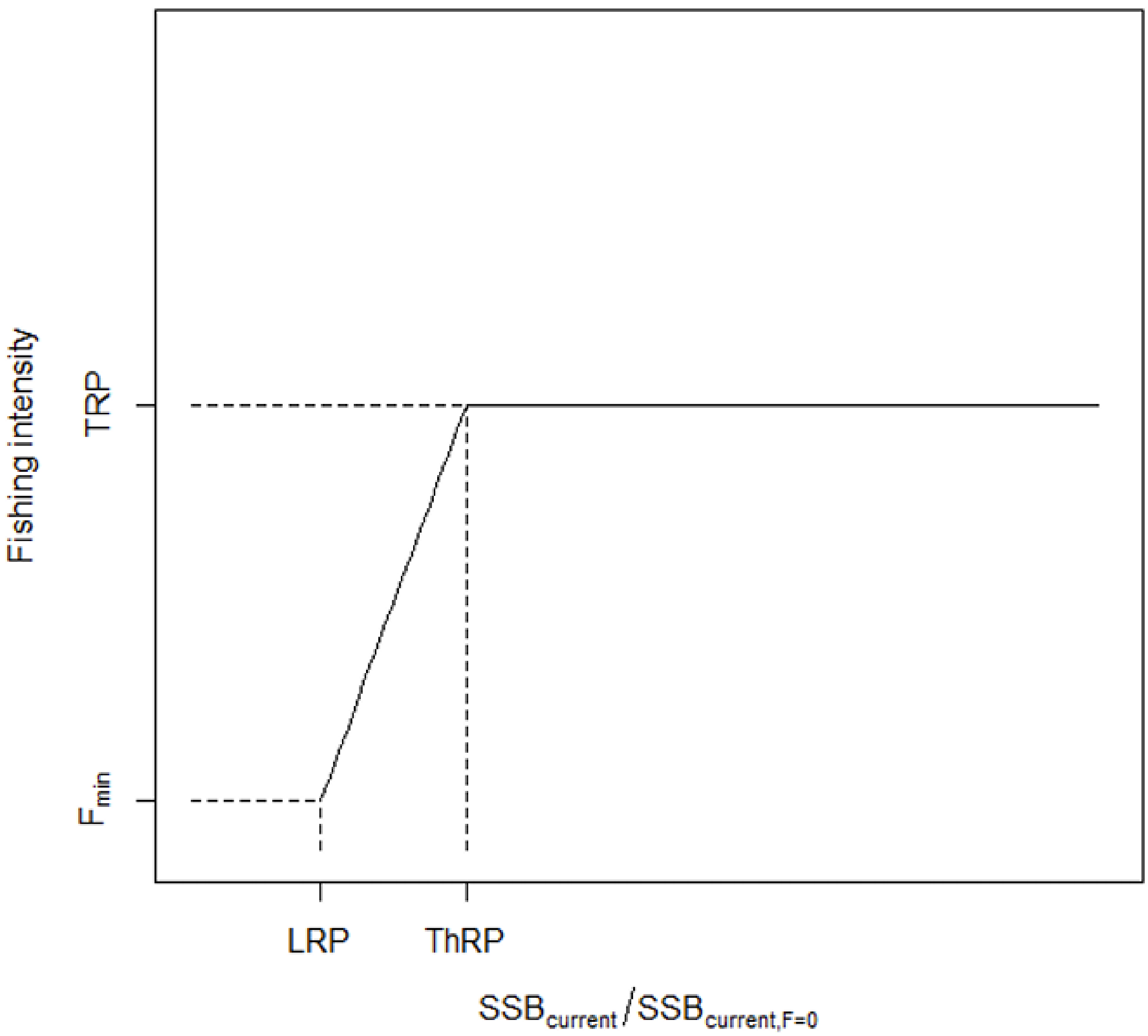


FIGURE F-4. Illustration of the harvest control rules with target reference point (TRP), threshold reference point (ThRP), limit reference point (LRP), and the minimum allowed fishing intensity (F_{min}). The harvest control rules include the triggering of a rebuilding measure if the $SSB_{current}/SSB_{current,F=0}$ falls below the LRP.
FIGURA F-4. Ilustración de las reglas de control de extracción con el punto de referencia objetivo (PRO), el punto de referencia umbral (PRU), el punto de referencia límite (PRL) y la intensidad de pesca mínima permitida (Fmin). Las reglas de control de extracción incluyen la activación de una medida de recuperación si $SSB_{actual}/SSB_{actualF=0}$ cae por debajo del PRL.

TABLE F1. Bold values indicate corrected values from the 2023 stock assessment. Estimates of maximum sustainable yield (MSY), female spawning stock biomass (SSB), fishing intensity (F), and reference point ratios for north Pacific albacore tuna for: 1) the base case model; 2) two important sensitivity models due to uncertainty in growth parameters; and 3) a model representing an update of the 2020 base case model to 2023 data. SSB_0, $SSB_{current, F=0}$ and SSB_{MSY} are the expected female SSB of a population in the equilibrium, unfished state; in the current, dynamic, unfished state; and at MSY, respectively. The Fs in this table are indicators of fishing intensity based on spawning potential ratio (SPR) and calculated as %SPR. SPR is the ratio of the equilibrium SSB per recruit that would result from the estimated F-at-age relative to that of an unfished population. Depletion is calculated as the proportion of the age-1+ biomass during the specified period relative to an unfished age-1+ equilibrium biomass. The model representing an update of the 2020 base case model is similar to but not identical to the 2020 base case model due to changes in data preparation and model structure. *Model may not have converged, and uncertainty estimates were unreliable because of the lack of a positive, definite Hessian matrix. [†]A value of >1 for the depletion ratio indicates higher age-1+ biomass in 2021 relative to the 2006 – 2015 period. [§]Higher %SPR values indicate lower fishing intensity levels. [¶]Values of >1 for ratios of $F_{\%SPR}$ to $F_{\%SPR}$-based reference points indicate fishing intensity levels lower than the reference points.

TABLA F1. Los valores en negrita indican los valores corregidos de la evaluación de la población de 2023. Estimaciones del rendimiento máximo sostenible (RMS), biomasa reproductora de las hembras (SSB), intensidad de pesca (F) y cocientes de puntos de referencia para el atún albacora del Pacífico norte para: 1) el modelo de caso base; 2) dos importantes modelos de sensibilidad debido a la incertidumbre en los parámetros de crecimiento; y 3) un modelo que representa una actualización del modelo de caso base de 2020 a los datos de 2023. SSB_0, $SSB_{actual, F=0}$ y SSB_{RMS} son la SSB de las hembras esperada de una población en estado de equilibrio, sin pesca; en estado actual, dinámico, sin pesca; y en RMS, respectivamente. Las F de esta tabla son indicadores de la intensidad de pesca basados en la razón de potencial de desove (SPR) y calculados como %SPR. La SPR es la razón de la SSB en equilibrio por recluta que resultaría de la F por edad estimada en relación con la de una población en ausencia de pesca. La reducción se calcula como la proporción de la biomasa de edad 1+ durante el periodo especificado en relación con una biomasa de edad 1+ en equilibrio sin pesca. El modelo que representa una actualización del modelo de caso base de 2020 es similar pero no idéntico al modelo de caso base de 2020 debido a cambios en la preparación de los datos y en la estructura del modelo. *Es posible que el modelo no haya convergido y que las estimaciones de incertidumbre no sean fiables debido a la falta de una matriz hessiana positiva definida. [†]Un valor de >1 para la razón de reducción indica una mayor biomasa de edad 1+ en 2021 en relación con el periodo 2006-2015. [§]Valores de %SPR más altos indican niveles de intensidad de pesca más bajos. [¶]Valores de >1 para los cocientes de $F_{\%SPR}$ con respecto a los puntos de referencia basados en $F_{\%SPR}$ indican niveles de intensidad de pesca inferiores a los puntos de referencia.

Quantity	Base Case	Growth CV = 0.06 for L_{inf}	Growth All parameters estimated	Update of 2020 base case model to 2023 data*
MSY (t)	121,880	93,167	144,792	97,777
SSB_{MSY} (t)	23,154	18,133	30,435	18,756
SSB_0 (t)	165,567	128,155	198,913	132,570
SSB_{2021} (t)	70,229	35,418	101,161	36,909
$SSB_{current, F=0}$ (2021 estimate)	129,581	97,368	155,542	93,808
$SSB_{2021}/SSB_{current, F=0}$	0.54	0.36	0.65	0.39
$SSB_{2021}/30\%SSB_{current, F=0}$	1.81	1.21	2.17	1.31
$SSB_{2021}/14\%SSB_{current, F=0}$	3.87	2.60	4.65	2.81
[†] $Depletion_{2021}/Depletion_{2006-2015}$	1.34	1.33	1.37	1.30
[§] $F_{\%SPR, 2018-2020}$ (%SPR)	59.0	41.4	70.4	43.2
[§] $F_{\%SPR, 2011-2020}$ (%SPR)	**53.3**	36.6	63.8	37.9
[¶] $F_{\%SPR, 2018-2020}/F_{\%SPR, MSY}$	**3.60**	**2.50**	**3.99**	**2.61**
[¶] $F_{\%SPR, 2011-2020}/F45_{\%SPR}$	**1.19**	0.81	1.42	0.84
[¶] $F_{\%SPR, 2018-2020}/F45_{\%SPR}$	1.31	0.92	1.56	0.96
[¶] $F_{\%SPR, 2018-2020}/F_{\%SPR, 2002-2004}$	1.48	1.63	1.40	1.25

G. SWORDFISH

Swordfish (*Xiphias gladius*) occur throughout the Pacific Ocean (PO) between about 50°N and 50°S. In the eastern Pacific Ocean (EPO), they are caught mostly by the longline fishery—about 80% of the catch in weight on average in recent years —by distant water fleets of Far East and Western Hemisphere nations. Lesser amounts are taken by drifting gillnets (~20%), mainly in South America, and minimal amounts by other gillnets and harpoon. They are seldom caught in the recreational fishery in the EPO.

Swordfish grow in length very rapidly, with both males and the faster-growing females reaching lower-jaw-fork lengths of more than a meter during their first year. Swordfish begin reaching maturity at about two years of age, when they are about 150 to 170 cm in length, and by age four all are mature. They probably spawn more than once per season. For fish greater than 170 cm in length, the proportion of females increases with increasing length.

Swordfish tend to inhabit waters further below the surface during the day than at night, and they tend to inhabit current frontal zones. Several of these fronts occur in the eastern Pacific Ocean (EPO), including areas off California and Baja California, off Ecuador, Peru, and Chile, and in the equatorial Pacific. Swordfish tolerate temperatures of about 5° to 27°C, but their preferred range is about 18° to 22°C, while larvae have been found only at temperatures exceeding 24°C.

There is strong evidence that swordfish in the Pacific comprise multiple stocks. Several specific spawning regions are known, and analyses of fisheries, tagging and genetic data suggest that there is only limited exchange of swordfish between geographical areas, including between the eastern and western, and the northern and southern, Pacific Ocean. As many as six stocks may exist in the Pacific Ocean, but the exact boundaries of these stocks, as well as their exchange rates—for the purposes of stock assessment—is currently uncertain. In the early 2000's, the IATTC produced indicators for swordfish in five areas of the EPO: two areas north of 10°N, separated at 125°W, a central area between 10°N and 5°S, and two areas south of 5°S, separated at 90°W.

Currently, two stocks are assumed to inhabit the EPO. One in the south and one in the north. The stock boundaries are uncertain, but it was assumed in the most recent assessments that the southern EPO stock could be distributed up to 10°N and that the north Pacific Ocean stock includes the EPO north of 10°N. The area north of 5°S and south of 10°N was added in the south EPO assessment in one of the stock structure hypotheses considered, as there was evidence of connectivity between that area and the area south of 5°S (SAC-13 INF-N), which defined the stock boundary in the previous assessment (SAC-02-09). The definition used in the previous assessment was also included as an alternative stock structure hypothesis. Tagging studies (presented during SWO-01) showed movement of swordfish across the previously assumed stock boundary between the north and central Pacific Ocean swordfish stock and the north EPO —a diagonal line from the tropics in the central Pacific to the northern coast of Mexico. This information motivated the revision of the stock boundary assumed for the north Pacific swordfish stock (ISC/21/BILLWG-01) to include the EPO north of 10°N. This new stock boundary assumption allowed for the inclusion of areas off Mexico and Central America in the 2023 north Pacific swordfish assessment (ISC/23/ANNEX/11), which were not included in the 2018 assessment (ISC/18/ANNEX/16).

In the northern EPO (north of 10°N), the annual longline fishing effort for the main longline fleets[5] operating decreased from about 21 million hooks in 2017 to about 10 million hooks in 2023 (Figure G-1). The last three-year average (2021-2022) of about 11 million hooks remains within the historical range of 5 million to 23 million hooks (Figure G-1).

The catches in the EPO north of 10°N average about 2,000 tons in the last 40 years (ranged from 250 tons to 3,800 tons) , decreased to an average of about 1,000 tons in the most recent 10 years and are currently in the lowest levels of about 380 tons in the last three years (Figure G-2), when effort is also low (Figure G-1).

In the southern hemisphere, the total annual longline fishing effort for the main longline fleets[1] in EPO was 210 million hooks in 1991 and declined steadily to about half that in 1999, increasing again to an average of 177

[5] Japan, Korea, Chinese Taipei, China, United States and French Polynesia

million hooks in 2001–2004, decreasing to about 69 million hooks in 2008. Since 2012 the total effort was relatively stable, averaging 155 million hooks in the from 2020–2022 (Figure G-3). In 2023 there was a sharp decline in effort to 85 million hooks, about 55% of the 2020-2022 average.

Figure G-4 shows the data on catches reported to the IATTC. For the assessment of south EPO swordfish, a compilation of catch data was conducted which resulted in higher values than those in Figure G-4 due to some catches, mainly of artisanal fleets, still underreported to the IATTC. The catch data compiled for the EPO south of 10°N showed a dramatic increase since the mid-2000s (Figure 3 in SAC-14-15). The average catch per year from 2000 to 2009 was about 15,000 tons, while the average catch per year for 2010 to 2019 almost doubled to about 29,000 tons. In the last three years of the compilation available for the assessment (2017 - 2019), the average catch was about 34,000 t a year (of those about 30,000 t were reported to the IATTC, Figure G-4). The average reported catches in the most recent 3 years (2021-2023) are about 26,000 t, which is about 76% of the catches reported to the IATTC corresponding to the most recent 3 years included in the most recent stock assessment for south EPO (SAC-14-15). The fleets that currently take the most catch are the Spanish longline fleet, which catches about 30% of the total catches in weight, followed by the Chilean gillnet fleet with 22%, and the Ecuadorian longline fleet with 20%.

The last assessment of the north Pacific Ocean swordfish stock, which included the EPO north of 10°N, was conducted in 2023 by the Billfish Working Group (BILLWG) of the International Scientific Committee for Tuna and Tuna-like Species in the north Pacific Ocean. Results indicated that stock biomass (age 1 and older) for the stock fluctuated around an average of 83,000 t during 1975-2021 and was estimated to be 88,755 t in 2021. The recent 3-year (2019-2021) average spawning biomass was 34,900 t, 2.5 times greater than SSB_{MSY}. The fishing mortality (F) has been declining steadily since 2001 and was 49% of F_{MSY} during 2019-2021 (average F for ages 1 – 10). Reference points for the stock are yet to be adopted. Using MSY-based reference points as illustration, the base case model indicated that under current conditions the stock was very likely not overfished (>99% probability) and was very likely not subject to overfishing (>99% probability).

For the south EPO stock, the most recent benchmark assessment was done in 2023 with data up to 2019 (SAC-14-15). The main uncertainties accounted for were stock structure and the relationship of the indices of abundance with the stock biomass. Associated with the increase in catches, there was a clear increase in the indices of abundance, which was a continuation of the trends already apparent in the 2011 assessment. Four hypotheses were proposed to explain the simultaneous increase of catches and indices of abundance, which included both the possibilities that the increase is either real or not (increase in availability or catchability). Reference points, which are used only for illustrative purposes since reference points have yet to be adopted for swordfish by the Commission, indicated that the stock is approaching one of the hypothetical dynamic biomass TRP (of 40% unfished biomass) for one of the hypotheses and is larger for the other hypotheses ($SSB_{current}/SSBF = 0 > 0.4$). However, the stock is not approaching the hypothetical dynamic limit reference point of 20% unfished biomass (Figure G-5). All models estimate a strong increase in fishing mortality since the start of the fishery in the 1950's. The fishing intensity is slightly above the fishing intensity target reference point for one of the hypotheses and below for the other hypotheses (Figure G-6). There is not enough information in the current data to determine the relative plausibility of the different hypotheses that may explain the simultaneous increases in catch and indices of abundance. Annecdotical evidence is surfacing that the gear may have change causing increases in catchability.

In June 2025, a regional workshop was held in Chile with the participation of Chile, Ecuador, Costa Rica, the European Union and the IATTC stock assessment staff to improve the research and information for the future south EPO swordfish stock assessment.

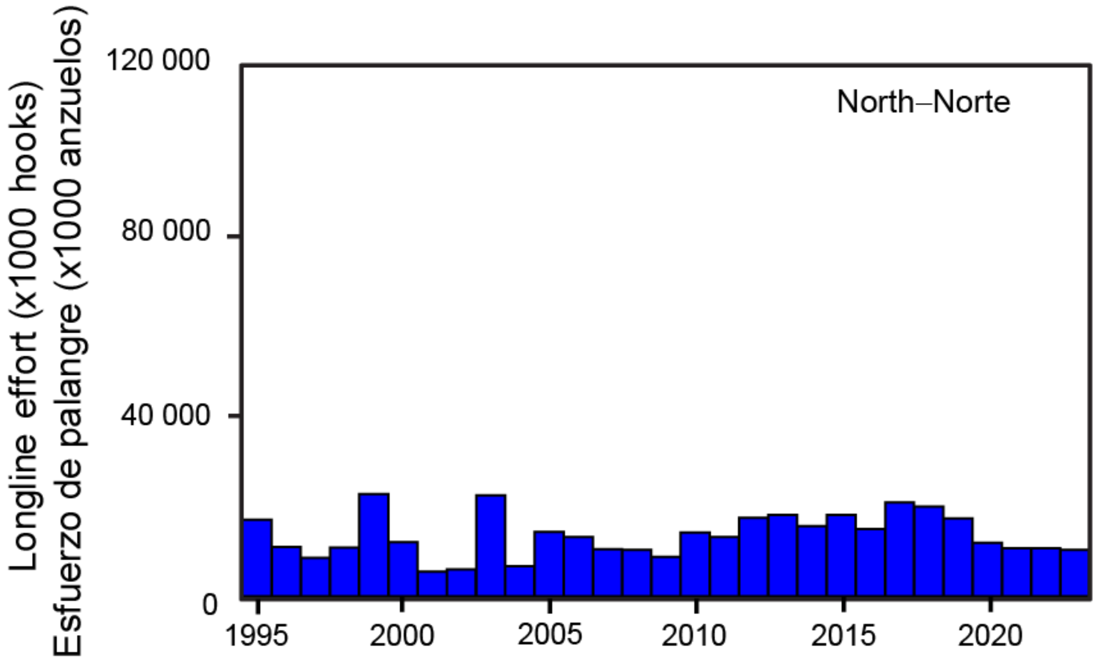


FIGURE G-1. Longline fishing effort (in millions of hooks) in the north EPO for the main longline fleets for 1995–2023 (Table A-9).
FIGURA G-1. Esfuerzo de pesca de palangre (en millones de anzuelos) en el OPO Norte para las principales flotas palangreras para 1995–2023 (Tabla A-9) (al norte 10°N).

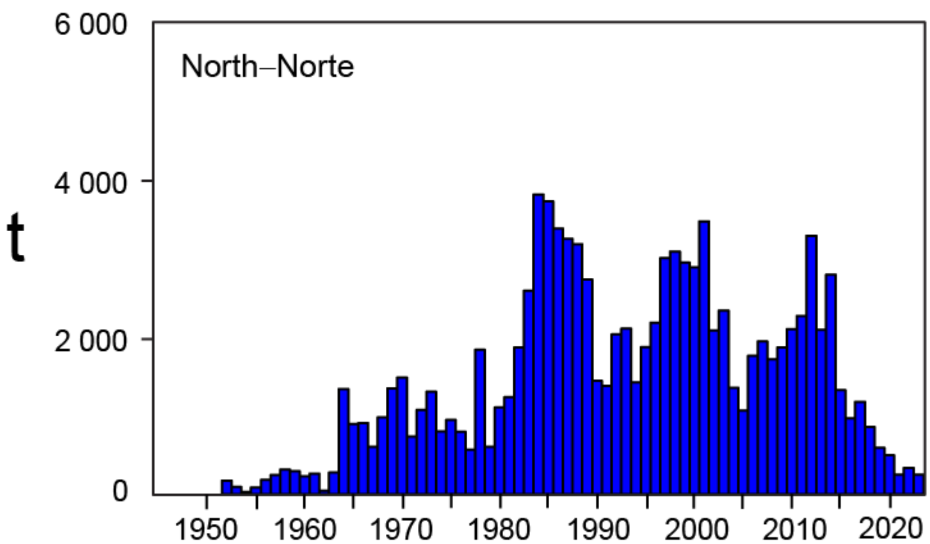


FIGURE G-2. Retained catches of swordfish in the north EPO stock for 1945–2023 (north of 10°N)
FIGURA G-2. Capturas retenidas de pez espada en la población del OPO Norte para 1945–2023 (al norte de 10°N).

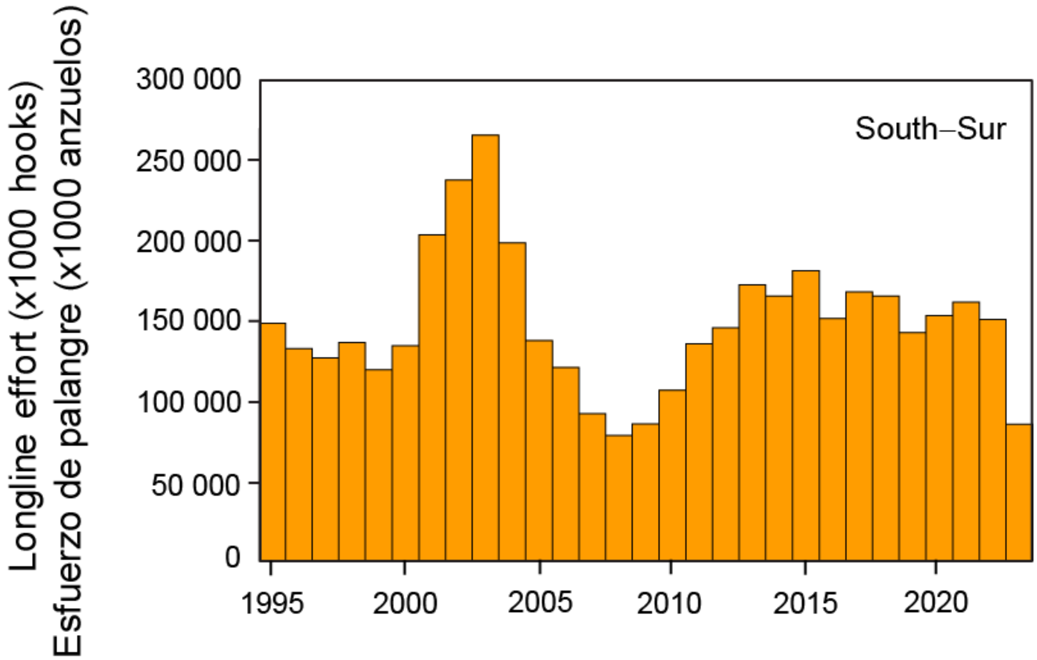


FIGURE G-3. Longline fishing effort (in millions of hooks) in the south EPO for the main longline fleets for 1995–2023 (Table A-9).
FIGURA G-3. Esfuerzo de pesca de palangre (en millones de anzuelos) en el OPO Sur para las principales flotas palangreras para 1995–2023 (Tabla A-9)

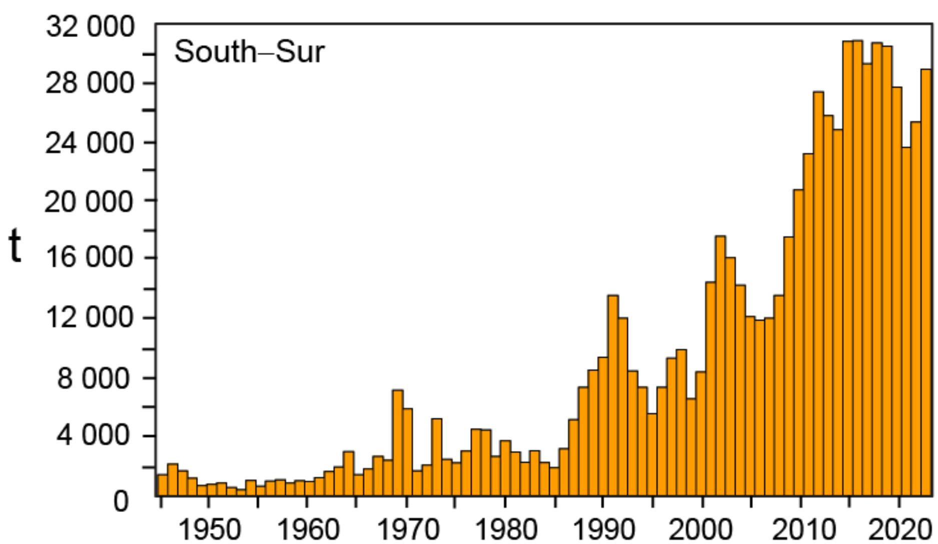


FIGURE G-4. Retained catches of swordfish in the south EPO stock for 1945–2023 (south of 10°N) reported to the IATTC.
FIGURA G-4. Capturas retenidas de pez espada en la población del OPO Sur para 1945–2023 (al sur de 10°N).

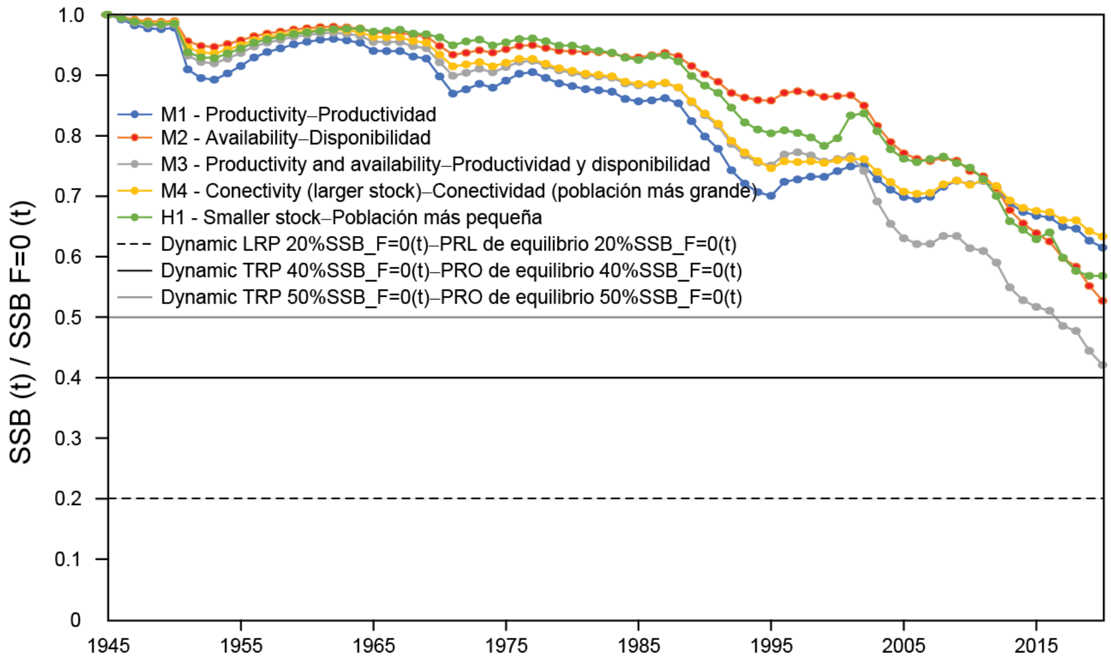


FIGURE G-5. Ratio of the estimated spawning stock biomass and spawning stock biomass with no fishing (dynamic) for the models corresponding to the four hypotheses that explain the simultaneous increase in indices of abundance and catches and the model corresponding to the stock structure hypothesis H1 (north boundary at 5°S). Note that M4 corresponds to the stock structure hypothesis H3 (western boundary at 170°W).

FIGURE G-5. Razón entre la biomasa de la población reproductora estimada y la biomasa de la población reproductora sin pesca (dinámica) para los modelos correspondientes a las cuatro hipótesis que explican el aumento simultáneo de los índices de abundancia y las capturas y el modelo correspondiente a la hipótesis de estructura de la población H1 (límite norte en 5°S). Nótese que el modelo M4 corresponde a la hipótesis de estructura de la población H3 (límite occidental en 170°O).

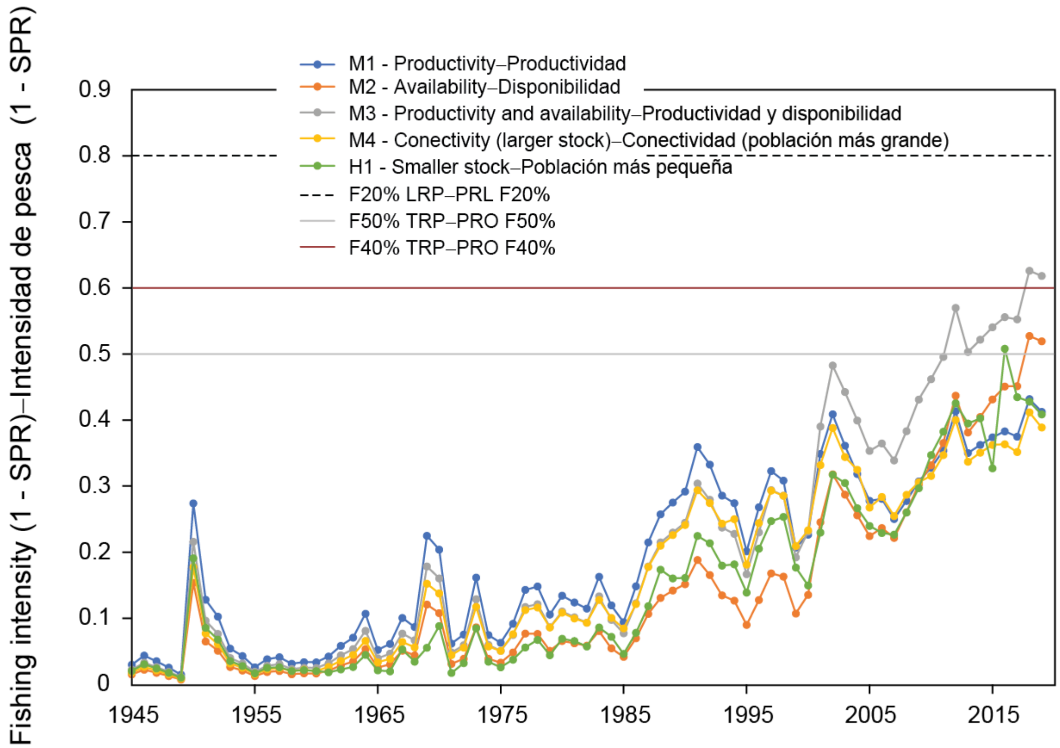


FIGURE G-6. Fishing intensity (1-SPR) for the models corresponding to the four hypotheses that explain the simultaneous increase in indices of abundance and catches and the model corresponding to the stock structure hypothesis H1 (north boundary at 5°S). Note that M4 corresponds to the stock structure hypothesis H3 (western boundary at 170°W). Fishing intensity is a proxy for fishing mortality, based on SPR (proportion of the spawning biomass produced by each recruit with fishing relative to biomass per recruit in the unfished condition, Goodyear 1993). Large SPR are indicative of low fishing mortality, thus a proxy for fishing mortality is 1-SPR.

FIGURE G-6. Intensidad de pesca (1-SPR) para los modelos modelos correspondientes a las cuatro hipótesis que explican el aumento simultáneo de los índices de abundancia y las capturas y el modelo correspondiente a la hipótesis de estructura de la población H1 (límite norte en 5°S). Nótese que el modelo M4 corresponde a la hipótesis de estructura de la población H3 (límite occidental en 170°O). La intensidad de pesca es un sustituto de la mortalidad por pesca, con base en SPR (proporción de la biomasa reproductora producida por cada recluta con pesca en relación con la biomasa por recluta en ausencia de pesca, Goodyear 1993). Una SPR alta indica una mortalidad por pesca baja, por lo que 1-SPR es sustituto de la mortalidad por pesca.

H. BLUE MARLIN

The best information currently available indicates that blue marlin constitutes a single world-wide species (*Makaira nigricans*) and a single stock in the Pacific Ocean. For this reason, statistics on catches (Figure H-1) are compiled, and analyses of stock status are made, for the entire Pacific Ocean.

Blue marlin are taken mostly in longline fisheries for tunas and billfishes between about 30°N and 30°S. Lesser amounts are taken by recreational fisheries and by various other commercial fisheries, such as purse-seine.

Small numbers of blue marlin have been tagged with conventional dart tags, by researchers. In contrast, over 50,000 blue marlin have been tagged by recreational fishers among the world's five largest volunteer gamefish tagging programs, with over 600 fish being recaptured. While a small number of tagged fish have been recaptured long distances from their release locations (4,000–15,000 km), the majority of tagged fish have been recaptured less than 1000 km from their release location, despite some being at liberty for over 3 years. Blue marlin have been tagged in studies of post-release survival and movement, mostly in the Gulf of Mexico and the Atlantic Ocean, using electronic pop-up satellite tags (PSATs) that collected data over periods of about 30–180 days. A number of similar studies have been undertaken in the Pacific Ocean as part of the International Gamefish Association's "Great Marlin Race" tagging program.

Blue marlin usually inhabit regions where the sea-surface temperatures (SSTs) are greater than 24°C, and spend about 90% of their time at depths with temperatures within 1° to 2° of the SSTs. They inhabit the equatorial area (10°N to 10°S) but their latitudinal range may expand seasonally during the summer in each hemisphere to 35°N or 25°S in the EPO. They are epipelagic and spend most of their time within 10 m of depth but do occasional dives below 500 m.

The most recent full assessment of the status and trends of the species was conducted in 2021 (SC/21/ANNEX/10), which included data through 2019. No target or limit reference points have been adopted for blue marlin in the Pacific Ocean. As an illustration the MSY-based reference points were used to evaluate stock status. The assessment results indicated that the spawning stock biomass of blue marlin in the Pacific Ocean decreased steadily since the 1970's to levels below SSB_{MSY} in mid-2000's, increasing to above SSB_{MSY} in 2010. In 2019 the spawning biomass was 17% above SSB_{MSY}, while fishing mortality during 2017-2019 was 40% below F_{MSY}. Therefore, the assessment concluded that the stock was neither overfished nor subject to overfishing. The annual catches in the EPO average about 4,400 t from 2012 to 2018, declined to about 3,000 t in 2019-2020 and are currently about 1,600 t, which is about 40% of the average annual catches in 2017-2019, the last years in the assessment (Figure H-1). The catches in the EPO were about 30% before 2000 and are currently 13% of the total catches in the Pacific Ocean (average for 2021-2023) (Figure H-1).

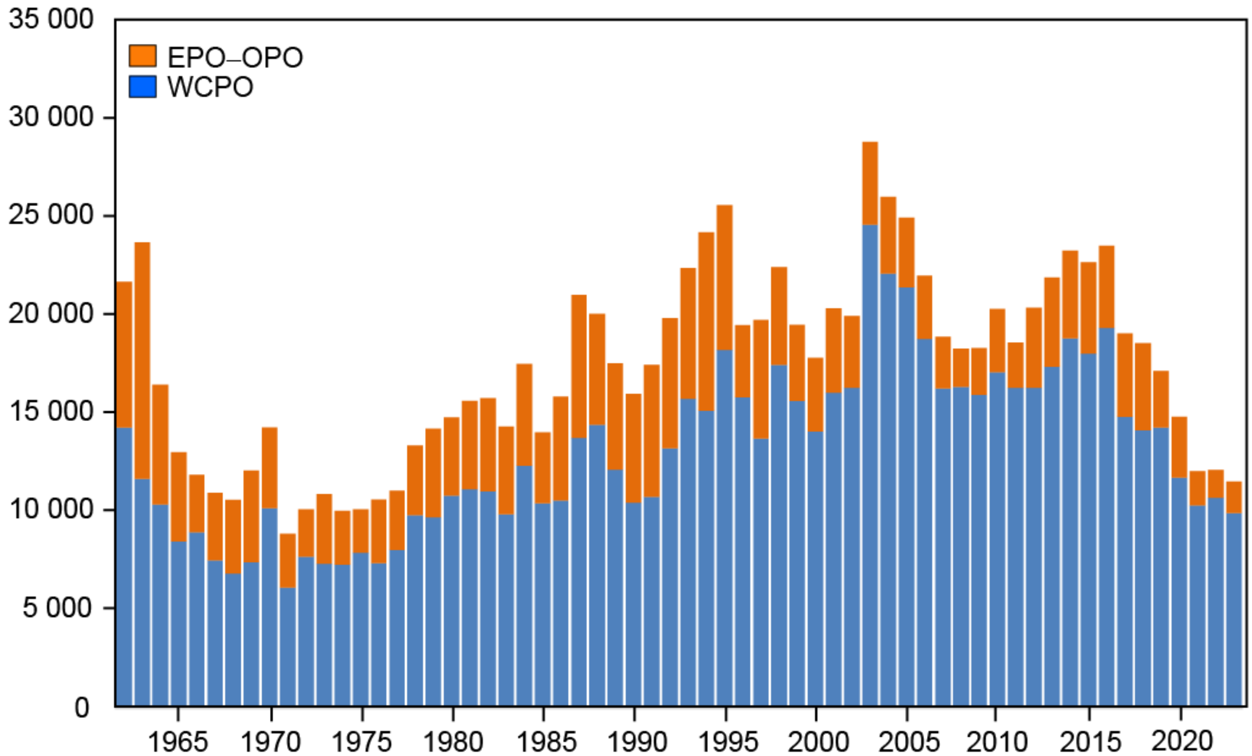


FIGURE H-1. Retained catches of blue marlin in the Pacific Ocean, by region.
FIGURA H-1. Capturas retenidas de marlín azul en el Océano Pacífico, por región.

I. STRIPED MARLIN

Striped marlin (*Kajikia audax*) occurs throughout the Pacific Ocean between about 45°N and 45°S. Significant effort has been devoted to understanding the stock structure of striped marlin in the Pacific Ocean, which is moderately well known. There most likely are a number of stripped marlin stocks in the Pacific Ocean, but the boundaries are uncertain. Information on movement from research studies deploying conventional dart tags is limited, although over 40,000 striped marlin have been tagged by various volunteer recreational fisher tagging programs. Although reported recapture rates are below 1%, recapture data show that striped marlin are capable of moving long distances (5,000–6,000 km), however, most recaptures have occurred reasonably close to the release location. In the EPO specifically, fish tagged off the tip of Baja California were generally recaptured near where they were tagged, but some were recaptured around the Revillagigedo Islands, a few around Hawaii, and one near Norfolk Island, off Australia. Tagging studies in the Pacific, using pop-off satellite tags, indicated that there is essentially no mixing among tagging areas, and that striped marlin maintain site fidelity. Analyses of fisheries and genetic data indicate that the northern EPO supports a single stock, though there may be a seasonal low-level presence of juveniles from a more westerly Hawaii/Japan stock.

Historically, most of the catch in the EPO was taken by longline fisheries, which began expanding into the EPO in the mid-1950s and extended throughout the region by the late 1960s. Except for a few years in the late 1960s to early 1970s in the northern EPO, these fisheries did not target billfish. The fishing effort by large longline vessels in the North EPO has decreased by about 50% since 2017 (Figure G-1) and remains stable in the South EPO, except for the sharp decrease in 2023 (Figure G-3), but the catch of striped marlin has remained largely unchanged since then, and it is currently about 1,300 t (annual average for 2021-2023). Since the early 1990's, the catches by recreational fisheries have become important, although most fish caught are released (Figure I-1). However, the survival rate of released fish is little understood.

The recreational fishery has increased its contribution to the total annual reported catches of striped marlin in the EPO, particularly in the North EPO, from around 10% in 1990 to 64% and 84% in 2007 and 2008, respectively. However, a paucity of reported data since 2009 probably means that the catches of striped marlin in the EPO have been significantly underestimated since this time. Also, it appears that catches of billfishes, including striped marlin, by the artisanal longline fisheries from coastal CPCs may be incomplete. Therefore, the total catch of striped marlin in the EPO, and thus the total impact of fishing on the stock since about 2009, is not known.

Fishing by artisanal longline vessels targeting tuna and other species off Central America, for which data availability is limited, appears to have increased, over the past decade at least. The shifting patterns of areas fished and targeting practices increase the difficulties encountered when using fisheries data in analyses of stock status and trends. These difficulties are exacerbated when analyzing species which are not principal targets of the fishery, and further complicated when the total catch of the species by all fisheries is not known.

The last full assessment of striped marlin in the EPO was conducted in 2008, using Stock Synthesis, and later updated with data through October 2010 (SAC-01-10). The spatial domain of the assessment was north of 10°S, east of about 145°W north of the equator, and east of about 165°W south of the equator. Key results were that (1) the stock was not overfished; (2) overfishing was not occurring; and (3) the spawning stock biomass was above the level that would support MSY. More recently, average annual catches in the last ten years (2014–2023, 1,638 t) were at about half the estimated MSY level in 2010. If fishing effort and catches continue at or below the 2010 level (2,129 t), it is expected that the biomass of the stock will continue to increase over the near term.

In 2022-2023, the Billfish Working Group (BILLWG) of the International Scientific Committee for Tuna and Tuna-like Species in the north Pacific Ocean completed a full assessment of the western and central north Pacific Ocean (WCNPO) stock of striped marlin (ISC/23/ANNEX/14). A Stock Synthesis model was produced with the best-available life history parameters and catch, abundance index, and length composition data for the period 1977–2020. The results indicated that the fishing mortality (average for ages 3 – 12 during 2018-2020) was about three times the F_{MSY} and 9% above $F20\%SSB_{(F=0)}$. The spawning biomass (average for 2018-2020) was of 1,360 t, which is 63% below 20%$SSB_{F=0}$. Relative to dynamic 20-year 20%SSBF=0-based reference point, the WCNPO striped marlin stock was very likely overfished and was likely subject to overfishing.

Efforts continue to obtain reliable catch data from all fisheries. Until the data are available and updated, and a review of the status of striped marlin in the EPO is completed, it is recommended that, as a precautionary measure, fishing effort by fisheries that take most of the striped marlin catch in the EPO not be increased.

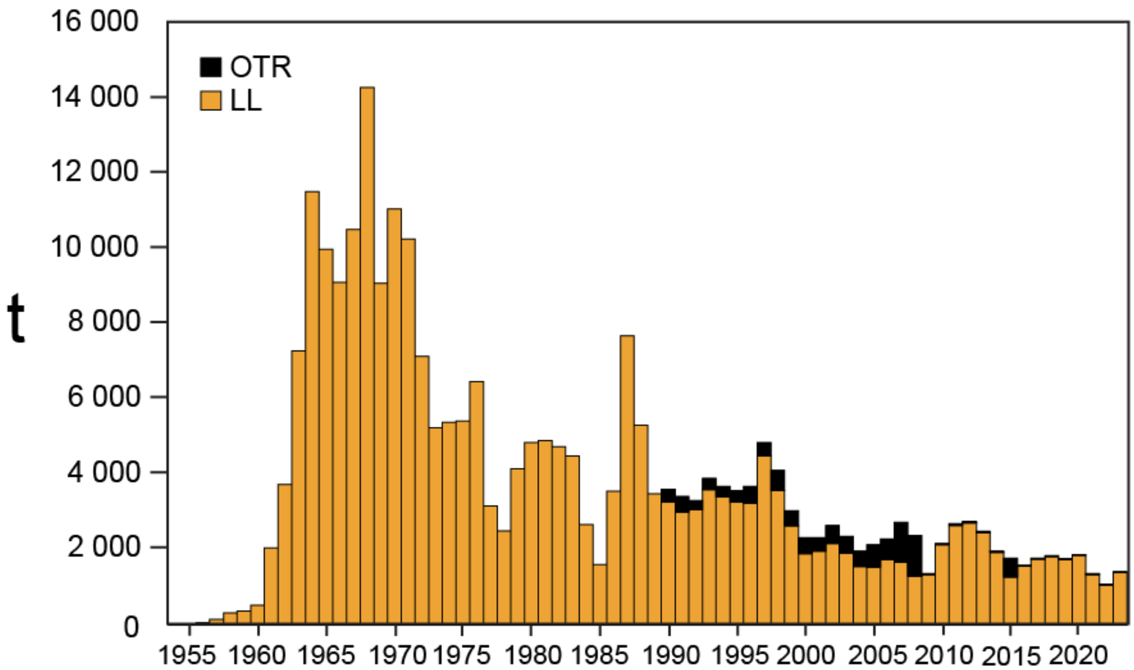


FIGURE I-1. Total reported retained catches of striped marlin in the North EPO by longline (LL) and other (OTR) fisheries (primarily recreational, 1954–2023. Due to unreported catches by recreational fisheries, estimates for 2009–2021 are minimums.

FIGURA I-1. Capturas retenidas totales reportadas de marlín rayado en el OPO Norte por las pesquerías palangreras (LL) y otras (OTR, principalmente recreativas), 1954–2023. Debido a capturas no reportadas por pesquerías recreativas, las estimaciones de 2009–2021 son mínimas.

J. SAILFISH

The stock structure of sailfish (*Istiophorus platypterus*) in the Pacific Ocean is well known. The species is most abundant in waters relatively near the continents and the Indo-Pacific land masses bordering the Pacific, and less frequently encountered in the high seas separating them. The populations in the EPO and in the western Pacific are genetically distinct.

The centers of sailfish distribution along the coast of the Americas shift in response to seasonal changes in surface and mixed-layer water temperature. Sailfish are found most often in waters warmer than about 28°C, and are present in tropical waters nearer the equator in all months of the year. Sailfish have among the largest number of conventional tag deployment of all billfishes, mainly attributed to their high importance to recreational fisheries worldwide. At least 126,000 sailfish have been tagged among the world's five largest volunteer gamefish tagging programs, although less than 2,000 fish (1.5%) have been recaptured. The data complement genetic information in that there appears to be high population substructure with fish often moving less than 500 km from their release locations. However, there are several instances where sailfish have moved reasonably long distances (2,000–3,500 km) over periods of less than a year, however, these distances can be considered small in comparison to movements of other billfish species in the EPO.

Spawning takes place off the coast of Mexico during the summer and fall, and off Costa Rica during winter, and perhaps year-round in areas with suitable conditions. The sex ratio is highly skewed towards males during spawning. The known shifts in sex ratios among spawning areas, and the spatial-temporal distributions of gonad indices and size-frequency distributions, which show smaller fish offshore, suggest that there may be maturity-dependent patterns in the distribution of the species in the EPO. Sailfish can reach an age of about 11 years in the EPO.

The principal fisheries that capture sailfish in the EPO include the large-scale tuna longline fishery primarily consisting of China, Chinese Taipei, Japan, and Korea; the smaller-vessel longline fisheries targeting tuna and other species, particularly those operating off Central America; and the artisanal and recreational fisheries of Central and South America. Sailfish are also taken occasionally in the purse-seine fisheries targeting tropical tunas, particularly in more coastal regions.

The first assessment of sailfish in the EPO was conducted in 2013 (SAC-04-07c). Initial analyses indicated that either this stock had uncharacteristically low productivity and high standing biomass, or—more likely—that a large amount of catch was missing in the data compiled for the assessment. A satisfactorily estimate of the missing catch was unavaible, thus the estimates of stock status and trends using Stock Synthesis—the preferred model for assessments—were unreliable. As a result, the assessment was conducted using a surplus production model, which provided results consistent with those obtained with Stock Synthesis and simplified the illustration of the issues in the assessment.

Key results:

1. It is not possible to determine the status of the sailfish stock in the EPO with respect to specific management parameters, such as maximum sustained yield (MSY), because the parameter estimates used in making these determinations in this case cannot be derived from the model results.
2. Average annual reported catches during 2021–2023 were 545 t (Figure J-1), significantly less than the 1993–2007 average of 2,057 t.
3. Sailfish abundance trended downward during 1994–2009, since then it has been relatively constant or slightly increasing until 2011, the last year in the assessment model (Figure J-2).
4. Assessment model results suggest that there are significant levels of unreported catch, and the actual catch in earlier years was probably higher than those reported for 1993–2007. Assuming that this level of harvest has existed for many years, it is expected that the stock condition will not deteriorate if catch is not increased above current levels.
5. A precautionary approach that does not increase fishing effort directed at sailfish, and that closely

monitors catch until sufficient data are available to conduct another assessment, is recommended.

6. A reliable assessment of the sailfish resources in the EPO cannot be obtained without reliable estimates of catch. It is therefore recommended that:
   a. historical data on catches of sailfish be obtained wherever possible
   b. fisheries currently reporting sailfish catches commingled with other species be required to report catches by species.
   c. existing data from small-scale fisheries, such as local longline fleets, artisanal and recreational fisheries, be compiled and that, where necessary, catch monitoring programs to identify catches by species be implemented.

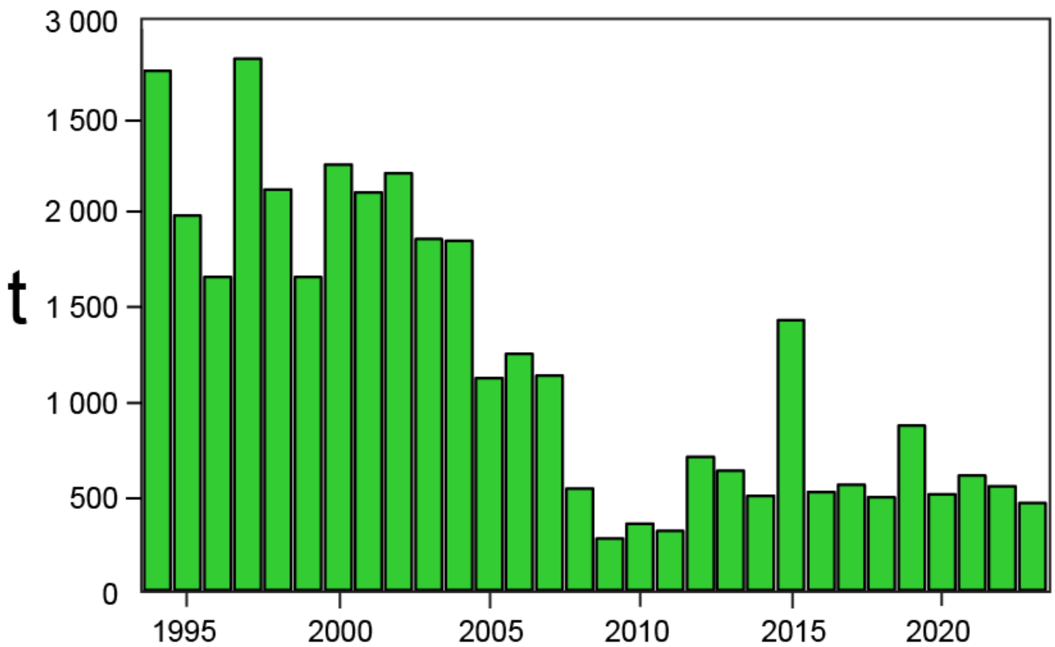


FIGURE J-1. Total reported catches of sailfish in the EPO, 1994–2023. (The actual catches were probably greater).

FIGURA J-1. Capturas totales reportadas de pez vela en el OPO, 1994–2023. (Las capturas reales fueron probablemente mayores).

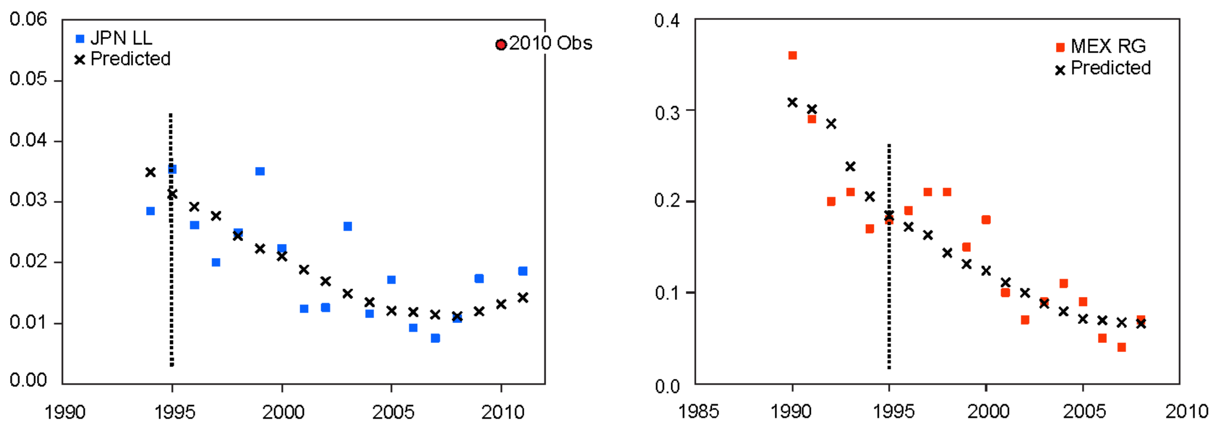


FIGURE J-2. Observed and predicted indices of relative abundance of sailfish in the EPO from Japanese longline (JPN LL) and Mexican recreational (MEX RG) fisheries. The 2010 observation in the JPN LL series was not included in the analyses.

FIGURA J-2. Índices observados y predichos de abundancia relativa del pez vela en el OPO, basados en las pesquerías palangrera japonesa (JPN LL) y recreacional mexicana (MEX RG). No se incluyó en los análisis la observación de 2010 en la serie JPN LL.

K. SHARKS

Over 300 species of sharks inhabit the Pacific Ocean, of which at least 49 species have been documented to be caught, either as a target or incidental bycatch, in the industrial and small-scale coastal (*i.e.*, 'artisanal') pelagic fisheries of the eastern Pacific Ocean (EPO). In general, sharks are long-lived (20+ years), slow growing, mature late in life and produce a small number of offspring (<10 pups), often every few years, resulting in conservation concerns for many species impacted by fishing. In recognition of the potential negative impacts of fishing on sharks globally, many species interacting with pelagic fisheries in EPO are listed by the International Union for Conservation of Nature (IUCN) Red List of Threatened Species and/or by the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES). Furthermore, the IATTC has implemented a range of conservation and management measures (CMMs) for sharks since at least 2005 to limit or prohibit their capture, or to promote handling practices to maximize their post-release survival. For example, retention prohibition measures have been in place for oceanic whitetip shark in all EPO industrial tuna fisheries since 2011 (Resolution C-11-10) and for silky shark in all purse-seine fisheries since 2016 (Resolution C-16-06). In 2024, the IATTC adopted Resolution C-23-07 "*Conservation measures for the protection and sustainable management of sharks*" which consolidates existing measures that pertain to sharks in IATTC Resolutions, and strengthens shark conservation and management measures in the EPO. Furthermore, the resolution requires the IATTC staff to draft, in collaboration with the EBWG and the SAC, an interim list of shark species for the consideration by Members to be under the purview of the Commission. A list of 49 species documented to interact with pelagic fisheries in the EPO was used in combination with other available species lists, ecological characteristics and conservation classifications by international instruments to provide a recommendations from the staff for an interim list of shark species (see SAC-15-09). Based on the discussions with the EBWG and the IATTC staff, the SAC recommended 18 shark species be included in the draft list of species (SAC-15-09 Recs). These species were subsequently adopted by the Commission at its 102nd meeting in 2024 in Resolution C-24-05 as priority species for research, with a particular emphasis on *Carcharhinus longimanus* and *C. falciformis*, *Sphyrna lewini*, *S. zygaena*, and *S. mokarran*, *Alopias pelagicus* and *A. supercilicious*, and *Prionace glauca*, with a goal to collaborate with the Western and Central Pacific Fisheries Commission (WCPFC) for Pacific-wide stocks.

Sharks are often incidentally caught as bycatch in EPO fisheries targeting tunas and billfish, and therefore insufficient or unreliable catch and biological data available for the majority of shark species has hindered the development of stock assessments, except for a small number of economically important species such as blue and shortfin mako sharks that were assessed by the ISC as contiguous north Pacific stocks in 2022 and 2024, respectively. Given data deficiencies, but at the same time acknowledging the need to demonstrate ecological sustainability mandates under the Antigua Convention, the IATTC has developed a strategic research plan (see SAC-16-07) to use ecological risk assessment to identify vulnerable species for monitoring, research and management, and where possible, undertake detailed assessments of stock indicators or stock status.

Vulnerability assessment of sharks caught in eastern Pacific Ocean pelagic fisheries

In 2018, the IATTC staff developed of a flexible spatially-explicit quantitative ecological risk assessment approach—Ecological Assessment of Sustainable Impacts of Fisheries (EASI-Fish)—specifically designed to quantify the cumulative impacts of multiple fisheries for data-limited bycatch species to identify vulnerable species and prioritize them for data collection, research and management. In 2022, the IATTC undertook the first comprehensive vulnerability assessment for sharks in the EPO using EASI-Fish (SAC-13-11), which characterized their vulnerability status for 2019, the most recent complete fishing year to be representative of contemporary fishing effort regimes in the EPO before fishing effort, data collection and provision were significantly impacted by the COVID-19 pandemic.

Of the 49 shark species recorded to interact with industrial (purse-seine and longline) and artisanal (longline and gillnet) pelagic fisheries in the EPO, 32 species were formally assessed using EASI-Fish. In 2019, estimates of a proxy for fishing mortality ($\tilde{F}_{2019}$) and the spawning stock biomass per recruit (SBR_{2019}) exceeded biological reference points ($F_{40\%}$ and $SBR_{40\%}$) for 20 species, classifying them as "most vulnerable" (Figure K-1; SAC-13-11). These included hammerhead sharks (5 species; *Sphyrna corona, S. media, S. mokarran, S. lewini,* and *S. zygaena*), requiem sharks (10 species; *Carcharhinus altimus, C. brachyurus, C. falciformis, C. leucas, C. limbatus, C. longimanus, C. plumbeus, C. porosus, Nasolamia velox,* and *Rhizoprionodon longurio*), threshers (2 species; *Alopias superciliosus* and *A. pelagicus*), mesopelagic sharks (3 species; *Dalatias licha, Pseudocarcharias kamoharai,* and *Zameus squamulosus*) and the commercially important blue shark (*Prionace glauca*) and shortfin mako (*Isurus oxyrinchus*). The remaining 12 species were classified as "least vulnerable" (9 species) or "increasingly vulnerable" (3 species). Key knowledge gaps identified were the location of fishing effort and the shark catch in artisanal fisheries and basic biological information for several species. Overall, the most vulnerable species were *S. zygaena, C. falciformis* and *S. lewini*, which coincidentally, were identified by the IATTC as a priority for stock assessments (Resolution C-16-05), while stock indicators for silky shark have been produced annually since 2014 (see below). However, given the lack of species-specific catch data for these species, particularly in artisanal fisheries where catches are believed to be highest, EASI-Fish is planned to be used as an exploratory tool in the interim period until catch and post-release survival data are improved to simulate changes to existing, or additional, management measures, either in isolation or in concert, to determine their efficacy for reducing species-specific vulnerability. This exploratory approach was implemented in 2023, where the effects of 43 different conservation and management measures were simulated for silky shark (*Carcharhinus falciformis*) and three hammerhead species; scalloped hammerhead (*Sphyrna lewini*), great hammerhead (*Sphyrna mokarran*), and smooth hammerhead (*Sphyrna zygaena*) using EASI-Fish (SAC-14-12). This assessment showed that no single management measure was able to reduce the vulnerability status of any species from a "vulnerable" to a "least vulnerable" status. Although scenarios such as temporal EPO closures, banning wire traces, imposing a 100 cm total length minimum retention length for all sharks, and even prohibiting landing of all sharks predicted a significant reduction in at-vessel mortality, this positive effect on vulnerability was mostly negated by high post-release mortality of these species. These results highlighted that the most effective mitigation measure for these sharks is to avoid interaction with EPO fisheries. The assessment identified several major data gaps that need to be addressed through a collaborative participatory research approach between the IATTC and its CPCs, including basic biology and improved species-specific catch and size composition data in artisanal fisheries and the industrial longline fishery. Addressing these data needs will not only help to improve short-term rapid assessments such as EASI-Fish, but also develop longer-term time series data required to undertake new and conventional methods such as close-kin mark recapture or traditional stock assessments from the which population status of these vulnerable species can be determined.

Updated stock status indicators for silky sharks in the eastern Pacific Ocean (1994-2022)

The indices for large silky sharks (>150 cm total length (TL)), based on data from the purse-seine fishery on floating objects, have been updated through 2024 for the north and south EPO (Figure 5; SAC-16-161). Previous analyses (SAC-08-08a(i), Lennert-Cody et al., 2019) identified a correlation between north EPO indices, particularly those for small (<90 cm TL) and medium silky sharks (90–150 cm TL), and interannual variability in oceanographic conditions, and thus the indices for those size categories, and for all silky sharks, were not updated because of concerns about bias. Because of recent increases in the live release of silky sharks, two sets of indices for large silky sharks were computed, one including live release data and the other not. Taken together, the two sets of indices likely bracket the trend that would have resulted in both the north and south EPO if "finning"[6], shark handling, and data recording practices had continued unchanged since 1994. The real trend is considered to be closer to the index based on dead + live releases because sharks recorded as released alive in recent years would probably have been recorded as dead previously, and thus the dead + live release is likely a more consistent indicator. The terminal point of these indices suggest a relatively stable abundance level for over a decade, with the 2024 values in both the south and north EPO being similar to the 2023 value, and thus no changes to management measures are recommended. However, the stock status is uncertain, and an assessment has not been possible due to the

[6] Cutting the fins off sharks and discarding the carcass.

paucity of data, especially for the longline fleets of coastal nations, which are believed to have the greatest impact on the stock (SAC-05-11a, SAC-14 INF-L). Thus, the IATTC staff reiterates its previous recommendations (SAC-07-06b(i), SAC-07-06b(iii), SAC-08-11) that improving shark fishery data collection in the EPO is critical. This will facilitate the development of other reliable stock status indicators and/or conventional stock assessments to better inform the management of the silky shark, and likely other, co-occurring shark species.

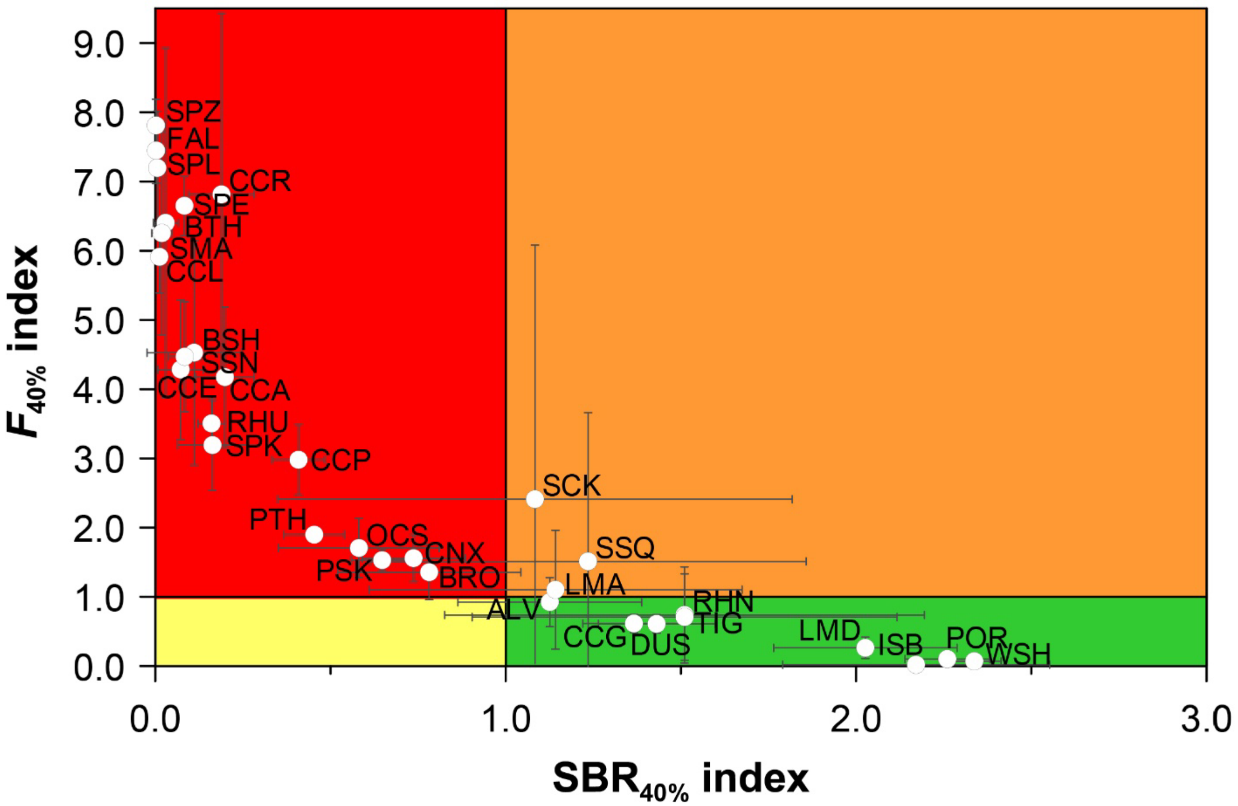


FIGURE K-1. Vulnerability phase plot showing the vulnerability status of 32 shark species caught in eastern Pacific Ocean pelagic fisheries assessed by EASI-Fish represented by mean (± standard deviation) estimates the biological reference points $\tilde{F}_{2019}/F_{40\%}$ and $SBR_{2019}/SBR_{40\%}$. Labels adjacent to symbols denote species codes shown Table 6. Vulnerability status values for each species are provided in Table 6.

FIGURA K-1. Gráfica de fase de vulnerabilidad que muestra el estado de vulnerabilidad de 32 especies de tiburones capturadas en las pesquerías pelágicas del Océano Pacífico oriental evaluadas por EASI-Fish, representadas por estimaciones promedio (± desviación estándar) de los puntos de referencia biológicos $\tilde{F}_{2019}/F_{40\%}$ y $SBR_{2019}/SBR_{40\%}$. Las etiquetas adyacentes a los símbolos indican los códigos de especie mostrados en la Tabla 6. Los valores del estado de vulnerabilidad de cada especie se presentan en la Tabla 6.

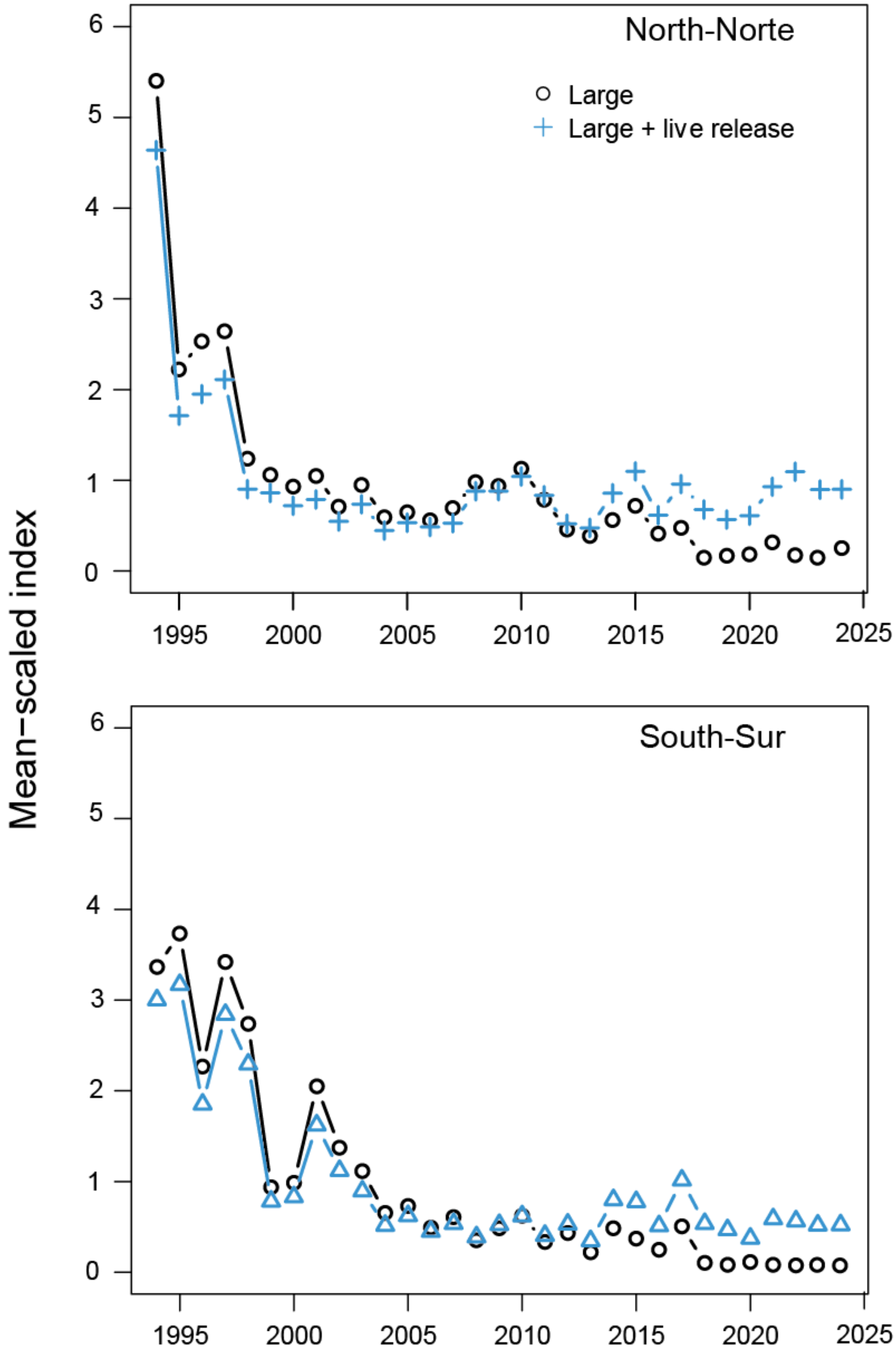


FIGURE K-2. Mean-scaled standardized bycatch-per-set (in numbers of sharks per set) of large silky sharks in sets on floating objects, with and without live release, in the north (top) and south (bottom) EPO.
FIGURA K-2. Captura incidental por lance (en número de tiburones por lance) estandarizada de tiburones sedosos grandes en lances sobre objetos flotantes, con y sin liberación en vivo, en el OPO norte (arriba) y sur (abajo).

L. ECOSYSTEM CONSIDERATIONS

CONTENTS

SUMMARY

Over the past two decades, the scope of management of many fisheries worldwide has broadened to include the impacts of fishing on non-target species in particular, and the ecosystem more broadly. This ecosystem approach to fisheries management (EAFM) is important for maintaining the integrity and productivity of ecosystems while maximizing the utilization of commercially-important fisheries resources, but also ecosystem services that provide social, cultural and economic benefits to society. In response to the increasing interest in EAFM by the IATTC with the adoption of the Antigua Convention, the staff has presented an *Ecosystem Considerations* report since 2003 with information on non-target species and on the effect of the fishery on the ecosystem, and to describe how ecosystem research can contribute to management advice and the decision-making process. It also describes some important recent advances in research related to assessing ecological impacts of fishing and the environment on the eastern Pacific Ocean (EPO) ecosystem and its associated species. Specifically, information presented herein includes: (1) fisheries interactions (e.g., incidental catches of non-target species, generally termed "bycatch", by broad taxonomic groups i.e., marine mammals, sea turtles, seabirds, elasmobranchs and teleosts), (2) a broad overview of the physical environment including short and medium- (e.g., El Niño Southern Oscillation conditions) and long-term (e.g., Pacific Decadal Oscillation) environmental indicators, (3) tools for identifying potentially vulnerable species[7] (e.g., the Ecological Assessment of Sustainable Impacts of Fisheries (EASI-Fish)), (4) ecosystem dynamics assessed through an eastern tropical Pacific Ocean (ETP)

[7] Unless specified otherwise, including but not limited to citations to vulnerability assessments and any qualitative/quantitative scores (e.g. BYC-10 INF-B; SAC-13-11; SAC-14-12), the staff's definition of "vulnerable species" refers to the species that, in the sensu latu, and due to their low-productive life-history traits (i.e. K species in r/K selection theory), are more vulnerable to the impacts of fisheries and other anthropogenic activities on these species or their habitat and ecosystem. This includes the marine mammals, seabirds, sea turtles and the elasmobranchs.

ecosystem model and corresponding ecological indicators, and (5) future developments for ecological research in the EPO to continue to guide science-based advice to the IATTC. It is important to note that data availability is poor for many bycatch taxa caught by fisheries other than the large vessel purse-seine fishery (class 6, >363 t), which has 100% observer coverage, such as the industrial longline fishery having a mandate of at least 5% observer coverage. Biological data is also lacking for many of these same species. This paucity in data has long been recognized by the staff (e.g., see SAC-07-INF C(d), SAC-08-07b, SAC-10 INF-B). Consequently, recommendations by the staff for improvements in data collection and submission are underway. These include data improvement workshops (e.g., "industrial longline" (see WSDAT-01, WSDAT-01-RPT); "small purse-seine vessels" i.e., ≤363 t (see WSDAT-02, WSDAT-02-RPT) and a compilation of updated recommendations for both fisheries based on participant feedback (SAC-16 INF-O)), a proposed biological sampling project (SAC-14 INF-J) and a list of ray species under the purview of the IATTC (SAC-16-08). The latter, similar to what was supported by the IATTC for sharks (see Resolution C-24-05), is expected to facilitate progress of science-based advice for guiding and implementing EAFM. Furthermore, updates to the proposal to restructure the *Ecosystem Considerations* report into two ecosystem-advice products (presented in EB-02-02): an indicator-based ecosystem report card ("*EcoCard*") and a complementary *Ecosystem Status Assessment* are presented in EB-03-04 to improve IATTC's communication of ecosystem status.

INTRODUCTION

The ecosystem approach to fisheries management (EAFM) was first formalized in the 1995 FAO *Code of Conduct for Responsible Fisheries*, which stipulates that "*States and users of living aquatic resources should conserve aquatic ecosystems*" and that "*management measures should not only ensure the conservation of target species, but also of species belonging to the same ecosystem or associated with or dependent upon the target species*". In 2001, the Reykjavik Declaration on Responsible Fisheries in the Marine Ecosystem elaborated on these principles with a commitment to incorporate an ecosystem approach into fisheries management.

The IATTC's Antigua Convention, which entered into force in 2010, is consistent with these instruments and principles. Article VII (f) establishes that one of the functions of the IATTC is to "*adopt, as necessary, conservation and management measures and recommendations for species belonging to the same ecosystem and that are affected by fishing for, or dependent on or associated with, the fish stocks covered by this Convention, with a view to maintaining or restoring populations of such species above levels at which their reproduction may become seriously threatened*". Prior to that, the 1999 Agreement on the International Dolphin Conservation Program (AIDCP) introduced ecosystem considerations into the management of the tuna fisheries in the EPO. Consequently, for over twenty years the IATTC has been aware of ecosystem issues pertaining to tuna fishing activities, and has moved towards EAFM in many of its management decisions (e.g., SAC-10 INF-B; Juan-Jorda et al. 2018). Within the framework of the IATTC's 5-year Strategic Science Plan (SSP), first implemented in 2019, the IATTC staff conducts novel and innovative ecological research aimed at obtaining the data and developing the tools required to implement EAFM in the tuna fisheries of the EPO. Current and planned ecosystem-related activities by the staff is summarized in the SSP (IATTC-93-06a, SAC-16-07) and the Staff Activities and Research report (e.g., SAC-16 INF-E).

Assessing the ecological sustainability of EPO tuna fisheries is a significant challenge, given the wide range of species with differing life histories with which tuna fisheries interact. While relatively good information is available for catches of tunas and tuna-like species throughout the Convention area, this is not the case for most non-target (i.e., "bycatch") species, especially those that are less frequently encountered, discarded at sea or have low economic value (see section 2 and IATTC Special Report 25). Furthermore, environmental processes that operate on a variety of temporal and spatial scales (e.g., El Niño-Southern Oscillation, Pacific Decadal Oscillation, ocean warming, anoxia and acidification) can influence the abundance and horizontal and vertical distributions of species to differing degrees, which in turn affects their potential to interact with tuna fisheries (e.g., SAC-15 INF-L, SAC-16 INF-T). At its 101st meeting, the IATTC adopted its first Resolution on climate change (C-23-10). As a result, a proposed workplan towards climate resilient fisheries was presented at the 15th meeting of the Scientific Advisory Committee

(SAC) to facilitate a better understanding of climate change and to prepare for potential predicted impacts on fisheries, target species, non-target species, and the broader EPO ecosystem (SAC-15-12). In 2024, during the 102nd meeting of the IATTC, the climate change Resolution was amended (C-24-10), and the 1st Workshop on Climate Change (WSCC-01) was held virtually in February 2025. Updated background information and staff's recommendations on the goal, scope and the framework of the proposed Climate Change workplan can be found in SAC-16 INF-P.

Biological reference points, based on estimates of fishing mortality, spawning stock biomass, recruitment, and other biological parameters, have been used for conventional single-species management of target species, but the catch and/or biological data required for determining such reference points, or alternative performance measures, are unreliable or unavailable for most bycatch species. Similarly, given the complexity of marine ecosystems, there is no single indicator that can holistically represent their structure and internal dynamics and thus be used to monitor and detect the impacts of fishing and the environment.

Due to the broadening array of ecological, environmental and fishery issues that are required to support EAFM of the EPO ecosystem, the length and complexity of this all-encompassing document has increased significantly in recent years to the extent that it is not optimal for succinctly conveying key messages to IATTC's Cooperating Members and Non-members (CPCs), stakeholders and the wider public. Therefore, the staff plan to restructure this report—considering ongoing work by the other tuna-Regional Fisheries Management Organizations (t-RFMOs)—into two complementary ecosystem-advice products: (1) an indicator-based Ecosystem Report Card or "EcoCard" highlighting a selected set of 'key' bycatch, ecosystem, and climate, indicators determined by the staff and through stakeholder consultation to best represent ecosystem status and (2) a complementary "Ecosystem Status Assessment" detailing the full suite of indicators considered to communicate the overall status of marine ecosystems and trends over time. A background paper (EB-02-02) details current efforts on EcoCards for the western and central Pacific Ocean by the Western and Central Pacific Fisheries Commission (WCPFC), the Atlantic Ocean by the International Commission for the Conservation of Atlantic Tunas (ICCAT) and the Indian Ocean by the Indian Ocean Tuna Commission (IOTC), along with a proposed workplan for IATTC to develop these ecosystem-advice products in support of EAFM. An update of this workplan is provided in EB-03-04, focused on establishing the purpose (i.e., goal and objective) and a framework for the proposed *Ecocard* workplan. In the interim, the staff will continue to update the Ecosystem Considerations report.

DATA SOURCES

In this report, estimated total annual catches of bycatch species were obtained from observer data for the large-vessel purse-seine fishery[8], nominal catches reported by the limited observer coverage onboard the small-vessel purse-seine fishery[9], and gross annual removals by the longline fishery were obtained from annual summary reports (TASK I data, see SAC-12-09, WSDAT-01-01, specifications for data provision) submitted to the IATTC by CPCs. Minimum catches in 2023 reported by observers on longline vessels are also included as an interim measure until observer coverage increases from the mandated 5% to at least 20%—as recommended to the Commission by the scientific staff—that may allow total annual catches for some bycatch species to be reliably estimated. Observer coverage for CPCs has not been considered by staff to be representative of the activities of their longline fleets (see section 2.2. below and BYC-10 INF-D), although for some CPCs observer coverage has been above the 5% minimum coverage requirement (see e.g., SAC-15 INF-B, SAC-16 INF-B). Longline data were available through 2023 as the deadline for data reporting for the previous year occurs after the annual SAC meeting (see Resolutions C-03-05; C-19-08). However, these data are incomplete as operational data have not yet been received by all CPCs at the time of this report. Purse-seine data were available through 2024, with data from the last 2 years considered preliminary as of March 2025. Each data source and their associated data gaps are described in detail below. Additional information on bycatch data is available by fishery (see e.g., SAC-07-INF-C(d), SAC-12-09, WSDAT-01-01, WSDAT-02-01, IATTC Special Report 25).

[8] Size class 6 purse-seine vessels with a carrying capacity > 363 t

[9] Vessels with a carrying capacity ≤363 t

1.1. Purse-seine

Data from the purse-seine fishery is compiled from 3 data sources: 1) IATTC and National Program observer programs, 2) vessel logbooks that are obtained by staff at the Commission's field offices in Latin American tuna ports, and 3) canneries. The observer data from the large-vessel (Class 6) fishery are the most comprehensive in terms of bycatch species, since the 1992 Agreement on the Conservation of Dolphins (the La Jolla Agreement) has required an observer be onboard for all trips for Class- 6 vessels since 1993. An historical perspective of bycatch data collection from the observer programs is described in IATTC Special Report 25. Observers working in the IATTC and the various National Programs provide detailed bycatch data by species, catch, disposition and effort for the exact fishing position (i.e., the latitude and longitude of the purse-seine set). Both the fisher-completed logbook and cannery datasets contain very limited data on bycatch species as reporting is primarily focused on commercially important tuna species. The logbook data, like the observer data, includes exact fishing positions. The cannery (or "unloading") data do not have an exact fishing position but rather a broad geographic region where fish were caught (e.g., the eastern Pacific or western Pacific Ocean). These data contain bycatch species only if they were retained in a purse-seine well during the fishing operation and unloaded.

Smaller (Class 1–5) purse-seine vessels are not required to carry observers, except under specific circumstances (e.g., certification purposes, fishing during closure periods). The primary sources of unobserved data are logbook records and cannery unloading records. Some trips made by small purse-seine vessels are sampled for species composition and length frequencies (i.e., port sampling data). All of these data sources focus on tuna species. The FAD form, a logbook designed in late 2018 to be used by skippers of small vessels when fishing on FADs, is also a source of unobserved data for tunas and sensitive species groups, but bycatch data from this form is currently of little use for the purposes of the ecosystem considerations report as data are aggregated into broad taxonomic groups and data quality is uncertain. As such, there is limited information recorded on interactions with bycatch species by smaller purse-seine vessels. For additional information on data sources for the small purse-seine fishery see WSDAT-02-01.

In recent years there has been an increase in the number of smaller vessels that have carried observers. This is due to AIDCP requirements for these vessels to fish during closure periods for Class 6 purse-seine vessels, a desire for dolphin-safe fishery certification, an IATTC pilot project trialing the efficacy of electronic monitoring methodologies (SAC-11-11), and a voluntary observer program for smaller vessels established by the Tuna Conservation Group (TUNACONS)—a consortium of Ecuadorian tuna fishing companies that began in 2018. The minimum observer-derived catch reported by observers for bycatch species by small vessel trips are included in this report (Table L-8) to provide rudimentary information currently available for this fishery, with a view to expanding reporting on this fishery as data provision is hoped to improve in future (but see WSDAT-02-02). The 2nd Workshop on Data Improvement focused on the small purse-seine fishery and was held virtually in February 2025 (WSDAT-02) to discuss possible means for improving data collection and provision with the overarching goal of producing recommendations for updating the data provision Resolution C-03-05 (see WSDAT-02-RPT) and updated recommendations based on participant feedback (SAC-16 INF-O). In 2024, most trips (53%) made by smaller vessels were unobserved, 37% were observed by the voluntary TUNACONS observer program, 6% from the Ecuadorian National observer program, and 4% from the IATTC observer program.

Therefore, in this report we primarily focus on the comprehensive observer dataset from large purse-seine vessels to provide catch estimates for bycatch species. The bycatch data provided by the observers are used to estimate total catches, by set type (i.e., floating objects (OBJ), unassociated tunas (NOA), and dolphins (DEL)). The numbers of sets for each type made in the EPO during 2009–2024 are shown in Table A-7 of Document SAC-16-01.

Despite the observer requirement for all Class-6 trips, some sets are known to have taken place, based on logbooks and other sources, but were not observed. For example, at the start of bycatch data collection in 1993, about 46% of sets were observed, increasing to 70% in 1994. From 1994 to 2008, the average percent of sets observed was around 80%. From 2009 onwards, nearly 100% of sets were observed. Catch-per-day data for both target and non-target, bycatch species are extrapolated[10] to account for such instances.

1.2. Longline

The considerable variability in reporting formats, quality, completeness, and observer coverage levels of longline data has hindered the staff's ability to estimate EPO-wide catches for bycatch species (SAC-08-07b, SAC-08-07d, SAC-08-07e, BYC-10 INF-D). Bycatch data for longline fisheries reported herein were obtained using data of gross annual removals estimated by each CPC and reported to the IATTC in summarized form (i.e., termed "TASK I" data). Because there is uncertainty in whether the IATTC is receiving all bycatch data from the longline fishery of each CPC and considerable variability has been observed in the reported data by taxa, these data are considered incomplete, or 'sample data', and are therefore regarded as minimum annual reported catch estimates for 1994–2023. A staff- and stakeholder-wide collaboration is underway to provide recommendations for updating the data provision Resolution C-03-05 to improve the quality of data collection, reporting, and analysis to align with IATTC's responsibilities set forth in the Antigua Convention and the SSP (SAC-12-09). A preliminary objective of this work is to initiate a series of collaborative workshops between the staff and CPCs to assess the feasibility of collecting desirable data types and develop data collection templates for each gear type, with clear standards and procedures for data submission that will explicitly include interactions with bycatch species, especially those explicitly listed as priority species for research and management advice (e.g., see SAC-15-09, Resolution C-24-05). The first workshop in the series—focused on the industrial longline fishery—was held by videoconference on 09–10 January 2023 and was attended by nearly 100 participants. A background document detailing the need for improving longline data, along with case examples, and staff recommendations was prepared by the staff (WSDAT-01-01); a series of presentations on this document, as well as a presentation by an invited speaker, were discussed during the workshop. Staff recommendations for updating Resolution C-03-05, pertaining to industrial longline data, were further revised based on input from workshop participants and consultations with individual CPCs (see SAC-14-14). The workshop report has also been posted to the IATTC website (WSDAT-01-RPT) and a series of staff recommendations were revised based on participant feedback (see SAC-14 INF-Q; SAC-16 INF-O). In 2023, the SAC, in general terms, endorsed the recommendations on tunas presented by the staff in SAC-14-14 (see SAC-14-16, paragraph 1d, paragraph) as well as a recommendation that the Commission review and update Resolution C-03-05 on "Data Provision", taking into consideration document SAC-14 INF-Q (SAC-14-16, paragraph 7.1 Resolution C-03-05). In 2024, the SAC-15 Recommendations included two similar recommendations, stating, *"(c) That the Commission notes the importance and need of having operational data from the longline fleet in order for stock assessments of tuna and other associated species covered by the Antigua Convention to be completed and (d) That CPCs that maintain tuna longline fleets operating in the EPO provide the scientific staff with historical operational data to enable the implementation of the Scientific Plan with respect to the construction of indices of abundance and useful information for stock assessments of tropical and temperate tunas.*" Therefore, the importance of updating this resolution is reiterated in SAC-16-11 and encourages CPCs to update C-03-05 to better align data provision and submission requirements with the Antigua Convention's mandate to include non-target, dependent and associated species, and the effects of the fishery on the ecosystem.

As part of the data-review process for gathering information on data reported to the IATTC under

[10] The observed data is aggregated by species, year, flag and set type. The number of known unobserved sets is taken from logbooks and other sources. Additionally, there are known EPO trips for which the staff do not know the number and type of sets made. Therefore, known bycatch-per-day from observer data is calculated by species, year, flag and set type, and applied to the number of days-at-sea for each trip to estimate the bycatch.
In some instances, there may be unobserved sets or days-at-sea data by a flag that have no equivalent observer data for that year to facilitate a reliable estimation of catch. For these trips, yearly data from a proxy flag is used. The proxy flag is determined by subsequent 5 trips made by the vessel where an observer was onboard, and adopting the predominant flag used for those trips as the proxy flag. Then the bycatch-per-set or day of the known proxy flag for the year in question is applied to the data for the unrepresented flag.

Resolution C-03-05, the staff were able to determine that the longline catches of sharks reported by CPCs were several times higher than previously reported. A review of the data revealed that a high proportion of shark catches were assigned to "other gears" in the annual Fishery Status Reports since 2006 but were in fact taken by longline by coastal CPCs. Therefore, attributing the catch from "other gears" to "longline" significantly increased the longline catches of sharks from 2006 onwards (see Table A2c in SAC-11-03).

Longline observer data reporting for longline vessels >20 m has been improving since Resolution C-19-08 was adopted in 2019, updating the previous longline observer measure, C-11-08. The staff has received detailed set-by-set operational level observer data for several CPCs, but under coverage by observers was exacerbated by the challenges many CPCs had in placing observers during the COVID-19 pandemic. The program resumed in 2023 and the limited observer data (see section 2 Data Sources; SAC-16 INF-B), is included in this report. The IATTC staff, the Ecosystems and Bycatch Working Group (EBWG) and the Scientific Advisory Committee (SAC) have continued to recommend that the longline observer coverage requirement should be increased to at least 20%. IATTC staff discussed the inadequacy of 5% coverage for scientific purposes and the representativeness of the data to adequately describe the activities of longline fleets in the EPO (BYC-10 INF-D). Although CPCs have made a tremendous effort to improve their reporting of longline observer data, results from that analysis showed that 5% observer coverage is insufficient for estimating the total catch of the relatively data-rich yellowfin and bigeye tunas and so catch estimates for bycatch species are likely to be considerably less reliable given that less data are available for these species. The challenges to observer placement and reporting of observer data necessarily implies that the datasets presented in this report are provided for transparency and show only minimum interactions and mortalities submitted to the IATTC. IATTC staff will seek to provide fleet estimates of longline catches in the EPO based on observer data in the future, but the results of the aforementioned analyses highlight a clear need for data reporting of bycatch species to improve (see SAC-12-09, WSDAT-01-01, SAC-14 INF-Q) prior to data extrapolation attempts.

FISHERY INTERACTIONS WITH SPECIES GROUPS

1.3. Tunas and billfishes

Data on catches of the principal species of tunas and bonitos of the genera *Thunnus*, *Katsuwonis*, *Euthynnus*, and *Sarda*, and of billfishes in the Istiophoridae and Xiphiidae families, are reported in Document SAC-16-01. The staff has developed stock assessments—including benchmark assessments for bigeye tuna (SAC-15-02), yellowfin tuna (SAC-16-03) and skipjack tuna (SAC-15-04)—and/or stock status indicators (SSIs) for tropical tunas (SAC-16-02). A risk analysis (SAC-16-04) and spatiotemporal modeling (SAC-16 INF-D) on skipjack tuna and results for the management strategy evaluation (MSE) for bigeye tuna (SAC-16-06) were presented at the 16th meeting of the SAC. The staff has also collaborated on the assessments of Pacific bluefin (2024; SAC-16 INF-Q) and north Pacific albacore (2023)—along with a progress report on north Pacific albacore (SAC-16 INF-X)—tunas led by the International Scientific Committee for Tuna and Tuna-like Species in the North Pacific Ocean (ISC), the assessment of south Pacific albacore tuna (2024) led by the Western and Central Pacific Fisheries Commission (WCPFC), and collaborated on the ISC assessments for north Pacific swordfish (2023), western and central North Pacific striped marlin (2023), and blue marlin (2021). A southern EPO swordfish benchmark assessment is provided in SAC-14-15.

1.4. Marine mammals

Marine mammals, especially spotted dolphins (*Stenella attenuata*), spinner dolphins (*S. longirostris*), and common dolphins (*Delphinus delphis*), frequently co-occur with yellowfin tuna in the EPO. Purse-seine fishers commonly set their nets around herds of dolphins and the associated yellowfin tuna, and then release the dolphins while retaining the tunas. The incidental mortality of dolphins using this method was high during the early years of the fishery, but declined dramatically in the early 1990s, and has remained at low levels thereafter (AIDCP-43-02; Figure L-1). The IATTC staff is collaborating on two research projects on dolphins focused on improving current understanding of the potential impacts of tuna fisheries on dolphin populations (SAC-14 INF-K, SAC-16 INF-K), including a cow-calf separation study and a close kin mark recapture (CKMR) assessment pilot. Additionally, the staff co-organized a 2nd workshop on methods to monitor the status of dolphins in the EPO in May 2024 (see details here).

Estimates of incidental mortality of dolphins in the purse-seine fishery of large vessels during 1994–2024 are shown in Table L-1a. In 2024, the stock of dolphins with the highest incidental mortality was the eastern spinner (n=300), followed by the western-southern spotted (n=154), the northeastern spotted dolphins (n=151), and the whitebelly spinner (n=132). Common dolphins were least impacted by the fishery, with mortalities of 86 northern, 30 central, and 3 southern common dolphins.

In recent years, significant improvements have been made to the minimum data standards of longline observer data submitted to the IATTC, which now require submission of operational level data under Resolution C-19-08. However, as discussed in section 2.2, the low level of observer coverage (at least 5%) currently mandated for these vessels is not representative of the different fleet components and hinders the extrapolation of observed data to generate fleet totals (see BYC-10 INF-D). For the time being, only the minimum number of observed interactions and mortalities reported for marine mammals is presented for 2023 (Table L-1b). Interactions and mortalities were defined by subjective classification of fate (injured, discarded, released, or not reported) and release condition (alive, alive and healthy, alive and injured, dead, or not reported) as recorded by observers. Dispositions not reported or reported as discarded were precautionarily assumed to represent mortalities. Under these assumptions, three of the four interactions with marine mammals reported by observers in 2023 for the EPO were considered to be mortalities. These included 1 interaction with a false killer whale (*Pseudorca crassidens*), 1 interaction with a Risso's dolphin (*Grampus griseus*), and one with a Franciscana dolphin (*Pontoporia blainvillei*). The 1 interaction with a roughtoothed dolphin (*Steno bredanensis*) was recorded as released and was presumed to indicate survival. The staff reiterates that the level of observer coverage should be increased to at least the recommended 20% to help facilitate expansion of the number of interactions and mortalities to the total fleet activities for marine mammals and other vulnerable bycatch species.

1.5. Sea turtles

Sea turtles are occasionally caught in the purse-seine fishery in the EPO, usually when associated with floating objects that are encircled, although they are sometimes also caught by happenstance in sets on unassociated tunas or tunas associated with dolphins. They can also rarely become entangled in the webbing of fish-aggregating devices (FADs) or other floating objects (FAD-07-04) and drown or be injured or killed by fishing gear, although the impact of this is expected to be minimal due to improved FAD construction and design requirements (C-23-04 and C-23-05).

The number of estimated sea turtle mortalities and interactions recorded by observers on large purse-seine vessels, by set type, from 1994–2024 is shown in Figure L-2a and Figure L-2b, respectively. Interactions were defined from observer information recorded as fate on the dedicated turtle form as: entangled, released unharmed, light injuries, escaped from net, observed but not involved in the set and other/unknown, while mortalities were defined as those with fates recorded as: grave injuries, killed, or consumed. The Olive Ridley turtle (*Lepidochelys olivacea*) is, by far, the species of sea turtle most frequently caught, with a total of 21,469 interactions and 875 mortalities (~4%) during 1994–2024, but only 256 interactions and 1 mortality occurred in 2024 (Table L-2a). In 2024, there were 48 interactions recorded with eastern Pacific green, 35 loggerhead, 6 hawksbill, 3 leatherback, and 169 unidentified turtles and no mortalities.

In the longline fishery, sea turtles are caught when they swallow a baited hook, are foul hooked, or drown after becoming entangled in the mainline, floatlines or branchlines and cannot reach the surface to breathe. They are also caught in coastal pelagic and bottom-set gillnet fisheries, where they become enmeshed in the net or entangled in the floatlines or headrope. Although very few data are available on incidental mortality of turtles by longline and gillnet fishing, the mortality rates in the EPO industrial longline fishery are likely to be lowest in "deep" sets (around 200–300 m) targeting bigeye tuna and albacore, and highest in "shallow" sets (<150 m) targeting swordfish. There is also a sizeable fleet of artisanal longline and gillnet fleets from coastal nations that are known to catch sea turtles, but limited data are available (see BYC-11-02).

Data on sea turtle interactions and mortalities in the longline fishery have not been available (SAC-08-07b), but has been improving since 2019 with the submission of operational-level observer data pursuant to Resolution C-19-08. Recalling the observer coverage for most longline vessels is 5% or less (see BYC-10 INF-D), compared to 100% of observed trips in the large-vessel purse-seine fishery, the observer data provided by CPCs for 2023 are considered minimum numbers of interactions and mortalities (Table L-2b) that have been reported to the IATTC (see section 2.2). Here interactions and mortalities were defined by fate (discarded, injured, grave injuries, released, released with hook, or not reported) and/or release condition (alive and healthy, alive and injured, dead, unknown, or not reported) as recorded by observers. Observers reported 88 interactions of sea turtles in the EPO (50 black/green turtles, 16 Olive Ridley turtles, 11 loggerhead, 10 leatherback and 1 hawksbill) for 2023. Thirteen of the 88 interactions resulted in mortalities (6 black/green turtles (12%), 4 loggerhead turtles (36%) and 3 leatherback turtles (30%). The staff hopes to use the new operational observer data submissions required under C-19-08 to report the first total longline fleet catch estimate for sea turtle species in the future, although BYC-10 INF-D cautions that the current 5% observer coverage is insufficient for producing reliable estimates of total catch.

Various IATTC resolutions, most recently C-19-04, have been intended to mitigate fishing impacts on sea turtles and establish safe handling and release procedures for sea turtles caught by purse-seine and longline gears. Additionally, a "circle hook" workshop was held prior to the 13th SAC meeting to discuss a) the effects of different sizes of circle hooks on mitigating bycatch of sea turtles and other vulnerable species in the longline fishery and b) the minimum hook size to satisfy the requirements outlined in Resolution C-19-04. The workshop participants discussed the use of different circle hooks in longline fisheries to satisfy C-19-04, with minimum width of the hook defined on a fishery-specific basis and dependent upon the target species. However, no definitive conclusions or recommendations were made (WSHKS-01), although discussions on this topic resumed during the 11th Bycatch Working Group meeting in May 2022, the 1st EBWG meeting in May 2023, continued at the 2nd EBWG meeting in June 2024 and a 2nd circle hook workshop was held in April 2025 (WSHKS-02). The EBWG requested the workshop to address several topics including: 1) Define the size characteristics that qualify as a 'large' circle hook (Resolution C-19-04, Paragraph 3(d)(i)); 2) Review of the impacts of fishing operations on the form and structure (i.e., longevity and integrity) of circle hooks of various sizes and from different manufacturers; 3) Develop a third mitigation measure as described in Paragraph 3(d)(iii) of Resolution C-19-04 for small coastal multi-species vessel fleets; and 4) Update best handling and release practice guidelines for shallow-set longline fisheries. A background document (WSHKS-02-01), with several reviews on the workshop topics, is available on the workshop website.

A preliminary vulnerability assessment was conducted in collaboration with the Inter-American Convention for the Protection and Conservation of Sea Turtles (IAC) for the eastern Pacific stock of leatherback turtles for 2018, using the Ecological Assessment of Sustainable Impacts of Fisheries (EASI-Fish) approach (see section 5) (BYC-10 INF-B). The vulnerability status of the stock was determined to be "most vulnerable" in 2018. The staff continued to collaborate with IAC in 2020–2023 to improve the species distribution model (BYC-11-01, Lopez et al. 2024) and vulnerability assessment using updated fisheries data from coastal CPCs (BYC-11-02, Griffiths, Wallace et al. 2024). The final assessment showed that the vulnerability status of the stock remained as "most vulnerable" in 2019. Modelling of 70 conservation and management scenarios showed that the implementation of improved handling and release practices by industrial and artisanal fleets, or use of circle hooks, or use of fish bait by longline fleets could reduce at-vessel and/or post-release mortality to an extent where the vulnerability status of the population could improve to "least vulnerable", assuming the fishing effort dynamics of all EPO fisheries do not change. The use of these three measures in concert was predicted to reduce vulnerability even further. Detailed results from this work were presented in 2022, at the Bycatch Working Group meeting (BYC-11-01, BYC-11-02) and at the Ecosystem and Bycatch Working Group of ICCAT in May 2023, as an example of a successful collaboration between two international organizations. Yet, Resolution C-19-04 has not been updated to reflect the potential benefits of such conservation and management measures on the leatherback turtle.

1.6. Seabirds

There are approximately 100 species of seabirds in the tropical EPO. Some of them associate with epipelagic predators, such as fishes (especially tunas) and marine mammals, near the ocean surface; for some, feeding opportunities are dependent on the presence of tuna schools feeding near the surface. Some seabirds, especially albatrosses and petrels, are attracted to the lights and baits of pelagic longline vessels and are caught on baited hooks—often in the process of their deployment—used by this fishery. Sightings-only data are available for the purse-seine fishery (IATTC Special Report 25).

The IATTC has adopted one resolution on seabirds (C-11-02), and draft guidelines for best handling and release practices (BHRP) of seabirds were presented to the 1st EBWG meeting in 2023 (EB-01-01, Annex 1) and the 2nd EBWG in 2024 (EB-02-03, Annex 1). The BHRPs were further developed for seabirds captured in all fisheries under IATTC purview and were discussed again in 2025 during the 3rd EBWG (EB-03-06)

Participants in the circle hook workshop, held in March 2022 (WSHKS-01), discussed the influence of circle hooks on seabird capture and mortality. The available data seem to be inconclusive to comment on any conservation value of circle hooks over other hook shapes or sizes to seabirds, given a lack of empirical studies. In 2024 the EBWG adopted a seabird action plan (see SAC-15-15, Annex 1) , requesting the IATTC scientific staff to: 1) Conduct a comparison between IATTC seabird mitigation measures described in C-11-02 and mitigation measures used in other tuna RFMOs; 2) Update SAR-7-05b which examined the spatial distribution of seabird species in the IATTC Convention Area relative to longline fishing effort; 3) Generate an overview of mitigation measures in use by CPCs in the IATTC Convention Area, including those CPCs that may have vessels fishing in areas where bycatch mitigation measures are not required; and 4) Summarize observed and estimated seabird bycatch rates in the IATTC Convention Area to inform CPC discussions regarding a potential update to Resolution C-11-02. In 2025, two documents addressing the four objectives laid out in the seabird action plan were presented at the 3rd EBWG. Document EB-03-02 provides information on seabird distribution overlap with longline fishing effort and seabird bycatch rates in the IATTC Convention Area, and document EB-03-03 provides a review of bycatch mitigation options, measures and use.

As with sea turtles, data on seabird interactions and mortalities in the longline fishery have been unavailable (SAC-08-07b), but with the submission of operational-level observer data for longline vessels >20 m beginning in 2019 some minimum values for 2023 are available (Table L-3) (but see section 2.2 for uncertainties and data gaps in reported data).

The observer data submitted by CPCs for 2023 contained 15 total interactions (14 mortalities) with two seabird taxa, the black-footed albatross, *Phoebastria nigripes*, (10 interactions; 10 mortalities) and unidentified albatross (5 interactions; 4 mortalities) in the EPO. Dispositions for 14 of the interactions were recorded as "discarded" and without additional information, these were precautionarily presumed to result in mortalities. One interaction with an unidentified albatross was recorded as "released" and this was presumed to indicate survival. The staff hopes to report the first total longline fleet catch estimate for seabird species in the future using the operational observer data as improvements in data collection continue—but see BYC-10 INF-D for a discussion on the current inadequacy of longline observer data for expanding data to the activities of the longline fleet to provide estimates of total catch.

1.7. Sharks

Sharks are caught as bycatch in EPO tuna purse-seine fisheries and as either bycatch or a target in longline and multi-species and multi-gear fisheries of the coastal nations. To mitigate the impacts of fishing on sharks, guidelines for best handling and release practices (BHRP) in IATTC fisheries were presented in SAC-15-11, as requested under Resolution C-23-07. An updated shark conservation Resolution C-24-05 was adopted in 2024 and incorporated BHRP recommendations with a request for the staff to work with the CPCs and industry representatives on updating the BHRP guidelines in 2025. Document SAC-16-10 addresses this request and provides the staff's recommendations for updating the adopted BHRP guidelines. These recommendations are data driven and based upon practices that demonstrate measurable improvements to post release survival rates and include, among others, and to the extent possible, removing sharks from the purse-seine net prior to sacking up, releasing entangled sharks promptly and ensuring that sharks are sorted on the main-work deck and do not go down the chutes to the wells, and minimizing handling stress and time onboard for purse-seine fisheries, and leaving sharks in the water, removing trailing gear, and minimizing handling stress to improve post-release survival for longline fisheries.

Stock assessments or stock status indicators (SSIs) are available for only 4 shark species in the EPO: silky (*Carcharhinus falciformis*) (Lennert-Cody *et al*. 2018; BYC-10 INF-A, BYC-11 INF-A), blue (*Prionace glauca*) (ISC Shark Working Group), shortfin mako (*Isurus oxyrinchus*) (ISC Shark Working Group), and common thresher (*Alopias vulpinus*) (NMFS). As part of the FAO Common Oceans Tuna Project, Pacific-wide assessments of the porbeagle shark (*Lamna nasus*) in the southern hemisphere (Clarke 2017) and the bigeye thresher shark (*Alopias superciliosus*) (Fu *et al*. 2018) were completed in 2017, and for the silky shark (Clarke 2018a), as well as a risk assessment for the Indo-Pacific whale shark population (Clarke 2018b), both in 2018. Whale shark interactions with the tuna purse-seine fishery in the EPO are summarized in document BYC-08 INF-A. The staff is currently conducting a CKMR pilot for silky sharks, as well as improving data collection and the understanding of the catches of sharks by the small-scale coastal fisheries in Central America, Mexico, Peru and Ecuador, with an emphasis on silky sharks and hammerheads (e.g., SAC-14 INF-L, SAC-14 INF-M, SAC-16 INF-V, SAC-16 INF-W).

The first quantitative vulnerability assessment of sharks for EPO industrial and artisanal fisheries—using the EASI-Fish methodology (section 5)—was completed in 2022 and was presented at SAC-13 (SAC-13-11). A total of 49 shark species were recorded to interact with EPO tuna fisheries, of which 32 species were formally assessed using EASI-Fish for 2019. Overall, 20 species were classified as "most vulnerable", including hammerhead sharks (4 species), requiem sharks (10 species), threshers (*Alopias superciliosus* and *A. pelagicus*), mesopelagic sharks (3 species) and the commercially important blue shark (*Prionace glauca*) and shortfin mako (*Isurus oxyrinchus*). The remaining 12 species were classified as "least vulnerable" (9 species) or "increasingly vulnerable" (3 species). The staff recommended further analysis to explore a range of potential hypothetical conservation and management measures (CMMs) that may be implemented—in isolation or in combination—within the EPO to reduce fishery impacts on particularly vulnerable shark species identified, including silky, thresher and hammerhead sharks. The EASI-Fish approach was applied to silky shark and hammerhead sharks during 2022–2023 to determine the relative benefits of alternative management scenarios on species' vulnerability (SAC-14-12).

At its 101st meeting, the IATTC adopted Resolution C-23-07, which includes a provision for IATTC staff to draft, in collaboration with the EBWG and the SAC, an interim list of shark species for the consideration by Members to be under the purview of the Commission. A list of 49 species documented to interact with pelagic fisheries in the EPO was used in combination with other available species lists, ecological characteristics and conservation classifications by international instruments (e.g., IUCN Red List of Threatened Species) to provide potential recommendations from the staff for an interim list of shark species (SAC-15-09). As a result of this work, a final list of 18 species was adopted in 2024 in Annex 4 of Resolution C-24-05 to denote species of special research and management interest for the Commission.

Catches (t) of sharks in the large-vessel purse-seine fishery (1994–2024) and minimum reported catches[11] by longline fisheries (1994–2023) are provided in Table L-4a, while catches of the most frequently caught species, discussed below, are shown in Figure L-3a. Reporting of many shark species by longline gear began in 2006 (but see section 2 for data gaps, including high variability in this dataset). For purse seiners, the majority of the shark catch is from floating object sets, although this varies by species. Silky shark (family Carcharhinidae) is the most commonly caught shark species in the purse-seine fishery with annual catches averaging 551 t—primarily from sets on floating objects (Figure L-3a)—and being 727 t in 2024. In contrast, minimum reported annual catch in the longline sample data for 2006–2023 averaged 9,501 t while only 55 t were reported in 2023. Annual catch of the oceanic whitetip shark (Carcharhinidae) in the purse-seine fishery averaged 53 t (also primarily from sets on floating objects) and was 22 t in 2024. The

[11] Sharks caught by longline vessels are recorded using different weight metrics (e.g., round, trunk or whole weight) and thus, total annual reported catch estimates may contain a mix of these weight metrics. The staff is working on harmonizing shark data collection to improve the reliability of total catch estimates (e.g., SAC-11-13).

minimum reported annual catch in the longline fishery from 2006–2018 averaged 165 t and none were reported in 2019–2023. Catches of oceanic whitetip have declined in the purse-seine fishery since the early 2000s, while minimum reported catches have been variable in the longline fishery (Figure L-3). Minimum annual reported catch of blue shark in the longline fishery from 1994–2023 averaged 6,715 t and was 10,268 t in 2023. By contrast, the annual catch in the purse-seine fishery from 1994–2024 averaged only 2 t, with 2 t caught in 2024. Some anomalies in the reporting of longline data are likely related to the COVID-19 pandemic or variability in reporting certain species or information, although it's important to note the reporting of bycatch data is not compulsory according to the data provision resolution (C-03-05) and the corresponding specifications (see SAC-12-09, WSDAT-01-01, SAC-14 INF-Q, SAC-16 INF-O). Additionally, a list of priority shark species was only recently formally established (see Resolution C-24-05), which contributes to the variability in reporting for fisheries other than the large purse-seine fishery. The staff reiterate the importance of updating C-03-05 to adapt to mandates set forth in the Antigua Convention and encourage CPCs to draft a revised resolution based on input from the staff and workshop participants in SAC-16 INF-O. These efforts are expected to reduce the variability in data reporting and quality.

Other important species of sharks caught in the purse-seine and longline fisheries include the smooth hammerhead (*Sphyrna zygaena*), the pelagic thresher (*Alopias pelagicus*), and mako sharks (*Isurus* spp.) (Table L-4a, Figure L-3a). Catch estimates for the smooth hammerhead shark in the purse-seine fishery averaged 26 t (primarily caught in floating-object sets) and was 11 t in 2024, while in the longline fishery minimum annual reported catch averaged 802 t (2006–2023) and was 17 t in 2023. In contrast, the pelagic thresher was caught primarily in unassociated tuna school sets by the purse-seine fishery with the estimated annual catch averaging 4 t and was 2 t in 2024. Minimum annual reported catch of the pelagic thresher by the longline fishery averaged 1,703 t (2007–2023) and only 19 t was reported in 2023. Catch estimates for the mako sharks by the purse-seine fishery were lower than the aforementioned shark species averaging 3 t and was 1 t in 2024. However, in the longline fishery the minimum annual reported catch averaged 1,467 t (1994–2024) and was 1,220 t in 2023.

Complementary to the shark catches presented in Figure L-3a and similar to the purse-seine based SSIs reported by set type for the tropical tunas (SAC-16-02), catch by set type was scaled so that their average equals 1 during the 1994–2024 time period for 3 species of sharks with the highest annual nominal catches by large purse-seine vessels (i.e., silky shark, oceanic whitetip shark and smooth hammerhead shark). This relative catch in weight (t), which helps to better understand trends and anomalies in species catch, is presented in Figure L-3b. In the earlier years (pre-2000), the silky shark relative catch was 3–3.5 times greater than the mean for those caught in dolphin sets, and about 3.5 times greater than the mean (1994) for those caught in unassociated sets, while relative catches were less variable in the floating-object set fishery. For the oceanic whitetip shark, a decreasing trend in relative catches is apparent for all set types with the highest relative catches occurring prior to 2000. The relative catches of smooth hammerhead sharks were variable, particularly in dolphin and unassociated sets; about 4 and 5 times greater than the mean in dolphin sets and in unassociated sets in 2004, respectively.

The spatial distribution (in 5°x5° grid cells) of the catch of the same 3 shark species by set type for the large-vessel purse-seine fishery is presented in Figure L-3c to provide an indication of current (i.e., 2024) and past (average of the last 5 years; 2019–2023) spatial catch dynamics. Catches of silky shark were widely distributed across the EPO, but primarily in the 10°N to 10°S latitudinal band and occurred mostly in floating-object sets. Silky shark catches were slightly lower in 2024 compared to the 5-year average throughout the EPO with the exception of higher catches in unassociated sets off the coast of southern Mexico in 2024. Catches of oceanic whitetip shark and smooth hammerhead shark were mostly negligible (i.e., primarily <1 t) in both time periods. Minimal catches of oceanic whitetip shark were observed in two locations from floating-object sets in 2024 (5°N–10°N, 140°W–150°W and 10°S–15°S, 125°W–135°W), with no catches >1 t in the 5-year average. For the smooth hammerhead shark, minimal catches (>1 t) were observed east of 85°W and south of 10°S off South America in 2024 while catches >1 t were observed east of 100°W along the equator and south of 5°S off South America during the 5-year average.

The limited observer data from small purse-seine vessels showed 29 t of silky shark and 3 t of scalloped hammerhead were caught in floating-object sets in 2024, while catches of other shark species or species groups (5 taxa) were minimal (≤ 1 t) (Table L-8).

The minimum catches derived only from the reported observer data for sharks caught by longline in 2023 are presented in Table L-4b (see section 2.2 and BYC-10 INF-D for uncertainties and data gaps in longline data). Blue shark was by far the most frequently caught shark species in this dataset with 4,508 interactions and 4,179 mortalities in 2023, followed by the crocodile shark with 545 interactions and 152 mortalities (~28%), the shortfin mako shark with 225 interactions, which all resulted in mortalities, bigeye thresher shark with 119 interactions and 111 mortalities (93%) and velvet dogfish with 115 interactions and 106 mortalities (92%). Less than 100 interactions were reported for all other shark taxa. Under the disposition criteria described in Table L-4b, ~86% of interactions with all sharks reported by observers resulted in mortalities.

The artisanal longline fisheries of the coastal CPCs seasonally target sharks, tunas, billfishes and dorado (*Coryphaena hippurus*), and some of these vessels are similar to industrial longline fisheries in that they operate in areas beyond national jurisdictions (Martínez-Ortiz *et al.* 2015, SAC-16-09). However, essential shark data from these longline fisheries are often lacking, and therefore conventional stock assessments and/or stock status indicators cannot be produced (see data challenges outlined in SAC-07-06b(iii)). In 2025, a document describing proposed fleet characteristics to define three categories of longline fisheries was produced (SAC-16-09) to address a recommendation by the EBWG (see SAC-15-15 "Fleet Characteristics"). These proposed classifications of longline fleets included (1) large-scale longline, (2) medium-scale longline and (3) small-scale fisheries of coastal States. Adoption of these proposed classifications is essential for the appropriate development of IATTC documents, research planning, management decisions and measures, and for providing clarity and guidance to CPCs, data handlers, scientists, policy makers and all relevant stakeholders.

Since 2014, the IATTC staff has carried out extensive collaborative research with Organización del Sector Pesquero y Acuícola del Istmo Centroamericano (OSPESCA) and IATTC's Central American CPCs to develop a robust sampling methodology to improve data collection for shark fisheries in Central American EPO states. After approximately 7 years (2015–2021), this work—funded by the Food and Agriculture Organization of the United Nations (FAO) and the Global Environmental Facility (GEF) under the framework of the ABNJ Common Oceans program, the IATTC capacity building fund, and the European Union—was completed in December 2021. The project's final results were presented at the 14th meeting of the SAC (e.g., SAC-14 INF-L), but there is a great need to maintain continuity of data collection to generate key fisheries data to assess and manage shark species in the EPO. Meanwhile, a second phase of the FAO-GEF ABNJ project is underway and the IATTC is receiving support to expand the previous work conducted in Central America to other EPO coastal States (SAC-14 INF-M). Two documents on the progress of this second phase were provided at the 16th meeting of the SAC (see SAC-16 INF-V and SAC-16 INF-W). Data obtained from these projects may be included in future iterations of this report to provide improved catch estimates, albeit minimum estimates, for sharks by the various longline, gillnet and mixed gear fleets.

1.8. Rays

To better represent estimated annual catches of manta rays (Mobulidae) and stingrays (Dasyatidae), these taxa are now reported in numbers of individuals by the large-vessel purse-seine fishery (1994–2024) in Table L-5a, while catches of key species are shown in Figure L-4a. Rays have rarely been reported in the annual summary reports for the longline fishery, although data have been available in the more recently obtained observer data (see Table L-5b). The largest average catches in the purse-seine fishery were observed for unidentified mobulid rays (Mobulidae spp., average 1994–2024: 1,008 individuals; number of individuals in 2024: 612, followed by the pelagic stingray (average: 834; 2024: 944), the smoothtail manta (average: 336; 2024: 249), the spinetail manta (average: 249; 2024: 434), unidentified stingrays (Dasyatidae spp., average: 175; 190) and the giant manta ray (average: 108; 2024: 13 individuals). Although catches of these rays can vary by set type, they have been highest in unassociated sets, followed by dolphin sets, and lowest in floating-object sets (Figure L-4a).

Similar to sharks, relative catches of rays in numbers of individuals (i.e., scaled catch with the average equal to 1) by set type for large purse-seine vessels are provided in Figure L-4b. As with the reported observed catch (Figure L-4a), ray relative catches were highly variable with no apparent trends, and peaks of relatively high catches were not consistent between species and set type.

The spatial distribution of catches (5°x5° grid cells) was greatest for pelagic stingray with variability in catches by set type. Most catches occurred primarily in floating-object sets south of 5°N and east of 120°W, in dolphin sets north of the equator, and in unassociated tuna school sets along the coast of South America for the 5-year average (2019–2023). In 2024, the highest catches occurred in unassociated sets along the coast of South America and in dolphin sets in the Sea of Cortez (Figure L-4c). Minimal catches (<5 individuals) of the giant manta were observed across space and time while catches of the spinetail (primarily <30 individuals) and smoothtail (primarily <50 individuals) manta occurred in coastal areas. Catches of the spinetail manta occurred in dolphin sets off the coast of central America and mostly in unassociated sets off the coast of South America during both time periods. Catches of the smoothtail manta occurred in unassociated sets in the Sea of Cortez in both time periods with greater catches in the 5-year average, primarily in dolphin sets along the coast of central America in both time periods, and in unassociated sets off the coast of South America in 2024.

For the small purse-seine vessel fishery, the limited observer data available for 2024 showed floating-object sets contained the largest numbers of individual ray species, including the pelagic stingray (n=31), followed by the spinetail manta (n=11), Chilean devil ray (n=9) and the smoothtail manta (n=6) while the number of other rays were ≤2 (Table L-8).

The minimal data available from the reported longline observer dataset for 2023 (see section 2.2. for data gaps and BYC-10 INF-D) showed that the most interactions were with the pelagic stingray (*Pteroplatytrygon violacea*) (3,832 individuals) with 3,634 (95%) of these interactions resulting in mortalities, followed by unidentified rays and skates (Rajiiformes.) with 6 interactions (1 mortality, 17%), giant manta with 4 interactions (3 mortalities, 75%), and unidentified manta rays, Mobulidae (4 interactions, 4 mortalities) and *Mobula* spp. (1 interaction1, 1 mortality) (Table L-5b).

The vulnerability status and efficacy of potential conservation and management measures (CMMs) for the spinetail manta (*Mobula mobular*) impacted by industrial purse-seine and longline fisheries in the EPO was determined using the EASI-Fish methodology (section 5). In the assessment year of 2018, the estimated fishing mortality exceeded the $F/F_{40\%}$ and $SBR/SBR_{40\%}$ biological reference points, leading to a vulnerability classification of "most vulnerable". A retrospective analysis of vulnerability from 1979–2018 showed the species to be classified as "least vulnerable" between 1979 and 1993, but became "most vulnerable" from 1994, which coincided with the rapid spatial expansion of the industrial purse-seine fishery. Vulnerability increased significantly from 2011 following the rapid increase in the number of purse-seine sets made on floating objects to 2018. Simulating the CMMs in place in 2018 for EPO tuna fisheries (i.e., an EPO-wide closure) and for mobulids specifically (i.e., use of best handling and release practices under C-15-04) resulted in 31 of the 45 scenarios changing the classification of the species from "most vulnerable" to "least vulnerable", which primarily involved a reduction of post-capture mortality by as little as 20%. Implementing appropriate best handling and release practices can be a reasonably simple, rapid and cost-effective conservation measure, but a recommendation from the work was to extend the EASI-Fish analysis to all species of mobulids impacted by EPO tuna fisheries, improve estimates of post-release mortality for these species through dedicated tagging studies (which are currently being conducted: Project M.2.c), and improve species-specific catch reporting, especially in small scale coastal 'artisanal' fisheries, to improve the reliability of outputs from EASI-Fish assessments. The development of BHRP guidelines for rays is planned for 2026 (EB-02-03).

The IATTC has recognized the conservation importance of mobulids since 2015 when it implemented conservation and management measures in Resolution C-15-04. However, as was the case with shark species prior to 2024, there has been no prescriptive list of ray species that come under the purview of the IATTC. In 2024, the IATTC's Scientific Advisory Committee made a recommendation to the Commission that "…*the IATTC staff develop a draft list of ray and mobulid species under the purview of the IATTC for consideration by* *the EBWG and the SAC*". In 2025, the staff analyzed catch data from IATTC data holdings for industrial and artisanal pelagic fisheries in the EPO and identified interactions with 17 ray species. Of these, 7 species—6 mobulids and the pelagic stingray (*Pteroplatytrygon violacea*)—had oceanic distributions and occupied epipelagic habitats where IATTC pelagic fisheries operate and were recommended to the EBWG and the SAC to come under the purview of the IATTC (SAC-16-08).

1.9. Other large fishes

Species composition of catches varies between purse-seine and longline fisheries. Large pelagic fishes caught by the large-vessel purse-seine fishery, primarily in floating-object sets, (1994–2024) and longline (1994–2023) fisheries are shown in Table L-6a, with time series of catches of key species presented in Figure L-5. The most commonly-caught pelagic fish in both fisheries is dorado (Coryphaenidae) with the estimated average annual catch for the purse-seine fishery being 1,364 t (871 t in 2024) and the minimum reported annual catch for the longline fishery averaging 5,657 t (421 t in 2023). Dorado is also one of the most important species caught in the artisanal fisheries of the coastal nations of the EPO (SAC-07-06a(i)). Recommendations for potential reference points and harvest control rules for dorado in the EPO were presented at the 10th meeting of the SAC (SAC-10-11). Additionally, a Resolution (C-23-09) on the research for the management of dolphinfish was adopted at IATTC's 101st Commission meeting in 2023.

Other key species caught by the purse-seine fishery include wahoo (Scombridae) and rainbow runner (Carangidae). Wahoo had an estimated average annual catch of 361 t for the purse-seine fishery, although catches have declined from a peak of 1,025 t in 2001 to 233 t in 2024 (Figure L-5). Minimum reported annual catch of wahoo by the longline fishery have averaged 179 t and was 256 t in 2023. No catches of rainbow runner have been reported by the longline fishery. However, in the purse-seine fishery, estimated average annual catches of rainbow runner were 49 t, with the peak catch in 2007 at 158 t and declining thereafter to 87 t in 2024 (Figure L-5).

Pelagic fishes commonly reported by the longline fishery include opah (Lampridae), snake mackerels (Gempylidae) and pomfrets (Bramidae). Minimum reported annual catches for these species averaged 374 t (1994–2023), 357 t (2006–2023), and 55 t (1994–2023), respectively. Catches of all these taxa have increased after the mid-2000s (Figure L-5) but note the uncertainty and data gaps in this dataset (section 2.2). For the most recent reporting year (2023), there were 250 t, 288 t, and 64 t of opah, snake mackerels, and pomfrets reported, respectively (Table L-5a).

The limited observer data available for 2024 for the small purse-seine fishery included 126 t of dorado and 30 t of wahoo caught in floating-object sets, while the remaining species or species groups of large fishes (7 taxa) had ≤5 t reported (Table L-8).

For 2023, the limited available data from longline observers (see section 2.2. and BYC-10 INF-D) is provided in Table L-6b. These data show the most frequently caught species in this dataset was the long snouted lancetfish (*Alepisaurus ferox*) with 8,501 interactions (all resulted in mortalities), followed by escolar (*Lepidocybium flavobrunneum*) with 3,165 interactions, one of which resulted in a mortality, snake mackerel (*Gempylus serpens*) with 2,581 interactions and 2,544 mortalities (99%), dorado (Corpyhaenidae) with 2,468 interactions, all resulting in mortalities, wahoo (*Acanthocybium solandri*) with 1,707 interactions and 1,703 mortalities, opah (*Lampris* guttatus) with 1,171 interactions and 1,167 mortalities, and sickle pomfret (*Taractichthys steindachneri)* with 700 interactions and 697 mortalities. The remaining 7 taxa had approximately <500 interactions. Most interactions with large fishes resulted in mortalities (99%).

1.10. Forage species

A large number of taxa occupying the middle trophic levels in the EPO ecosystem—generically referred to as "forage" species—play a key role in providing a trophic link between primary producers at the base of the food web and the upper-trophic-level predators, such as tunas and billfishes. Some small forage fishes are incidentally caught in the EPO by purse-seine vessels on the high seas, mostly in sets on floating objects, and by coastal artisanal fisheries, but are generally discarded at sea. Catches of these species are presented in Table L-7 with key species as identified by catch data presented in Figure L-6 for the large-vessel purse-seine fishery.

Bullet and frigate tunas (Scombridae) are by far the most commonly reported forage species with estimated annual catches averaging 963 t from 1994–2024. However, their catches have declined from 1,921 in 2005 to 601 t in 2024 (Figure L-6). Triggerfishes (Balistidae) and filefishes (Monacanthidae) are the second most commonly reported forage group with annual estimated catches averaging 279 t and totaling 513 t in 2024. Combined catches for these two groups peaked in 2004 at 922 t but have otherwise been variable. Annual catches of sea chubs (Kyphosidae) have averaged 16 t and have remained minimal with 7 t in 2024. Lastly, annual catches of the various species in the category 'epipelagic forage fishes' averaged 7 t with 11 t estimated to be caught in 2024.

A total of 95 t of bullet and frigate tunas and 133 t of triggerfishes and filefishes caught in floating-object sets were reported by observers on the limited number of trips on small purse-seine vessels that carried an observer in 2024. Catches of all other species or species groups (4 taxa) of small fishes were minimal (≤1 t) (Table L-8).

PHYSICAL ENVIRONMENT

Environmental conditions affect marine ecosystems and therefore impact species distributions and abundance, the dynamics and catchability of target and bycatch species, and the activities of fishers[12] (e.g., SAC-10 INF-D, SAC-16 INF-T). At IATTC's 101st meeting in 2023, a resolution on climate change was adopted (C-23-10; amended in 2024 as C-24-10), and correspondingly, a proposed workplan towards climate resilient fisheries was presented at the 2nd EBWG meeting and the 15th meeting of the SAC (SAC-15-12). The following summary of the biophysical environment covers: 1) short-medium and long-term environmental indicators, and 2) environmental conditions and their potential effect on the fishery during the previous year, in this case, 2024.

1.11. Environmental indicators

The ocean environment changes on a variety of time scales, from seasonal to inter-annual, decadal, and longer "regimes". Longer-term climate-induced changes are typically decadal at intervals of around 10–30 years and are characterized by relatively stable average conditions and patterns in physical and biological variables. The dominant source of variability in the upper layers of the EPO is the El Niño-Southern Oscillation (ENSO), an irregular fluctuation involving the entire tropical Pacific Ocean and the world's atmosphere (Fiedler 2002). El Niño events occur at two- to seven-year intervals, and are characterized by weaker trade winds, deeper thermoclines, and higher sea-surface temperatures (SSTs) in the equatorial EPO. El Niño's alternate phase is commonly called La Niña and is characterized by stronger trade winds, shallower thermoclines, and lower SSTs. The changes in the biogeochemical environment caused by ENSO have an impact on the biological productivity, feeding, and reproduction of fishes, seabirds, and marine mammals (Fiedler 2002).

ENSO is thought to cause considerable variability in the availability of commercially-important tunas and billfishes to capture by tuna fleets in the EPO (Bayliff 1989). For example, the shallow thermocline during a La Niña event can increase purse-seine catch rates for tunas by compressing the preferred thermal habitat of small tunas near the sea surface, while the deeper thermocline during an El Niño event likely could make tunas less susceptible to capture, and thus reduce catch rates. Furthermore, warmer- or cooler-than-average SSTs can also cause the fish to move to more favorable habitats, which may also affect catch rates as fishers expend more effort on locating the fish.

Recruitment of tropical tunas in the EPO may also be affected by ENSO events. For example, strong La Niña events in 2007–2008 may have been partly responsible for the subsequent lower recruitment of bigeye tuna, while the largest recruitments corresponded to the extreme El Niño events in 1982–1983 and 1998 (SAC-09-05). Yellowfin recruitment was also low in 2007, but high during 2015–2016, after the extreme

[12] See SAC-04-08, *Physical Environment*, and SAC-06 INF-C for a comprehensive description of the effects of physical and biological oceanography on tunas, prey communities, and fisheries in the EPO.

El Niño event in 2014–2016 (SAC-09-06). Analyses on the potential effects of environment on tuna catches were presented at the 15th meeting of the SAC (SAC-15 INF-L) and updated for SAC-16 (SAC-16 INF-T).

The Climate Diagnostics Bulletin of the US National Weather Service reported that in 2024 anomalies—defined in the Bulletin as a departure from the monthly mean—in oceanic and atmospheric characteristics (e.g., surface and sub-surface temperatures, thermocline depth, wind, and convection) were consistent with weakening El Niño conditions from January through March, a transition to ENSO neutral conditions in April with these conditions lasting through November, and La Niña conditions in December.

Indices of variability in such conditions are commonly used to monitor the direction and magnitude of ENSO events in the Pacific Ocean. The Oceanic Niño Index (ONI) is used by the US National Oceanic and Atmospheric Administration (NOAA) as the primary indicator of warm El Niño and cool La Niña conditions within the Niño 3.4 region in the east-central tropical Pacific Ocean (Dahlman 2016) (Figure L-7a). Therefore, the ONI is used in this report to characterize inter-annual variability in SST anomalies. The ONI is a measure of El Niño defined by NOAA as "a phenomenon in the equatorial Pacific Ocean characterized by a five consecutive 3-month running mean of SST anomalies in the Niño 3.4 region that is above (below) the threshold of +0.5°C (-0.5°C)." The ONI categorizes ENSO events from "extreme" to "weak" (Figure L-7b). For example, the "extreme" El Niño event in 1997–1998 was followed by a "very strong" La Niña event in 1998–2000. "Strong" La Niña events were also observed in 2007–2008 and 2010–2011. The highest ONI values (>2.5) were recorded during the 2015–2016 "extreme" El Niño event. "Very strong" El Niño conditions began to weaken at the beginning of 2024 and transitioned to a neutral phase while the year ended in La Niña conditions, with values ranging from 1.8 to -0.5 during this time period (Figure L-7b).

The Pacific Decadal Oscillation (PDO; Figure L-8) index is used to describe longer-term environmental fluctuations in the Pacific Ocean. In the EPO, it has been used to explain the influence of environmental drivers on the vulnerability of some species, such as the silky shark, to capture by tuna fleets (Lennert-Cody *et al.* 2018). The PDO—a long-lived El Niño-like pattern of Pacific climate variability, with events persisting 20–30 years—tracks large-scale interdecadal patterns of environmental and biotic changes, primarily in the North Pacific Ocean (Mantua 1997), with secondary patterns observed in the tropical Pacific, the opposite of ENSO (Hare and Mantua 2000). As with ENSO, PDO phases are classified as "warm" or "cool". PDO values peaked at 2.79 in August 1997 and at 2.62 in April 2016, both of which coincided with the extreme El Niño events indicated by the ONI. The PDO has been in a "cool" phase since early 2020. During 2024, cool conditions persisted with the lowest value in October (-3.04) and the highest value in February (-1.07) (see ERSST V5 PDO Time series data).

1.12. Spatio-temporal exploration of environmental conditions

A time series of SST and chlorophyll-a concentration (CHL-a; an indicator of primary productivity biomass) (Figure L-9) in the eastern tropical Pacific (ETP) from 5°N to 5°S—the same latitudinal band used in the ONI—was developed to explore the variability in these variables across space and time using time-longitude Hovmöller diagrams. The SST time series show mean monthly values from 1993–2024, while monthly CHL-a concentrations covers data for 2003–2024 due to limitations with data availability. The SST plot (Figure L-9, top panel) clearly shows the extension of warmer waters during the extreme El Niño events of 1997–1998, 2015–2016, and for the latter half of 2023 into 2024 while cooler waters are observed during the strong La Niña events in 1999–2000, 2007–2008 and 2010–2011 across the ETP. The CHL-a plot (Figure L-9, bottom panel), although the pattern is less clear than the SST plot, shows an increase in CHL-a concentrations following the strong La Niña events particularly in 2010–2011, likely due to increases in nutrient availability.

1.13. Environmental conditions and distribution of catches

The availability of fish, and thus catches, are strongly related to environmental conditions and processes, particularly in pelagic waters (Fiedler and Lavín 2017; Chassot *et al.* 2011). ENSO conditions are influenced by many oceanic and atmospheric factors, but both SST and CHL-a levels are known to strongly influence the habitat and distributions of oceanic animals (Hobday and Hartog 2014).

Figures L-10 and L-11 show quarterly mean SSTs and CHL-a concentrations, respectively, to: 1) provide a general indication of seasonal environmental variability for 2024, and 2) overlay the distribution of tropical tuna catches, as a first step, to illustrate the potential influence of environmental conditions on catches across the EPO during 2024. In the future, the staff plans to incorporate catch distributions for key bycatch species and develop species distribution models (SDMs) to better describe potential relationships between environment and species. In 2021–2022, SDMs were developed for the leatherback sea turtle (BYC-11-01) and 32 species of sharks (SAC-13-11) and several high-resolution SDMs are underway for other vulnerable bycatch species, including oceanic whitetip, silky and hammerhead sharks.

Warm waters prevailed over much of the EPO during 2024, with the exception of the northern and southern extremities of the Convention Area where cooler waters occurred (Figure L-10). A warm pool off Central America was observed in quarter 1 that extended westwards during quarters 2 and 3 and retracted in quarter 4. A secondary, less intense, warm pool was observed in the southwestern EPO (below the equator–20°S, 130°–150°W) during quarters 1 and 2, which contracted in quarters 3 and 4.

Figure L-11 shows CHL-a concentrations were highest along the equator and the coast of the Americas year-round. The oligotrophic[13] South Pacific Gyre—located between 20°–40°S and extending from 150°–90°W—was present in quarter 1, retracted in quarters 2 and 3, and returned in quarter 4.

During quarters 1 and 2, skipjack predominated in the catches in waters ~20–25°C off the coast of South America (Fig. L-10), where CHL-a concentration was high (Fig. L-11). Yellowfin tuna was the predominant tuna species in the catch primarily north of the equator during these same quarters; yellowfin catches were present in the warmer waters (~29°C) off central America in quarters 2–4. Bigeye tuna catches mostly occurred south of 10°N with greater catches taken west of ~110°W, particularly in quarter 2. No tuna catches were recorded in the oligotrophic gyre located approximately south of 20°S and the western boundary of the EPO (150°W) to about 100°W.

IDENTIFICATION OF SPECIES AT RISK

The primary goal of EAFM is to ensure the long-term sustainability of all species impacted—directly or indirectly—by fishing. However, this is a significant challenge for fisheries that interact with many non-target species with diverse life histories, for which reliable catch and biological data required for single-species assessments are lacking. An alternative for such data-limited situations, reflected in Goal L of the SSP, are Ecological Risk Assessments (ERAs), assessments that are designed to identify and prioritize potentially vulnerable species for data collection, research and management.

'Vulnerability', in this risk assessment context, is defined as the potential for the productivity of a stock to be diminished by the direct and indirect impacts of fishing activities. The IATTC staff has applied qualitative assessments using Productivity-Susceptibility Analysis (PSA) to estimate the relative vulnerability of data-limited, non-target species caught in the EPO by large purse-seine vessels (Duffy *et al*. 2019) and by the longline fishery (SAC-08-07d).

Because PSA is unable to quantitatively estimate the cumulative effects of multiple fisheries on data-poor bycatch species, a new approach—Ecological Assessment of Sustainable Impacts of Fisheries (EASI-Fish)—was developed by the IATTC staff in 2018 (SAC-09-12) to overcome this, and other, technical issues. This flexible, spatially-explicit method uses a smaller set of parameters than PSA to first produce a proxy for the instantaneous fishing mortality rate ($\tilde{F}$) of each species, based on the 'volumetric overlap' of each fishery on the geographic distribution of these species. The estimate of $\tilde{F}$ is then used in length-structured yield- and spawning biomass per-recruit models to assess the vulnerability of each species using conventional biological reference points (e.g., F_{MSY}, $SPR_{40\%}$).

EASI-Fish was successfully applied to 24 species representing a range of life histories, including tunas,

[13] An area of low productivity, nutrients, and surface chlorophyll, often referred to as an "oceanic desert".

billfishes, tuna-like species, elasmobranchs, sea turtles and cetaceans caught in EPO tuna fisheries as a 'proof of concept' assessment in 2018 (SAC-09-12). It was subsequently used to assess the vulnerability status of the spinetail manta (*Mobula mobular*) caught by all industrial tuna fisheries in the EPO (BYC-09-01), and the East Pacific regional management unit (RMU) of the Critically Endangered leatherback turtle (*Dermochelys coriacea*) (BYC-10 INF-B, BYC-11-02). Therefore, EASI-Fish is planned to be used by the staff in future to assess species-specific vulnerability within all species groups (e.g., elasmobranchs, sea turtles, teleosts) impacted by EPO tuna fisheries. In 2022, EASI-Fish was used to assess the vulnerability of the East Pacific stock of the leatherback turtle and shark bycatch species in EPO tuna fisheries and the results were presented at BYC-11 (BYC-11-02) and SAC-13, respectively (SAC-13-11). An EASI-Fish assessment for silky shark and hammerheads was presented at SAC-14, where the potential efficacy of 43 different conservation and management measures was simulated (SAC-14-12). The simulations showed that almost all CMMs were effective in reducing vulnerability, such as banning wire leaders, imposing a 100 cm total length minimum retention for all sharks, and prohibiting landing of all sharks. However, the positive effects of these measures were negated in most scenarios due to high post-release mortality of these species. These results highlighted that the most effective conservation measure for sharks is to avoid interaction with EPO fisheries.

ECOSYSTEM DYNAMICS

Although vulnerability assessments (e.g., EASI-Fish) are useful for assessing the ecological impacts of fishing by assessing the populations of individual species, ecosystem models are required to detect changes in the structure and internal dynamics of an ecosystem. These models are generally data- and labor-intensive to construct, and consequently, few fisheries worldwide have access to a reliable ecosystem model to guide conservation and management. These models require a good understanding of ecosystem components and the direction and magnitude of the trophic flows between them, which require detailed ecological studies involving stomach contents and/or stable isotope studies. Purposefully, IATTC staff have had a long history of undertaking such trophic studies, including the experimental determination of consumption estimates of yellowfin tuna at the NMFS Kewalo Basin facility on Oahu, HI in the 1980s, to more recent analyses of stomach content and stable isotope analysis of a range of top-level predators.

In 2003, the IATTC staff compiled the trophic data to complete the development of a model of the pelagic ecosystem in the tropical EPO (IATTC Bulletin, Vol. 22, No. 3)—named "ETP7"—to explore how fishing and climate variation might affect target species (e.g., tunas), byproduct species (e.g., wahoo, dorado), elasmobranchs (e.g., sharks), forage groups (e.g., flyingfishes, squids) and species of conservation importance (e.g., sea turtles, cetaceans). A simplified food-web diagram, with approximate trophic levels (TLs), from the model is shown in Figure L-12.

The model was calibrated to time series of biomass and catch data for yellowfin and bigeye tunas for 1961–1998. There have been significant improvements in data collection programs in the EPO since 1998, that has allowed the model to be updated with these new data up to 2018 ("ETP-8"). The model required a further update in 2021 due to a significant change in how the IATTC staff have reclassified the catch data submitted by the CPCs for "other gears" into longline and other gear types following an internal review of the data. This resulted in a dramatic increase in reported longline catches of high trophic level predators (sharks), which can have a strong influence on ecosystem dynamics. Therefore, annual catch estimates by species for 1993–2018 were assigned to the relevant functional groups in the ETP-21 model, which was then rebalanced and recalibrated to time series data to provide an updated ecosystem status for 2021 and to undertake simulations to assess potential impacts of the FAD fishery on the structure of the ecosystem (SAC-12-13).

1.14. Ecological indicators

Since 2017, the most recent Ecopath model has been used in the *Ecosystem Considerations* report to provide annual values for seven ecological indicators that, together, can identify changes in the structure and internal dynamics of the ETP ecosystem. These indicators are: mean trophic level of the catch (TL_c), the Marine

Trophic Index (MTI), the Fishing in Balance (FIB) index, Shannon's index, and the mean trophic level of the modelled community for trophic levels 2.0–3.25 ($TL_{2.0}$), ≥3.25–4.0 ($TL_{3.5}$), and >4.0 ($TL_{4.0}$). A full description of these indicators is provided in SAC-10-14.

ETP-21 was updated in 2024 (named ETP-24) using annual catch estimates by species for 1993–2022 assigned to the relevant functional groups, which was then rebalanced to provide an updated ecosystem status for 2022.

Ecological indicators showed that values for TL_c and MTI decreased from their peak of 4.77 and 4.83 in 1991 to 4.66 and 4.69 in 2022, respectively, as the purse-seine fishing effort on floating objects significantly increased (Figure L-13), where there was increasing catches of high trophic level bycatch species that tend to aggregate around floating objects (e.g., sharks, billfish, wahoo and dorado). Since its peak in 1991, TL_c declined by 0.170 of a trophic level in the subsequent 30 years, or 0.057 trophic levels per decade. The increasing number of OBJ sets is also seen in the FIB index that exceeds zero after 1990, as well as the continual change in the evenness of biomass of the community indicated by Shannon's index.

The above indicators generally describe the change in the exploited components of the ecosystem, whereas community biomass indicators describe changes in the structure of the ecosystem once biomass has been removed due to fishing. The biomass of the $TL_{MC\mathit{4.0}}$ community was at one of its highest values (4.493) in 1986 but has continued to decline to 4.467 in 2022 (Figure L-13). As a result of changes in predation pressure on lower trophic levels, between 1993 and 2022 the biomass of the $TL_{MC\mathit{3.25}}$ community increased from 3.801 to 3.829, while interestingly, the biomass of the $TL_{MC\mathit{2.0}}$ community also increased from 3.092 to 3.107.

Together, these indicators show that the ecosystem structure has likely changed over the 43-year analysis period. The consistent patterns of change in each ecological indicator, particularly in the mean trophic level of the communities since 1993, certainly warrant the continuation, and ideally an expansion, of monitoring programs for fisheries in the EPO. The COVID-19 pandemic in 2020 allowed staff to examine the direct effects of reduced fishing effort on the ecosystem through use of ecological indicators. The most notable change was a 23% decrease in the number of purse-seine floating-object sets from 14,987 sets in 2019 to 11,543 sets in 2020. This decrease in effort resulted in abrupt changes in most ecological indicators for 2020 and increasing beyond pre-pandemic levels in 2022 when the number of floating-object sets increased significantly to 17,699 (Figure L-13). These results suggest that the increase in floating-object sets may be primarily responsible for the continued change in ecosystem structure over the past two decades.

FUTURE DEVELOPMENTS

It is unlikely, in the near future at least, that there will be stock assessments for most of the bycatch species caught by IATTC tuna fisheries. Therefore, the IATTC must continue to undertake ecological research and assessments that can provide managers with reliable information to guide the development of science-based conservation and management measures, where required, to ensure the IATTC continues to fulfil its responsibilities under the Antigua Convention and the objectives of the SSP. The priority research areas that have been identified by the scientific staff that require further development are detailed below:

- Following the development of the EASI-Fish approach, analysis of the full suite of over 100 impacted bycatch species will be conducted in stages, by taxonomic group (e.g., sharks, rays, teleosts, turtles and cetaceans). All pelagic shark species and the critically endangered eastern Pacific leatherback turtle stock were assessed in 2022.
- Given the high number of species classified as "most vulnerable" in the 2022 shark EASI-Fish assessment, a high priority is to develop a strategy for future conservation and management of these vulnerable species. As a first step EASI-Fish was used to explore the potential efficacy of hypothetical conservation and management measures for silky and hammerhead sharks in 2023 (SAC-14-12). This assessment is expected to be resumed in the near future with an external review of the EASI-Fish assessment planned for 2025 and the collaboration of the shark technical workshops of the IATTC.

- Significant knowledge gaps identified for sharks in the EASI-Fish assessment pertained to the fundamental parameter values required to characterize the population dynamics of several species in the EPO, even those that have been commonly recorded as bycatch for decades. Therefore, significant efforts are required by the IATTC and its Members to establish a strategy for undertaking cost-effective studies to collect data to develop morphometric relationships (e.g., length-weight and length-length), growth curves, and maturity ogives. In addition to the GEF-FAO ABNJ shark fishery data collection work recently completed in Central America and expanded to Mexico, Ecuador and Peru in 2023, which could be seen as an opportunity to achieve such a strategy (SAC-13-12, SAC-14 INF-L, SAC-14 INF-M), the IATTC staff has prepared a document identifying data gaps and potential opportunities for a phase-based approach to obtaining morphometric measurements and biological sampling of tunas, billfishes, and priority bycatch species on purse seiners and longliners (SAC-14 INF-J). In 2024, the staff proposed using the Enhanced Monitoring Program (EMP) as a means for collecting morphometric data for use in tuna stock assessments (SAC-15 INF-H). The Commission approved the initiation of morphometric sampling of tunas within the EMP framework, and during the last quarter of 2024 an experimental design was derived. Trials were conducted to guide the implementation of the sampling and sampling was initiated in January of 2025 in the ports of Mazatlán, Mexico and Manta, Ecuador. Opportunistic sampling of various retained bycatch species, including sharks, have been included in morphometric data collection.
- A shortcoming of the ETP-24 ecosystem model, from which the ecological indicators are derived, is that its structure is based on stomach content data from fish collected in 1992–1994. Given the significant environmental and fishery changes that have been observed in the EPO over the past decade, there is a critical need to collect updated trophic information. There have been proposals made by the staff in 2018–2024 to establish an ecological monitoring program to collect stomach content data to update the ecosystem model. Given the emerging requirements for biological data on sharks, such a monitoring program could incorporate all biological and ecological requirements of the IATTC. Again, the GEF-FAO ABNJ project which continues to expand among IATTC Members offers some opportunities for integrating such a sampling program, especially if the ABNJ pilot project continues in perpetuity as recommended by the staff. In addition, the proposed morphometric and biological sampling study (SAC-14 INF-J) aims to opportunistically collect biological samples, including stomachs, to obtain updated diet data for future use in a spatially-explicit ecosystem model.
- A second limitation of the ETP-24 model is that it describes only the tropical component of the EPO ecosystem, and results cannot be reliably extrapolated to other regions of the EPO. Therefore, after updated diet information is collected, future work will aim to develop a spatially-explicit model that covers the entire EPO and calibrate the model with available time series of catches, ideally for species representing different trophic levels, and effort data for key fisheries in the EPO.
- Environmental variables can have a profound influence on the catches of target and bycatch species, as has been shown previously by IATTC staff and now undertaken annually in this report, with a dedicated workplan on climate resilient fisheries resulting from Resolution C-23-10, amended in C-24-10, was proposed at SAC-15 (SAC-15-12). However, the staff's research to investigate the impact of environmental conditions on the fishery could be greatly improved with the availability of high-resolution operational level data for the longline fishery. Although IATTC Members and CPCs are now required to submit operational level observer data to the IATTC that covers at least 5% of their fleets, analyses conducted by the staff provide conclusive evidence that these data are not representative of the fleet (BYC-10 INF-D) and therefore brings into question the validity of using submitted longline data for future environmental analyses until the observer coverage reaches at least 20%.
- The task of disentangling the spatial and temporal overlap of multiple target and non-target species requires an in-depth exploration of risk and trade-offs across management scenarios and species groups. Although the scientific community has argued for the importance of exploring dynamic spatial management over the past 20 years, there are currently few examples of dynamic or adaptive

spatial management measures being implemented in tuna fisheries to reduce bycatch. In fact, no spatial management measures have been implemented to date to specifically reduce the catch of non-target species in tuna RFMOs. The identification of areas of potential interest for spatial management in the open ocean is directly dependent on the ever-changing species-environment relationship, which can be modeled to estimate and predict species' distributions and relative abundance across space and time and inform the design of adaptive management measures. Although the IATTC staff has started to investigate this issue in the EPO for both target and non-target species (e.g., SAC-10 INF-D, Pons et al 2022, BYC-11-04, Druon et al 2022, Ortuno-Crespo et al. 2024), the potential implementation and operationalization of adaptive management options for the IATTC should be explored in the coming years.

- The quality of ecological analyses and the annual reporting of EPO-wide catch estimates for bycatch species is currently hampered by IATTC's existing resolution on data provision (C-03-05), which no longer aligns with IATTC's evolving responsibilities under the Antigua Convention (see SAC-12-09). Such responsibilities include ensuring and monitoring the sustainable impacts of EPO fisheries on associated and dependent species, which is the primary reason for the creation, and annual updates of, this *Ecosystem Considerations* report. Presently, the only reliable source of bycatch data is from observers onboard large, size Class-6, purse-seine vessels. Limited data on bycatch exists for other pelagic fisheries in the EPO. Proposed capacity building opportunities and a series of workshops involving IATTC staff and CPCs to develop clear data reporting standards are expected to facilitate improved data submission, catch estimates and reporting, which in turn will improve ecological analyses to allow the IATTC to meet its obligations under the Antigua Convention. Discussions commenced during the first workshop on improving data collection for the industrial longline fisheries (WSDAT-01, WSDAT-01 RPT) and during the second workshop focused on the small purse-seine fishery (i.e., vessels with a carrying capacity ≤363 t) (WSDAT-02, WSDAT-02-01, WSDAT-02-02, WSDAT-02 RPT). A series of updated staff recommendations, which culminated from workshop participation and individual consultation with CPCs, is described in SAC-16 INF-O (compilation of updated recommendations for industrial longline and small purse-seine fisheries).
- During the 2nd meeting of the EBWG, a recommendation was adopted stating, "*the staff, in coordination with CPCs, develop and present to the Commission results of a process to characterize and classify the longline fleets and their fisheries in the Convention Area, distinguishing their dynamics and differentiated impacts, as well as the catchability of species, whether directed, associated or incidental*." Consequently, the IATTC staff developed an approach to produce, in coordination with CPCs, a formal classification and definition of longline fisheries in the eastern Pacific Ocean (EPO) (SAC-16-09). The results of that discussion will be useful for improving data collection and other provisions for the longline fisheries in the IATTC.
- The IATTC staff is collaborating on two research projects on dolphins focused on improving current understanding of the potential impacts of tuna fisheries on dolphin populations (SAC-14 INF-K), including a cow-calf separation study and a CKMR assessment pilot.
- The staff aim to restructure this *Ecosystem Considerations* report into two ecosystem-advice products: 1) an indicator-based ecosystem report card ("*EcoCard*") and corresponding *Ecosystem Status Assessment* to detail indicator selection, calculation, and validation, with a main goal of improving IATTC's communication of ecosystem status (see EB-02-02). The workplan in EB-02-02 was presented to, and supported by, the EBWG (see WGEB-02 Recommendations, SAC-15 Recommendations) and an update on the purpose (i.e., goal and objective) and framework of the proposed workplan is presented in EB-03-04 for discussion with EBWG participants.

ACKNOWLEDGMENTS

We would like to thank Sylvain Caillot, Nick Vogel, and Joydelee Marrow for their assistance with data preparation, Alexandre Aires-da-Silva and Paulina Llano for their reviews of this document, and Christine Patnode for improving the figures. We gratefully acknowledge the early ecosystem research by Robert Olson that contributed to this report. His initiation of the *Ecosystem Considerations* report in 2003 was first

presented at the 8th Meeting of the Working Group to Review Stock Assessments in 2007 (SAR-8-17 J) and has been updated annually.

LITERATURE CITED

Bayliff, W.H. 1989. Inter-American Tropical Tuna Commission, Annual Report for 1988. IATTC, La Jolla, CA USA. 270 pp.

Chassot, E., S. Bonhommeau, G. Reygondeau, K. Nieto, J.J. Polovina, M. Huret, N.K. Dulvy, and H. Demarcq. 2011. Satellite remote sensing for an ecosystem approach to fisheries management. ICES Journal of Marine Science 68(4): 651-666.

Clarke, S. 2017. Southern Hemisphere porbeagle shark (*Lamna nasus*) stock status assessment. WCPFC-SC13-2017/SA-WP-12 (rev. 2). Pages 75. *Western and Central Pacific Fisheries Commission. Scientific Committee Thirteenth Regular Session*, Rarotonga, Cook Islands.

Clarke, S. 2018a. Pacific-wide silky shark (*Carcharhinus falciformis*) Stock Status Assessment. WCPFC-SC14-2018/SA-WP-08. Pages 137. *Western and Central Pacific Fisheries Commission*, Busan, Korea.

Clarke, S. 2018b. Risk to the Indo-Pacific Ocean whale shark population from interactions with Pacific Ocean purse-seine fisheries. WCPFC-SC14-2018/SA-WP-12 (rev. 2). Pages 55. *Western and Central Pacific Fisheries Commission, Scientific Committee Fourteenth Regular Session*, Busan, Korea.

Dahlman, L. 2016. Climate Variability: Oceanic Niño Index. https://www.climate.gov/news-features/understanding-climate/climate-variability-oceanic-ni%C3%B1o-index. National Oceanic and Atmospheric Administration.

Druon, J.-N., S. Campana, F. Vandeperre, F. Hazin, H. Bowlby, R. Coelho, N. Queiroz, F. Serena, F. Abascal, D. Damalas, M. Musyl, J. Lopez, B. Block, P. Afonso, H. Dewar, P.S. Sabarros, B. Finucci, A. Zanzi, P. Bach, I. Senina, F. Garibaldi, D. Sims, J. Navarro, P. Cermeño, A. Leone, G. Diez, M. Teresa, M. Deflorio, E. Romanov, A. Jung, M. Lapinski, M. Francis, H. Hazin, and P. Travassos. 2022. Global-scale environmental niche and habitat of blue shark (Prionace glauca) by size and sex: a pivotal step to improving stock management. Frontiers in Marine Science 9

Duffy, L.M., and S.P. Griffiths. 2019. Assessing attribute redundancy in the application of productivity-susceptibility analysis to data-limited fisheries. Aquatic Living Resources 32(20): 1-11.

Duffy, L.M., C.E. Lennert-Cody, R. Olson, C.V. Minte-Vera, and S.P. Griffiths. 2019. Assessing vulnerability of bycatch species in the tuna purse-seine fisheries of the eastern Pacific Ocean. Fisheries Research 219: 105316

Fiedler, P., and M. Lavín. 2017. Oceanographic Conditions of the Eastern Tropical Pacific. *In* P. W. Glynn, D. P. Manzello, and I. C. Enochs (eds.), Coral Reefs of the Eastern Tropical Pacific: Persistence and Loss in a Dynamic Environment, p. 59-83. Springer, Netherlands.

Fiedler, P.C. 2002. Environmental change in the eastern tropical Pacific Ocean: review of ENSO and decadal variability. Administrative Report LJ-02-16. Southwest Fisheries Science Center. Pages 38. National Marine Fisheries Service, NOAA, La Jolla, CA.

Fu, D., M.-J. Roux, S. Clarke, M. Francis, A. Dunn, S. Hoyle, and C. Edwards. 2018. Pacific-wide sustainability risk assessment of bigeye thresher shark (*Alopias superciliosus*). WCPFC-SC13-2017/SA-WP-11. Rev 3 (11 April 2018). *Western and Central Pacific Fisheries Commission. Scientific Committee Thirteenth Regular Session*, Rarotonga, Cook Islands.

Griffiths, S.P., and N. Lezama-Ochoa. 2021. A 40-year chronology of the vulnerability of spinetail devil ray *(Mobula mobular*) to eastern Pacific tuna fisheries and options for future conservation and management. Aquatic Conservation: Marine and Freshwater Ecosystems 31(10): 2910-2925.

Griffiths S, Wallace B, Cáceres V, Rodríguez LH, Lopez J, Abrego M, Alfaro Shigueto J, Andraka S, Brito MJ, Bustos LC, Cari I, Carvajal JM, Clavijo L, Cocas L, de Paz Campos N, Herrera M, Lauritsen AM, Mangel J, Pérez-Huaripata M, Zarate P (2024) Vulnerability of the Critically Endangered leatherback turtle to fisheries bycatch in the eastern Pacific Ocean. II. Assessment of mitigation measures. Endangered Species Research 53:295-326

Hare, S.R., and N.J. Mantua. 2000. Empirical evidence for North Pacific regime shifts in 1977 and 1989. Progress in Oceanography 47: 103-145.

Hobday, A.J., and J.R. Hartog. 2014. Derived Ocean Features for Dynamic Ocean Management. Oceanography 27(4): 134-145.

Lennert-Cody, C.E., S.C. Clarke, A. Aires-da-Silva, M.N. Maunder, P.J.S. Franks, M.H. Román, A.J. Miller, and M. Minami. 2018. The importance of environment and life stage on interpretation of silky shark relative abundance indices for the equatorial Pacific Ocean Fisheries Oceanography: 1-11

Lopez J, Griffiths S, Wallace BP, Cáceres V, Helena Rodríguez L, Abrego M, Alfaro-Shigueto J, Andraka S, José Brito M, Camila Bustos L, Cari I, Carvajal JM, Clavijo L, Cocas L, de Paz N, Herrera M, Mangel JC, Pérez-Huaripata M, Piedra R, Quiñones Dávila JA, Rendón L, Rguez-Baron JM, Santana H, Suárez J, Veelenturf C, Vega R, Zárate P (2024) Vulnerability of the Critically Endangered leatherback turtle to fisheries bycatch in the eastern Pacific Ocean. I. A machine-learning species distribution model. Endangered Species Research 53:271-293

Mantua, N.J., S.R. Hare, Y. Zhang, J.M. Wallace, and R.C. Francis. 1997. A Pacific interdecadal climate oscillation with impacts on salmon production. Bulletin of the American Meteorological Society 78: 1069-1079.

Martínez-Ortiz, J., A. Aires-da-Silva, C.E. Lennert-Cody, and M.N. Maunder. 2015. The Ecuadorian artisanal fishery for large pelagics: species composition and spatio-temporal dynamics. PLoS ONE 10(8): e0135136.

Ortuno-Crespo GO, Griffiths S, Murua H, Österblom H, Lopez J (2024) Adaptive spatiotemporal management to reduce shark bycatch in tuna fisheries. 38:e14324

Pons, M., J.T. Watson, D. Ovando, S. Andraka, S. Brodie, A. Domingo, M. Fitchett, R. Forselledo, M. Hall, E.L. Hazen, J.E. Jannot, M. Herrera, S. Jiménez, D.M. Kaplan, S. Kerwath, J. Lopez, J. McVeigh, L. Pacheco, L. Rendon, K. Richerson, R. Sant'Ana, R. Sharma, J.A. Smith, K. Somers, and R. Hilborn. 2022. Trade-offs between bycatch and target catches in static versus dynamic fishery closures. Proceedings of the National Academy of Sciences 119(4): e2114508119.

Pons, M., J.T. Watson, D. Ovando, S. Andraka, S. Brodie, A. Domingo, M. Fitchett, R. Forselledo, M. Hall, E.L. Hazen, J.E. Jannot, M. Herrera, S. Jiménez, D.M. Kaplan, S. Kerwath, J. Lopez, J. McVeigh, L. Pacheco, L. Rendon, K. Richerson, R. Sant'Ana, R. Sharma, J.A. Smith, K. Somers, and R. Hilborn. 2022. Trade-offs between bycatch and target catches in static versus dynamic fishery closures. Proceedings of the National Academy of Sciences 119(4): e2114508119.

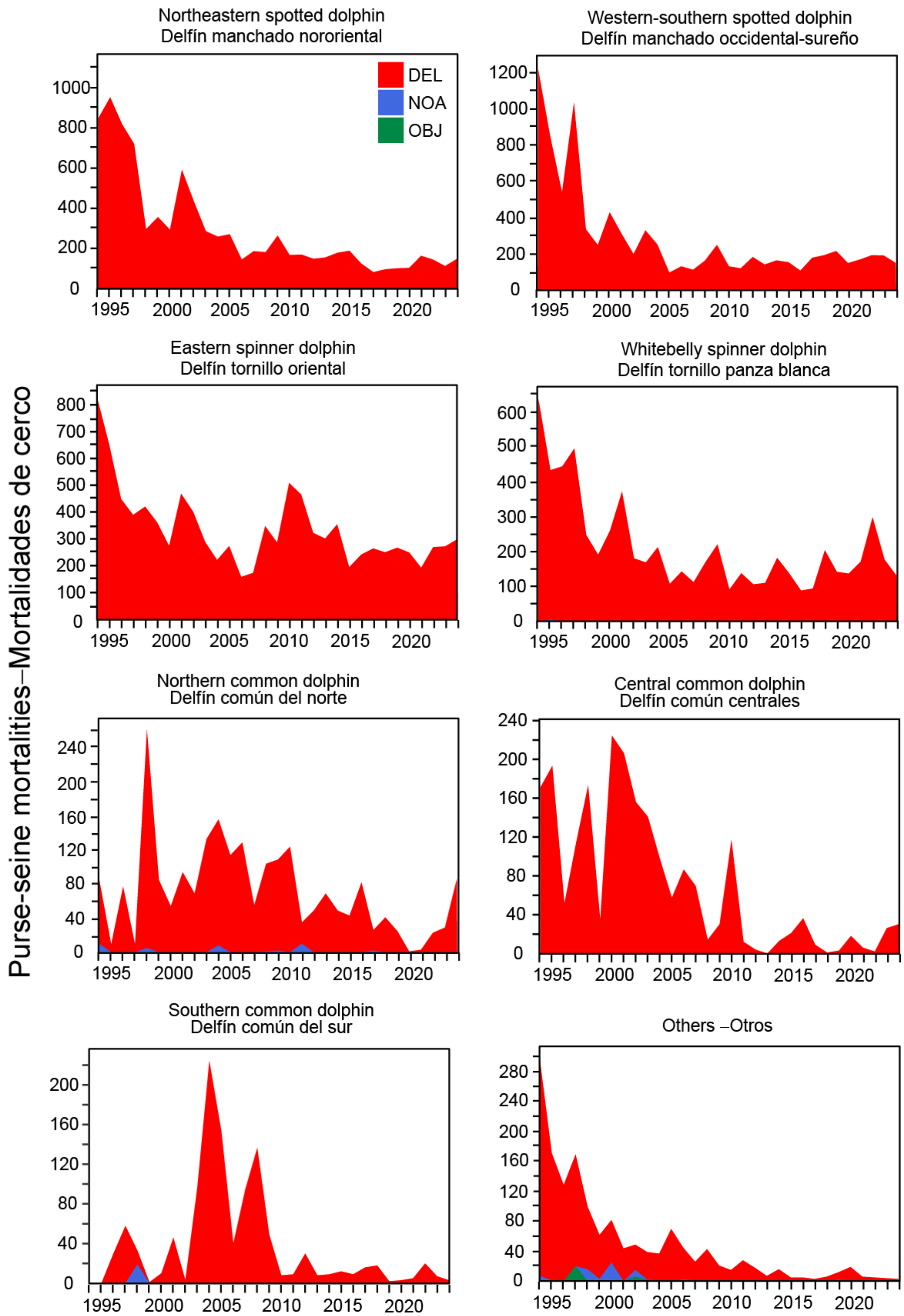
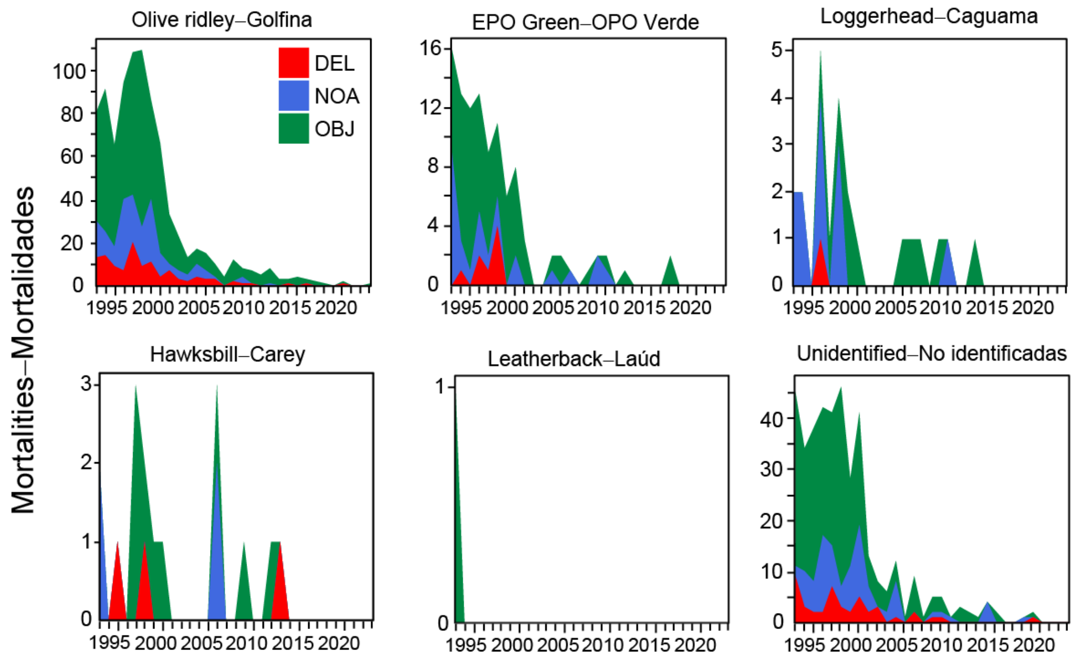


FIGURE L-1. Estimated number of incidental dolphin mortalities by observers onboard purse-seine vessels, 1994–2024.

FIGURA L-1. Número estimado de mortalidades incidentales de delfines por observadores a bordo de buques cerqueros grandes, 1994–2024.

a.



b.

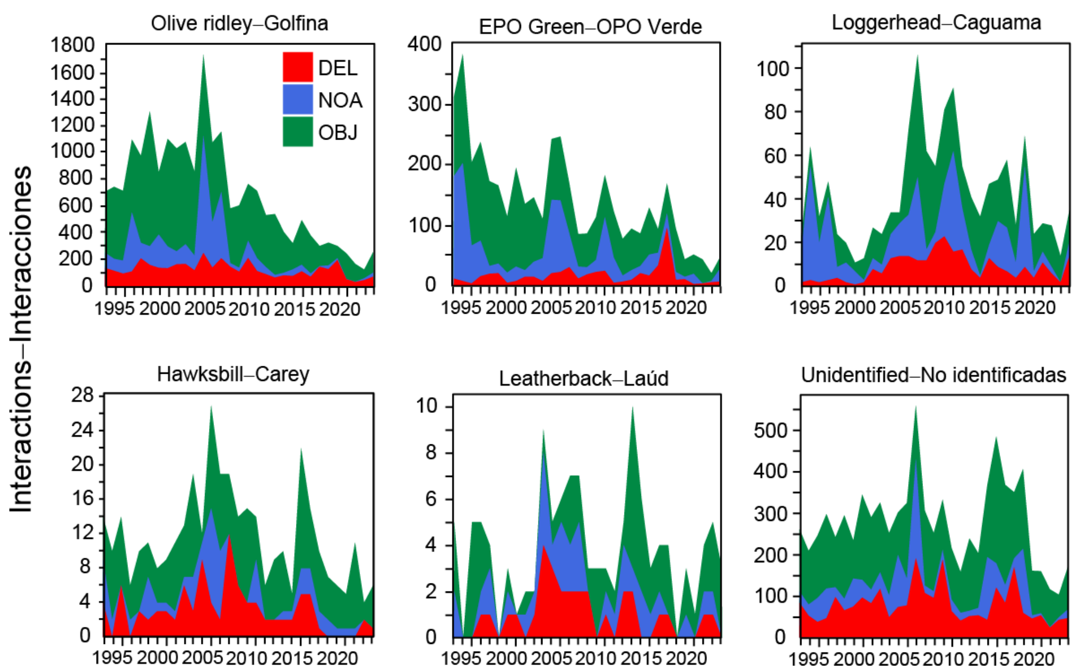


FIGURE L-2. Estimated number of sea turtle a) mortalities and b) interactions by observers onboard large purse-seine (Class 6, carrying capacity > 363 t) vessels, 1994–2024, by set type (dolphin (DEL), unassociated (NOA), floating object (OBJ)).

FIGURA L-2. Número estimado de a) mortalidades y b) interacciones de tortugas marinas por observadores a bordo de buques cerqueros grandes (clase 6, capacidad de acarreo > 363 t), 1994-2024, por tipo de lance (delfín (DEL), no asociado (NOA), objeto flotante (OBJ)).

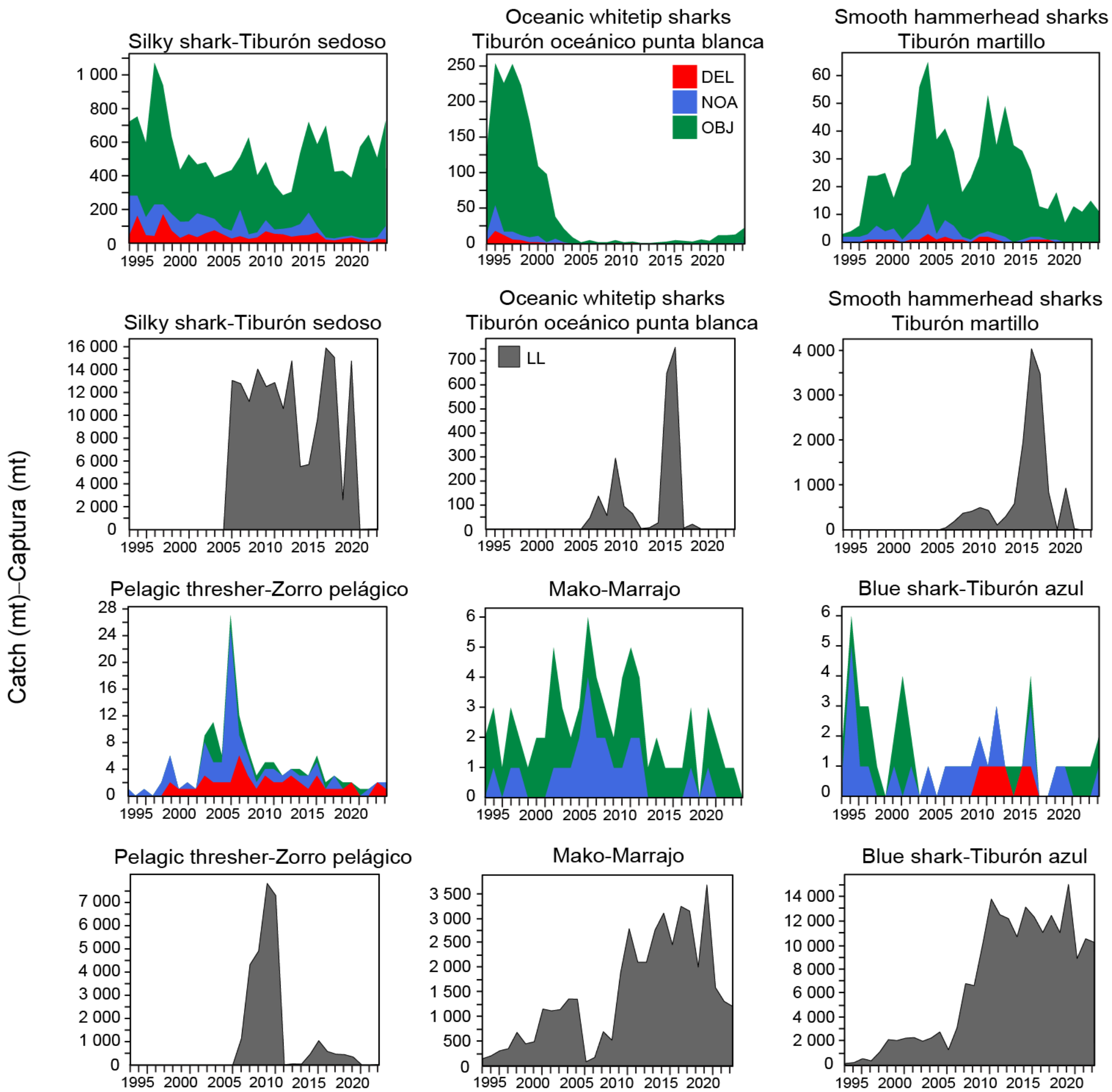


FIGURE L-3a. Estimated catches in metric tons (t) of key shark species in the eastern Pacific Ocean recorded by observers onboard large purse-seine (Class 6, carrying capacity > 363 t) vessels and minimum longline (LL) estimates of gross annual removals reported by CPCs (see section 2.2. for uncertainty and data gaps in reporting of bycatch species caught by longline). Purse-seine catches are provided for size-class 6 vessels with a carrying capacity >363 t (1994–2024) by set type: floating object (OBJ), unassociated tuna schools (NOA) and dolphins (DEL). Longline catches (1994–2023) are minimum reported gross-annual removals that may have been estimated using a mixture of different weight metrics (see footnote in section 3.5).

FIGURA L-3a. Capturas estimadas en toneladas (t) de especies clave de tiburones en el Océano Pacífico oriental registradas por observadores a bordo de buques cerqueros grandes (clase 6, capacidad de acarreo > 363 t) y estimaciones mínimas de palangre (LL) de extracciones anuales brutas reportadas por los CPC (ver Sección 2.2. para consultar información sobre la incertidumbre y las deficiencias de los datos en la notificación de especies capturadas incidentalmente con palangre). Se presentan las capturas cerqueras para buques de clase 6 con una capacidad de acarreo >363 t (1994-2024) por tipo de lance: objeto flotante (OBJ), atunes no asociados (NOA) y delfines (DEL). Las capturas palangreras (1994–2023) son extracciones anuales brutas mínimas reportadas que pueden haber sido estimadas usando una mezcla de diferentes métricas de peso (ver nota al pie de página en la sección 3.5).

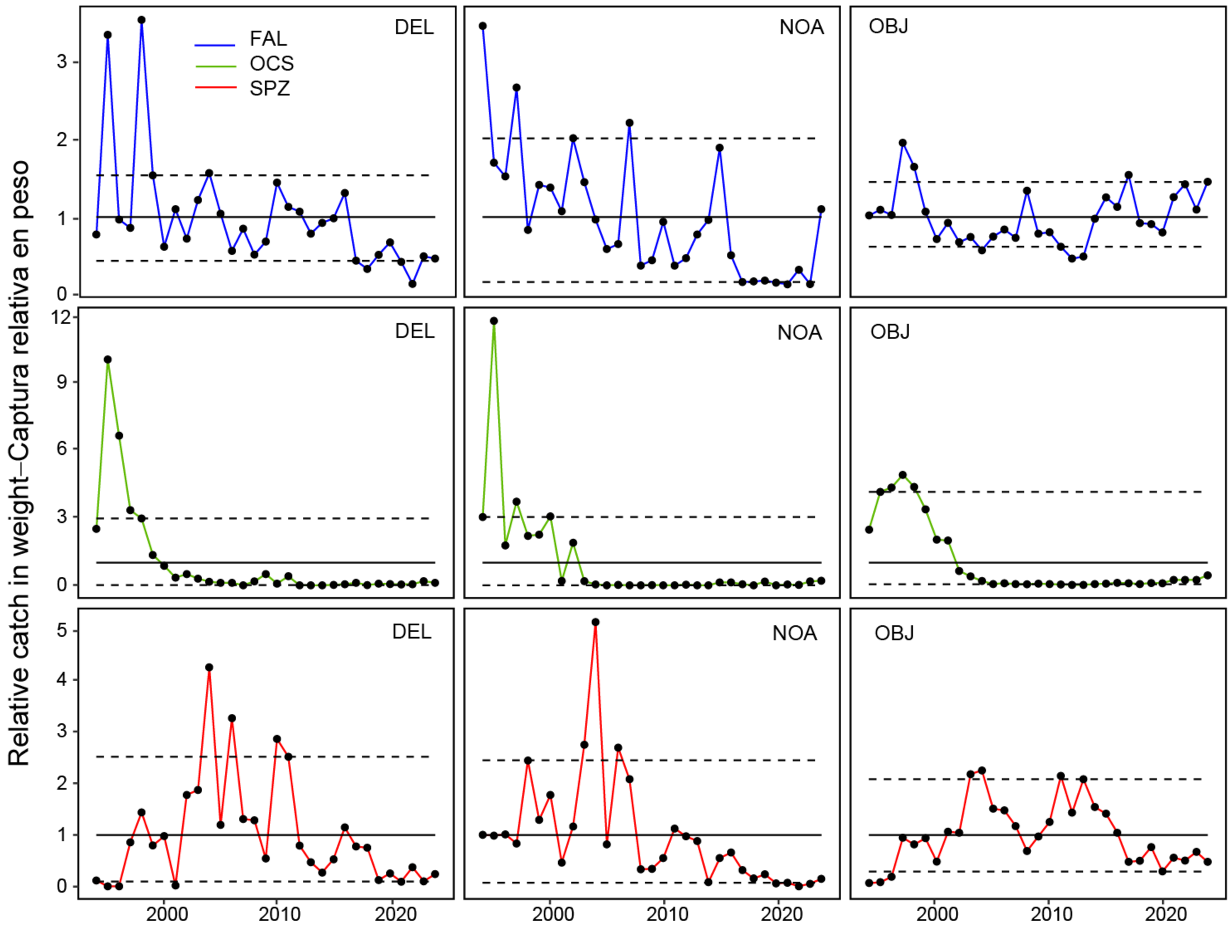


FIGURE L-3b. Indicators of relative catch of key shark species reported by observers onboard large purse-seine vessels (Class 6, carrying capacity > 363 t) by set type: dolphins (DEL), unassociated tuna schools (NOA) and floating object (OBJ). The solid line is the average total annual catch for the period 1994–2024 and scaled to 1 and the dashed lines represent the 10th and 90th percentiles. FAL: silky shark (*Carcharhinus falciformis*), OCS: oceanic whitetip shark (*Carcharhinus longimanus*), SPZ: smooth hammerhead shark (*Sphyrna zygaena*).

FIGURA L-3b. Indicadores de captura relativa de especies clave de tiburones notificada por observadores a bordo de buques cerqueros grandes (clase 6, capacidad de acarreo > 363 t) por tipo de lance: sobre delfines (DEL), no asociados (NOA) y sobre objetos flotantes (OBJ). La línea continua es el promedio de captura anual total para el periodo 1994-2024 y está escalada a 1 y las líneas punteadas representan los percentiles de 10 y 90%. FAL: tiburón sedoso (*Carcharhinus falciformis*), OCS: tiburón oceánico punta blanca (*Carcharhinus longimanus*), SPZ: cornuda cruz (*Sphyrna zygaena*).

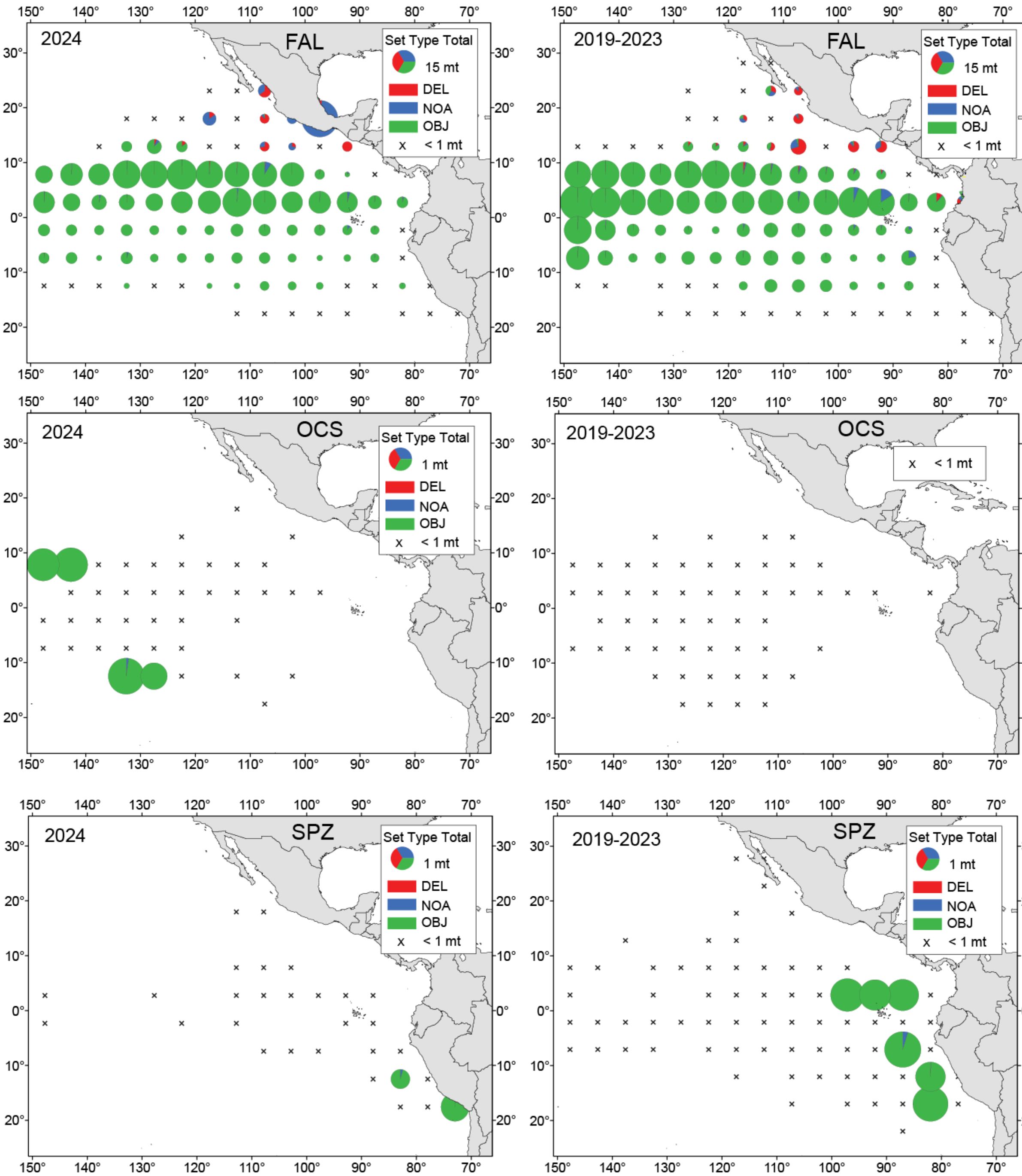


FIGURE L-3c. Purse-seine catches (Class 6, carrying capacity > 363 t) (at 5°x5° resolution) of key species of sharks by set type: floating object (OBJ) unassociated tuna schools (NOA) and dolphins (DEL), for 2024 (left panel) and the 2019–2023 averages (right panel). FAL: silky shark (*Carcharhinus falciformis*), OCS: oceanic whitetip shark (*Carcharhinus longimanus*), SPZ: smooth hammerhead shark (*Sphyrna zygaena*).
FIGURA L-3c. Capturas cerqueras (clase 6, capacidad de acarreo > 363 t) (resolución de 5°x5°) de especies clave de tiburones por tipo de lance: sobre objetos flotantes (OBJ), no asociados (NOA) y sobre delfines (DEL), para 2024 (panel izquierdo) y los promedios de 2019–2023 (panel derecho). FAL: tiburón sedoso (*Carcharhinus falciformis*), OCS: tiburón oceánico punta blanca (*Carcharhinus longimanus*), SPZ: cornuda cruz (*Sphyrna zygaena*).

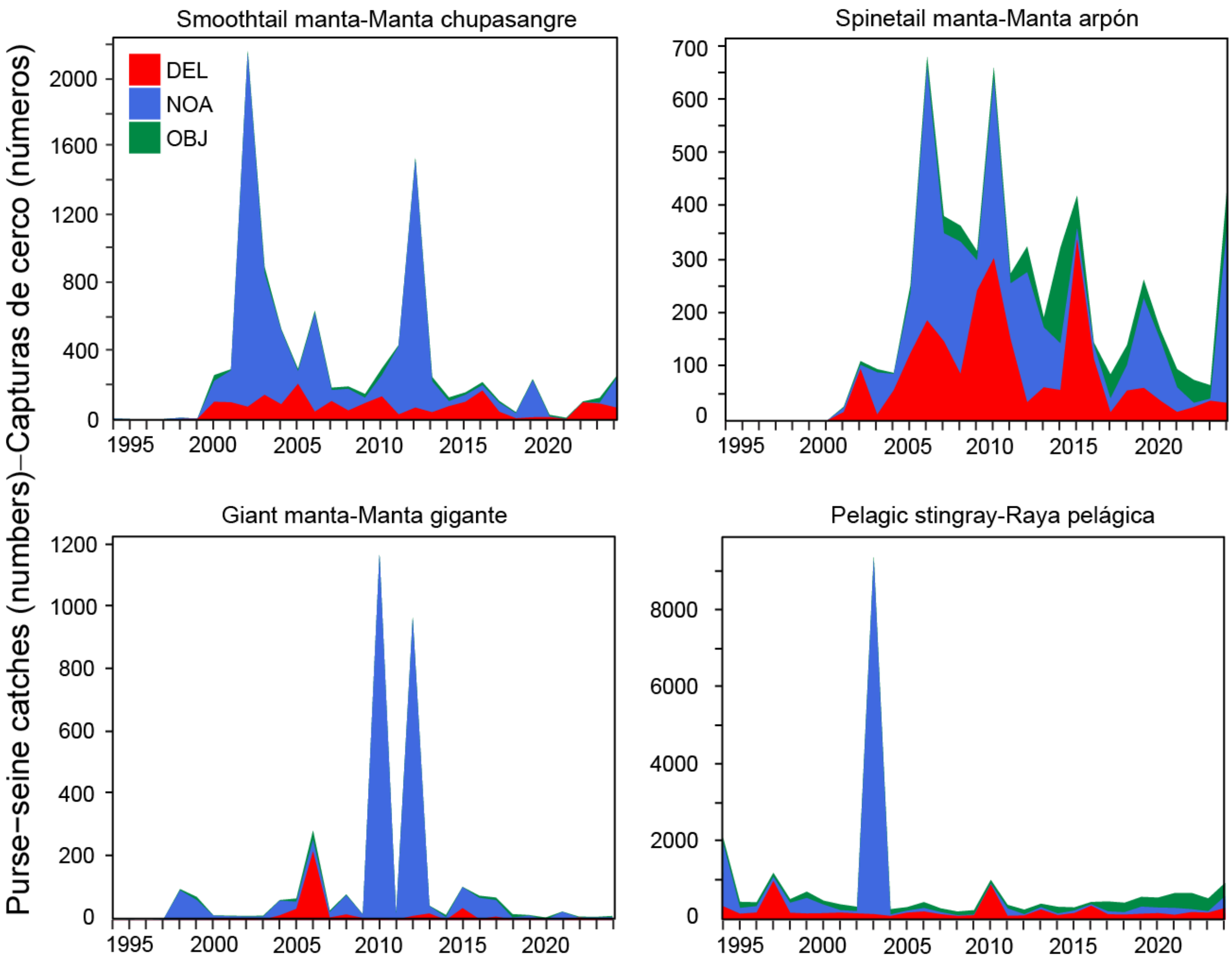


FIGURE L-4a. Estimated purse-seine catches in numbers of individuals of key species of rays in the eastern Pacific Ocean. Purse seine catches are provided for size-class 6 vessels with a carrying capacity >363 t (1994–2024) by set type: floating object (OBJ), unassociated tuna schools (NOA) and dolphins (DEL).

FIGURA L-4a. Capturas cerqueras estimadas en número de individuos de especies clave de rayas en el Océano Pacífico oriental. Se presentan las capturas cerqueras para buques de clase 6 con una capacidad de acarreo >363 t (1994-2024) por tipo de lance: objeto flotante (OBJ), atunes no asociados (NOA) y delfines (DEL).

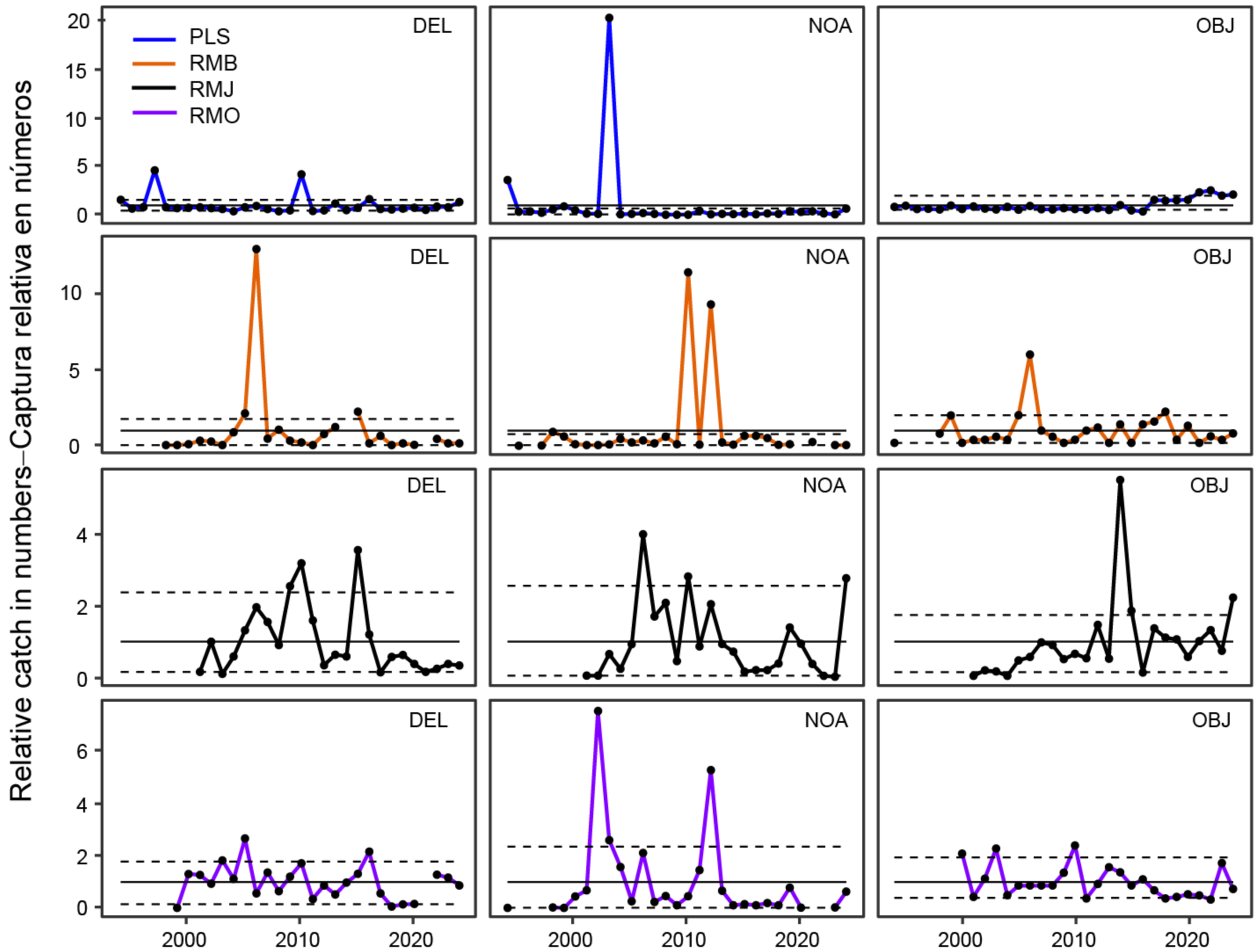


FIGURE L-4b. Indicators of relative number of individuals of rays reported by observers onboard large purse-seine vessels (Class 6, carrying capacity > 363 t) by set type: dolphins (DEL), unassociated tuna schools (NOA) and floating object (OBJ). The solid line is the average total annual catch for the period 1994–2024 and scaled to 1 and the dashed lines represent the 10th and 90th percentiles. PLS: pelagic stingray (*Pteroplatytrygon violacea*), RMB: giant manta (*Mobula birostris*), RMJ: spinetail manta (*Mobula mobular*), RMO: smoothtail manta (*Mobula thurstoni*).

FIGURA L-4b. Indicadores del número relativo de individuos de rayas notificado por observadores a bordo de buques cerqueros grandes (clase 6, capacidad de acarreo > 363 t) por tipo de lance: sobre delfines (DEL), no asociados (NOA) y sobre objetos flotantes (OBJ). La línea continua es el promedio de captura anual total para el periodo 1994-2024 y está escalada a 1 y las líneas punteadas representan los percentiles de 10 y 90%. PLS: raya pelágica (*Pteroplatytrygon violacea*), RMB: manta gigante (*Mobula birostris*), RMJ: manta mobula (*Mobula mobular*), RMO: manta diablo (*Mobula thurstoni*).

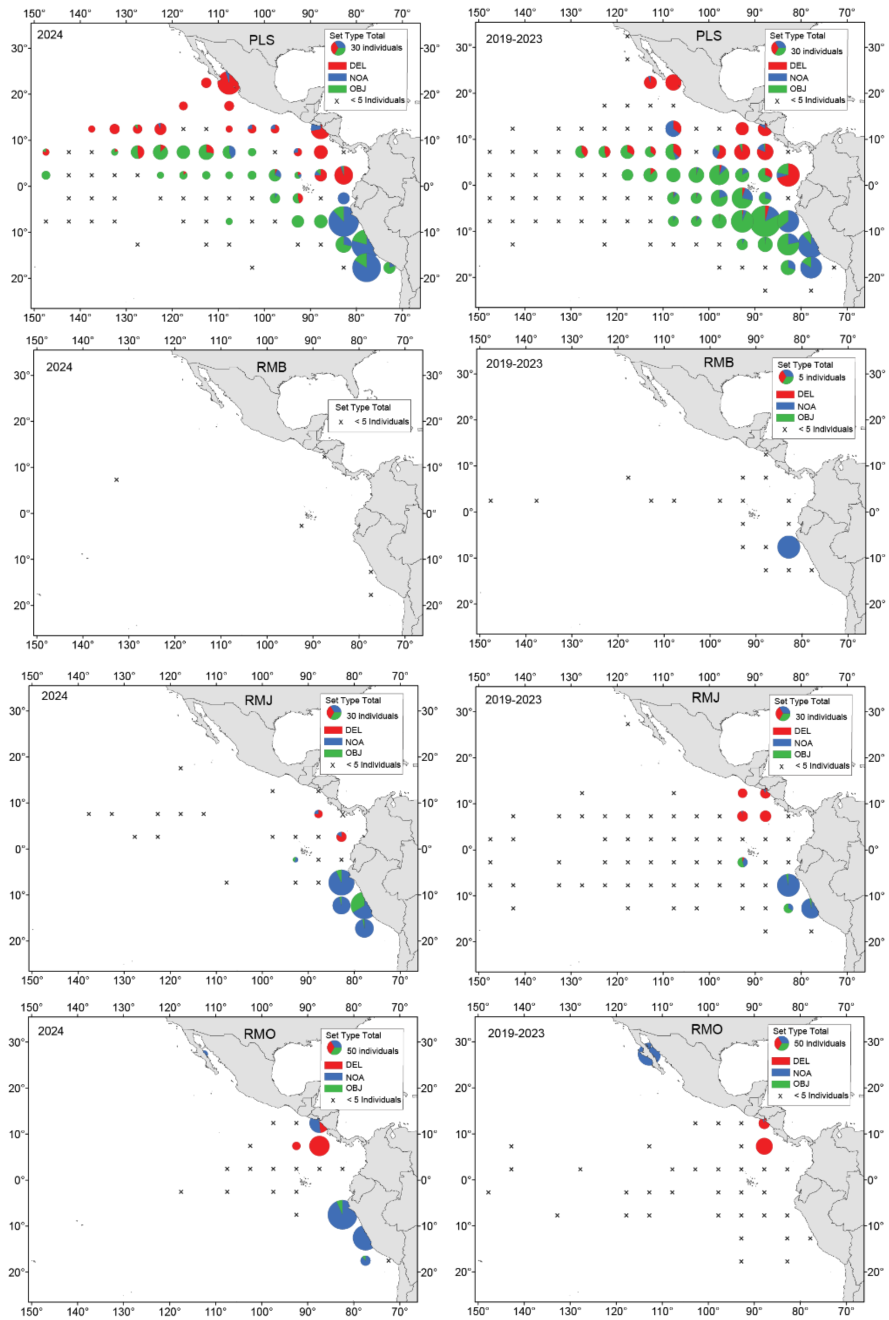


FIGURE L-4c. Purse-seine catches (Class 6, carrying capacity > 363 t) (at 5°x5° resolution) of key species of rays by set type: floating object (OBJ) unassociated tuna schools (NOA) and dolphins (DEL), for 2024 (left panel) and the 2019–2023 averages (right panel). PLS: pelagic stingray (*Pteroplatytrygon violacea*), RMB: giant manta (*Mobula birostris*), RMJ: spinetail manta (*Mobula mobular*), RMO: smoothtail manta (*Mobula thurstoni*).

FIGURA L-4c. Capturas cerqueras (clase 6, capacidad de acarreo > 363 t) (resolución de 5°x5°) de especies clave de rayas por tipo de lance: sobre objetos flotantes (OBJ), no asociados (NOA) y sobre delfines (DEL), para 2024 (panel izquierdo) y los promedios de 2019-2023 (panel derecho). PLS: raya pelágica (*Pteroplatytrygon violacea*), RMB: manta gigante (*Mobula birostris*), RMJ: manta mobula (*Mobula mobular*), RMO: manta diablo (*Mobula thurstoni*).

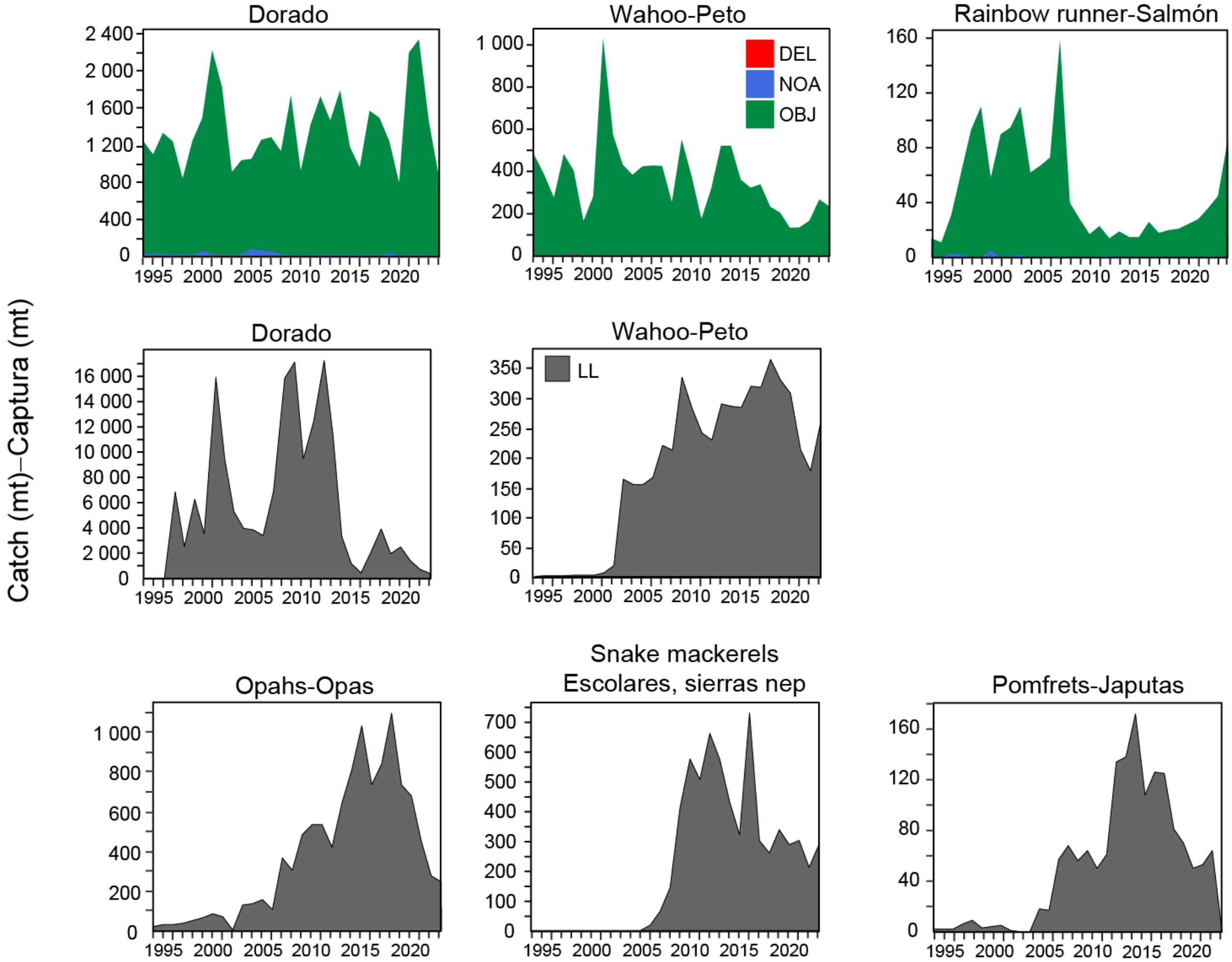


FIGURE L-5. Estimated purse-seine and longline catches in metric tons (t) of key species of large fishes in the eastern Pacific Ocean. Purse-seine catches are provided for size-class 6 vessels with a carrying capacity >363 t (1994–2024) by set type: floating object (OBJ), unassociated tuna schools (NOA) and dolphins (DEL). Longline (LL) catches (1994–2023) are minimum reported gross-annual removals (see section 2.2. for uncertainty and data gaps in reporting of bycatch species caught by longline).

FIGURA L-5. Capturas cerqueras y palangreras estimadas en toneladas (t) de especies clave de peces grandes en el Océano Pacífico oriental. Se presentan las capturas cerqueras para buques de clase 6 con una capacidad de acarreo >363 t (1994-2024) por tipo de lance: objeto flotante (OBJ), atunes no asociados (NOA) y delfines (DEL). Las capturas palangreras (LL) (1994–2023) son extracciones anuales brutas mínimas reportadas (ver la Sección 2.2 para consultar información sobre la incertidumbre y las deficiencias de los datos en la notificación de especies capturadas incidentalmente con palangre).

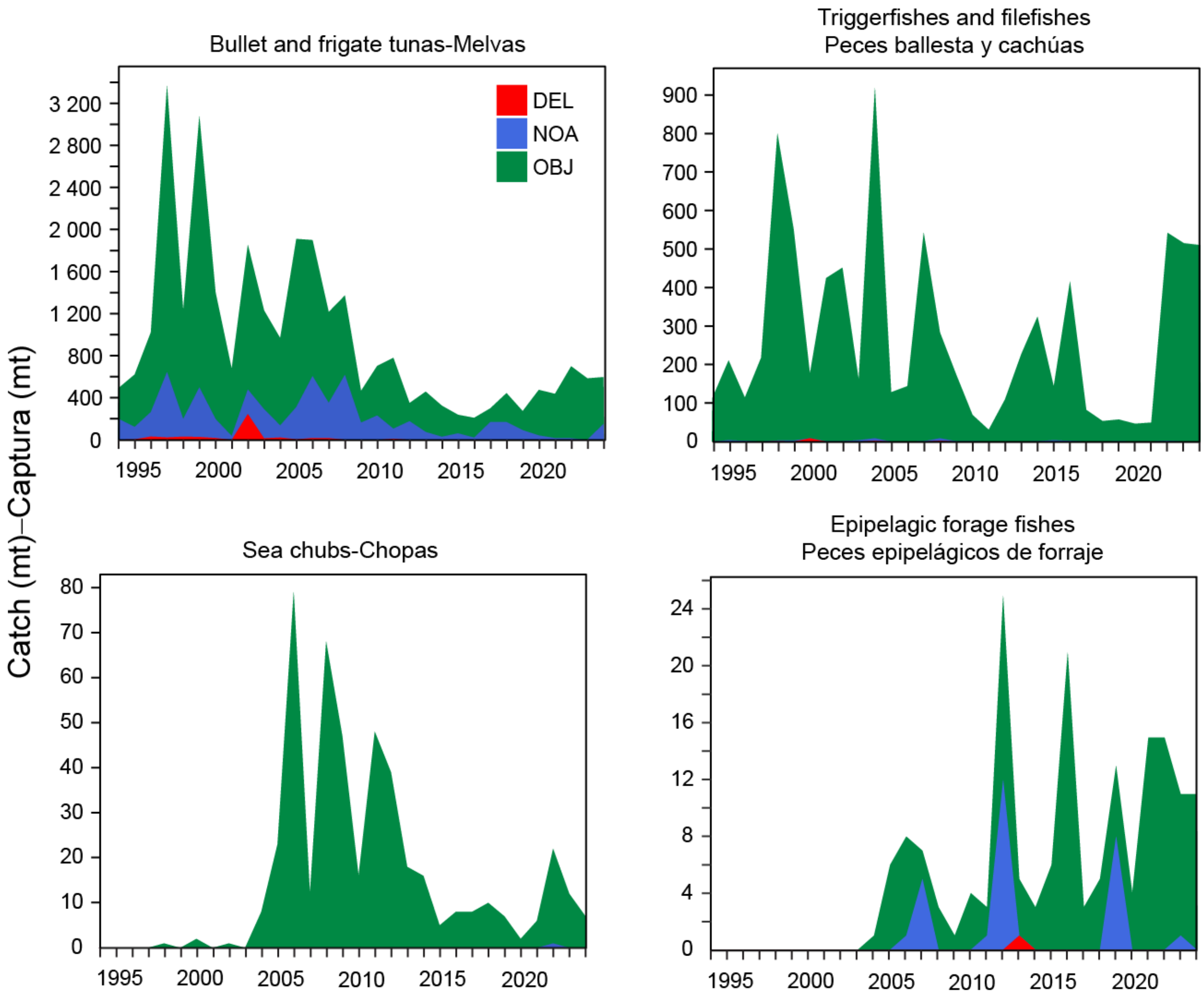


FIGURE L-6. Estimated purse-seine catches in metric tons (t) of key species of small fishes in the eastern Pacific Ocean. Purse seine catches are provided for size-class 6 vessels with a carrying capacity >363 t (1994–2024) by set type: floating object (OBJ), unassociated tuna schools (NOA) and dolphins (DEL).

FIGURA L-6. Capturas cerqueras estimadas en toneladas (t) de especies clave de peces pequeños en el Océano Pacífico oriental. Se presentan las capturas cerqueras para buques de clase 6 con una capacidad de acarreo >363 t (1994-2024) por tipo de lance: objeto flotante (OBJ), atunes no asociados (NOA) y delfines (DEL).

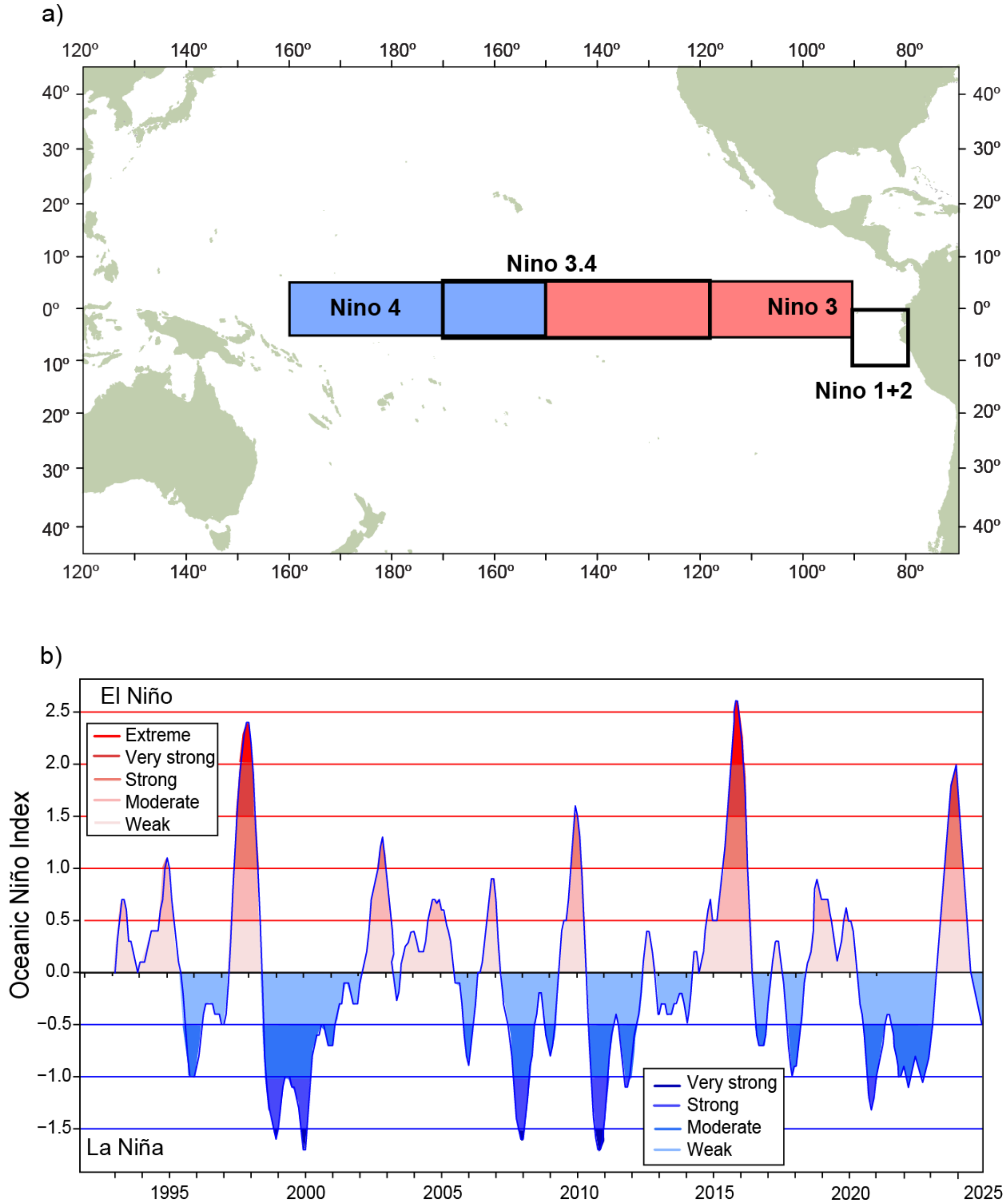


FIGURE L-7. El Niño regions used as indicators of El Niño Southern Oscillation (ENSO) events in the Pacific Ocean (top panel), and the Oceanic Niño Index (ONI) used to monitor ENSO conditions in Niño region 3.4 from 5°N to 5°S and 120°W to 170°W (bottom panel). Time series shows the running 3-month mean ONI values from the start of the IATTC observer program through December 2024. ONI data obtained from: http://origin.cpc.ncep.noaa.gov/products/analysis_monitoring/ensostuff/ONI_v5.php

FIGURA L-7. Regiones de El Niño utilizadas como indicadores de los eventos de El Niño-Oscilación del Sur (ENOS) en el Océano Pacífico (panel superior), e Índice de El Niño Oceánico (ONI) usado para dar seguimiento a las condiciones de ENOS en la región Niño 3.4 de 5°N a 5°S y de 120°O a 170°O (panel inferior). Las series de tiempo muestran los valores del promedio móvil de 3 meses del ONI desde el inicio del programa de observadores de la CIAT hasta finales de diciembre de 2024. Datos del ONI obtenidos de: http://origin.cpc.ncep.noaa.gov/products/analysis_monitoring/ensostuff/ONI_v5.php

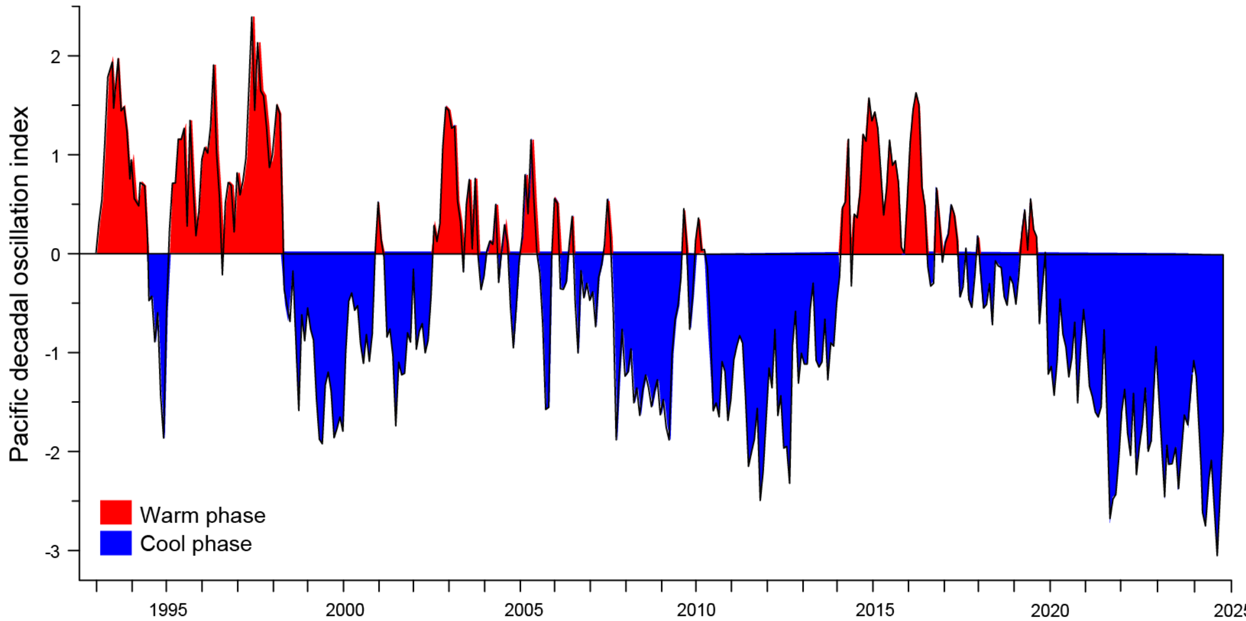


FIGURE L-8. Monthly values of the Pacific Decadal Oscillation (PDO) Index, January 1993–December 2024. ERSST V5 PDO Time Series data obtained from: https://psl.noaa.gov/pdo/

FIGURA L-8. Valores mensuales del índice de Oscilación Decadal del Pacífico (PDO), enero de 1993–diciembre de 2024. Datos de la serie de tiempo ERSST V5 PDO obtenidos de: https://psl.noaa.gov/pdo/

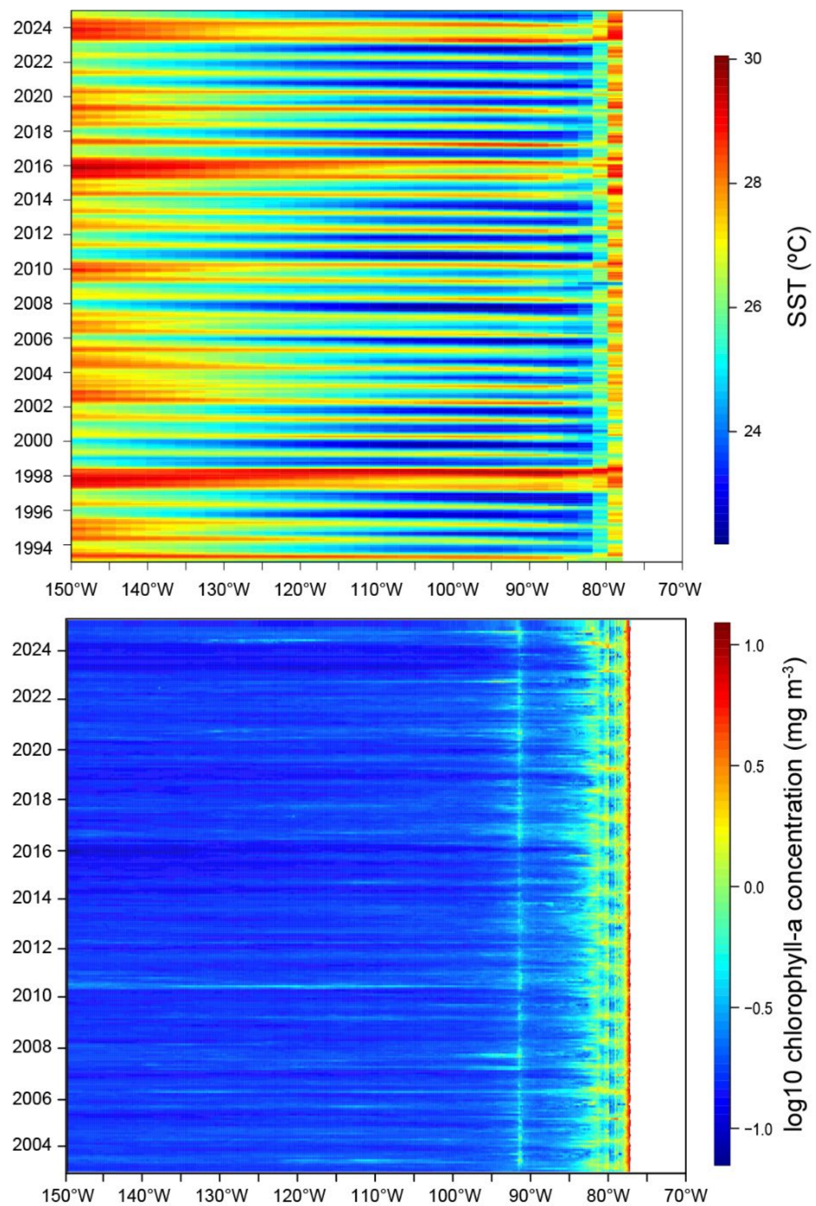


FIGURE L-9. Time-longitude Hovmöller diagram with data averaged across the tropical eastern Pacific Ocean from 5°N to 5°S for mean monthly SST for January 1993–December 2024 (top panel) (https://coastwatch.pfeg.noaa.gov/erddap/griddap/nceiErsstv5_LonPM180.html) and mean monthly chlorophyll-a concentration for January 2003–December 2024 (bottom panel) (https://coastwatch.pfeg.noaa.gov/erddap/info/erdMH1chlamday_R2022SQ/index.html.

FIGURA L-9. Diagrama de Hovmöller tiempo-longitud con datos promediados en el Océano Pacífico tropical oriental de 5°N a 5°S para la TSM promedio mensual de enero de 1993 a diciembre de 2024 (panel superior) (https://coastwatch.pfeg.noaa.gov/erddap/griddap/nceiErsstv5_LonPM180.html) y concentración promedio mensual de clorofila-a de enero de 2003 a diciembre de 2024 (panel inferior) (https://coastwatch.pfeg.noaa.gov/erddap/info/erdMH1chlamday_R2022SQ/index.html);

.

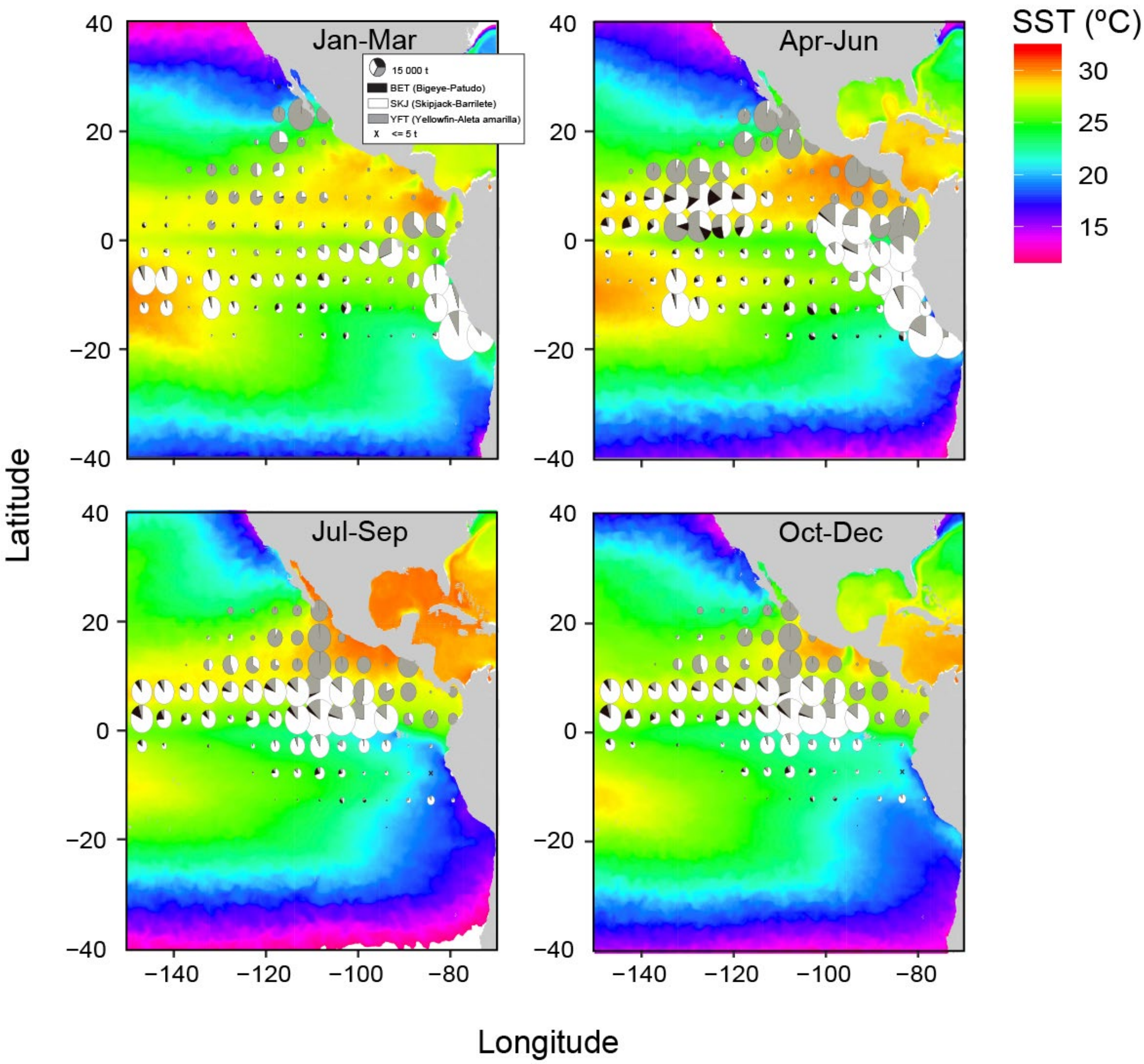


FIGURE L-10. Mean sea surface temperature (SST) for each quarter during 2024 with catches of tropical tunas overlaid. SST data obtained from NOAA NMFS SWFSC ERD on March 06, 2025, "Multi-scale Ultra-high Resolution (MUR) SST Analysis fv04.1, Global, 0.01°, 2002–present, Monthly", https://coastwatch.pfeg.noaa.gov/erddap/info/jplMURSST41mday/index.html.

FIGURA L-10 Temperatura superficial del mar (TSM) promedio para cada trimestre de 2024 con las capturas de atunes tropicales superpuestas. Datos de TSM obtenidos de NOAA NMFS SWFSC ERD el 6 de marzo de 2025, "Multi-scale Ultra-high Resolution (MUR) SST Analysis fv04.1, Global, 0.01°, 2002–present, Monthly", https://coastwatch.pfeg.noaa.gov/erddap/info/jplMURSST41mday/index.html.

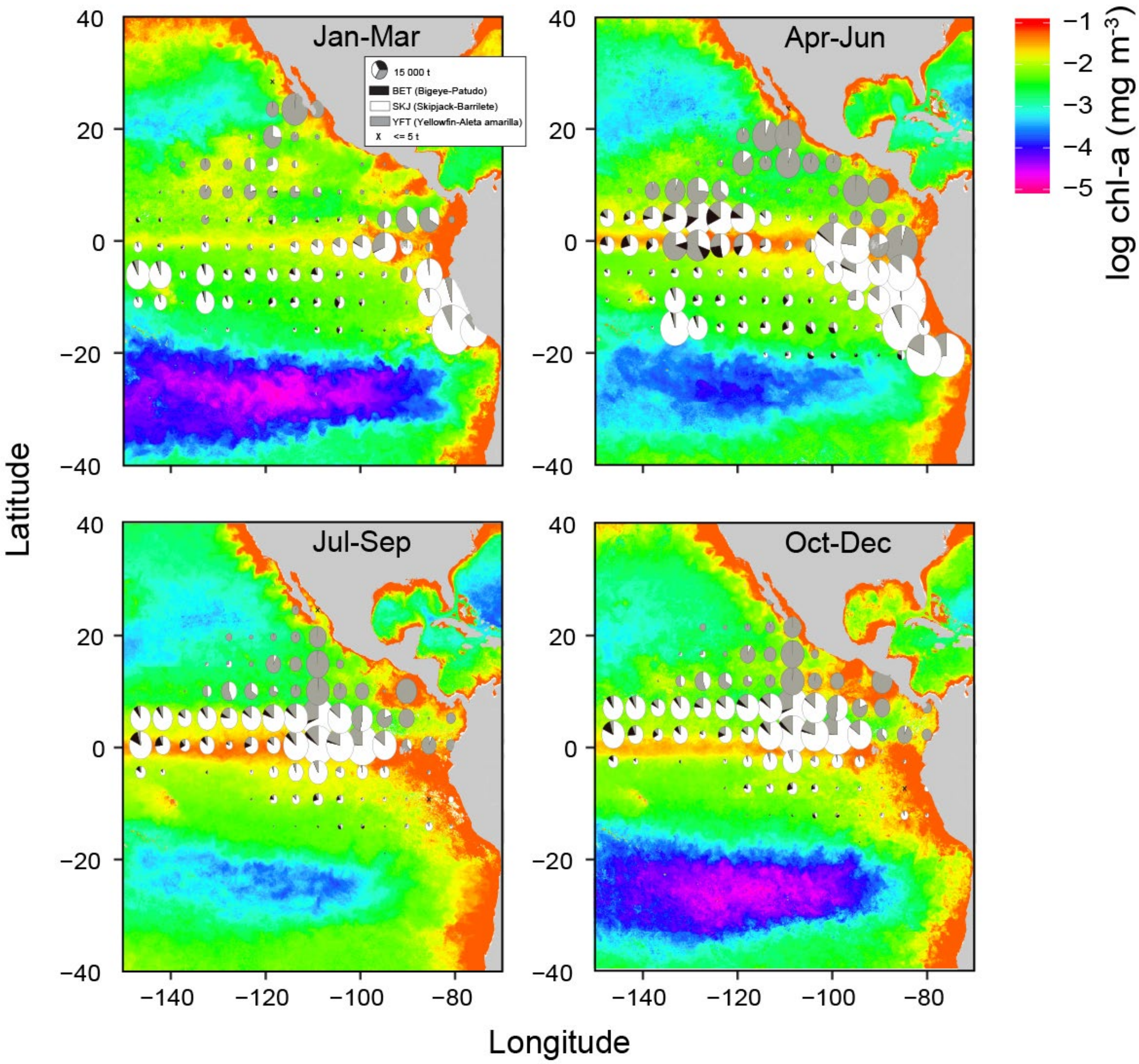


FIGURE L-11. Mean log chlorophyll-a concentration (in mg m^3) for each quarter during 2024 with catches of tropical tunas overlaid. Chlorophyll data obtained from NOAA CoastWatch on March 6, 2025, "Chlorophyll-a, Aqua MODIS, NPP, L3SMI, Global, 4km, R2022 SQ, 2003-present (Monthly Composite)", NOAA NMFS SWFSC ERD, https://coastwatch.pfeg.noaa.gov/erddap/info/erdMH1chlamday_R2022SQ/index.html.

FIGURA L-11. Concentración promedio de clorofila-a (en mg m^3) para cada trimestre de 2024 con las capturas de atunes tropicales superpuestas. Datos de clorofila obtenidos de NOAA CoastWatch el 6 de marzo de 2024, "Chlorophyll-a, Aqua MODIS, NPP, L3SMI, Global, 4km, R2022 SQ, 2003-present (Monthly Composite)", NOAA NMFS SWFSC ERD, https://coastwatch.pfeg.noaa.gov/erddap/info/erdMH1chlamday_R2022SQ/index.html.

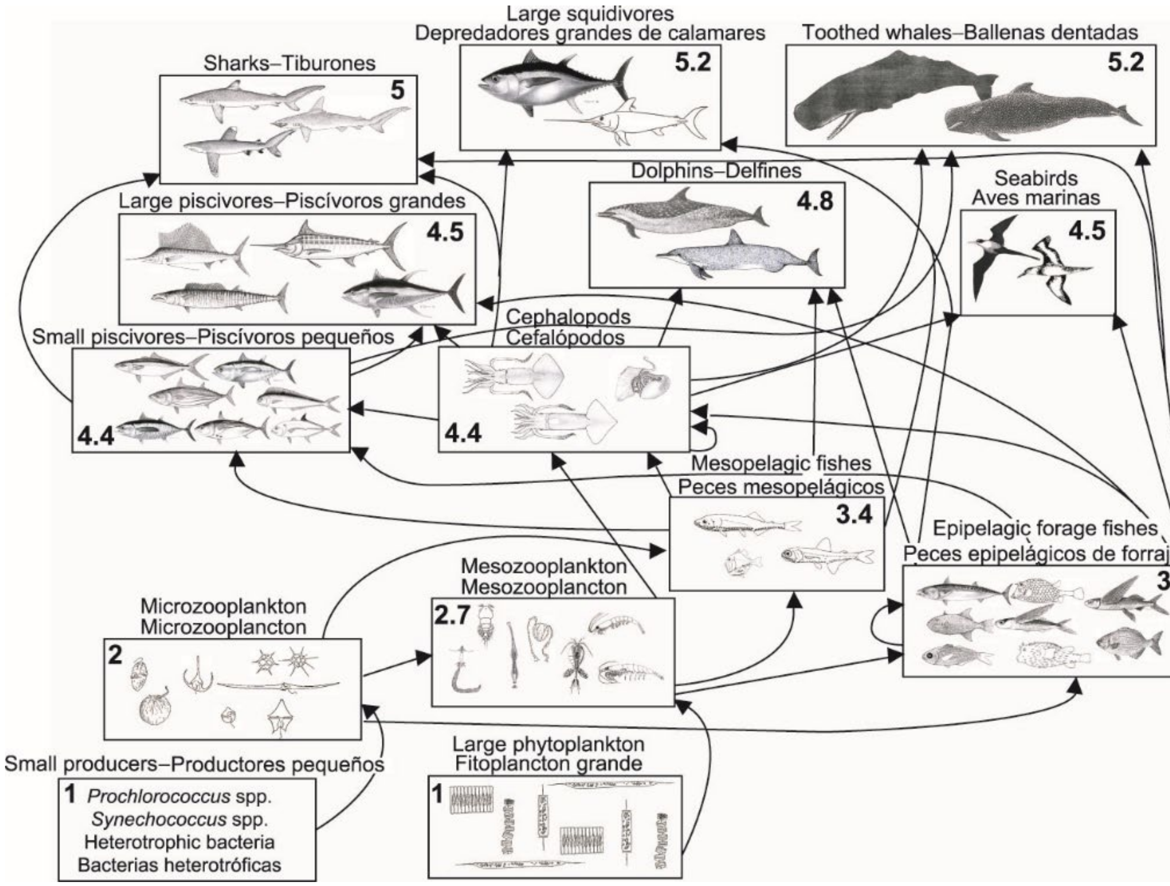


FIGURE L-12. Simplified food-web diagram of the pelagic ecosystem in the tropical EPO. The numbers inside the boxes indicate the approximate trophic level of each group.
FIGURA L-12. Diagrama simplificado de la red trófica del ecosistema pelágico en el OPO tropical. Los números en los recuadros indican el nivel trófico aproximado de cada grupo.

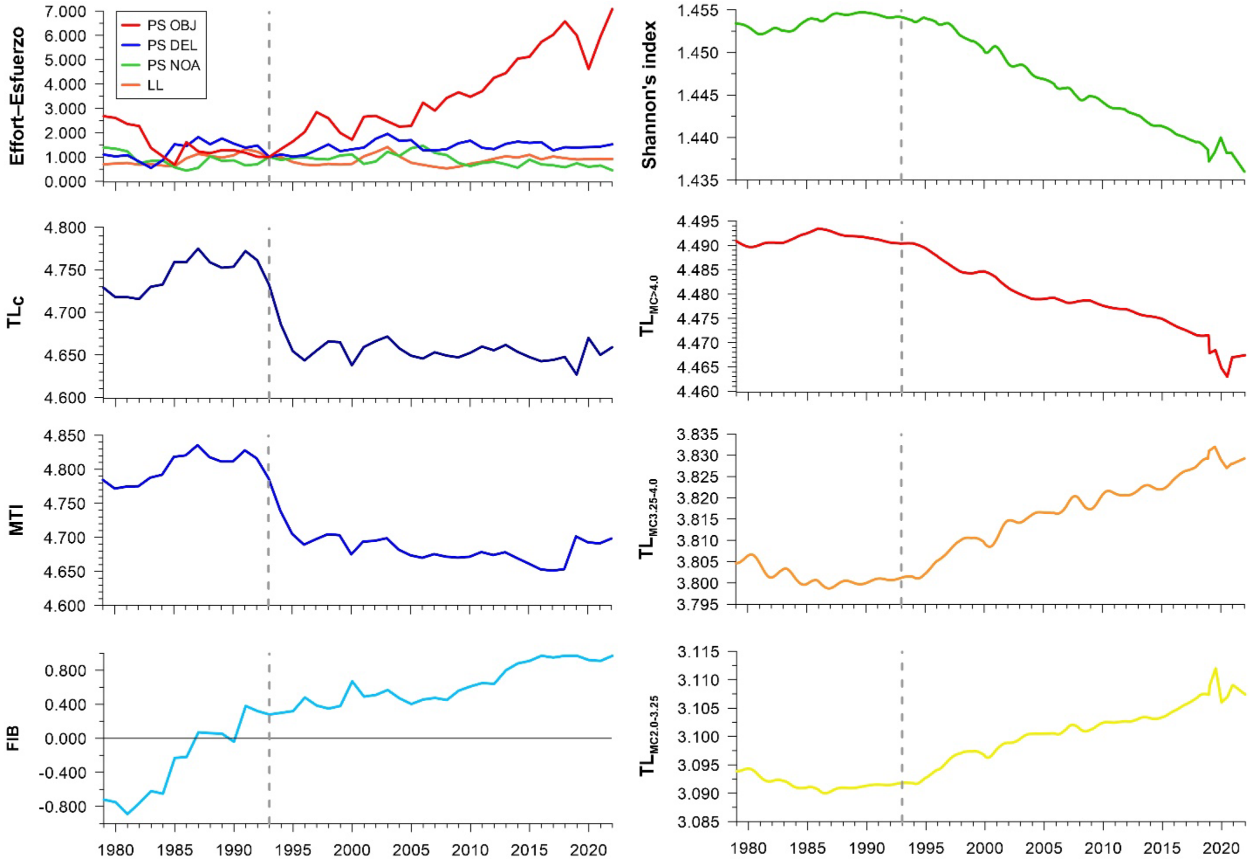


FIGURE L-13. Annual values for seven ecological indicators of changes in different components of the tropical EPO ecosystem, 1979–2022 (see Section 6 of text for details), and an index of longline (LL) and purse-seine (PS) fishing effort, by set type (dolphin (DEL), unassociated (NOA), floating object (OBJ)), relative to the model start year of 1993 (vertical dashed line), when the expansion of the purse-seine fishery on FADs began.

FIGURA L-13 Valores anuales de siete indicadores ecológicos de cambios en diferentes componentes del ecosistema del OPO tropical, 1979–2022 (ver detalles en la sección 6 del texto), y un índice de esfuerzo palangrero (LL) y cerquero (PS), por tipo de lance (delfín (DEL), no asociado (NOA), objeto flotante (OBJ)) relativo al año de inicio del modelo de 1993 (línea de trazos vertical), cuando comenzó la expansión de la pesquería cerquera sobre plantados.

Table L-1a. Estimated number of individuals of incidental dolphin mortalities by set type and stock in the eastern Pacific Ocean by the purse-seine fishery from 1994-2024. Purse-seine set types: floating object (OBJ), unassociated tuna schools (NOA) and dolphins (DEL). Data for 2023–2024 are considered preliminary.

Tabla L-1a. Número estimado de individuos de mortalidades incidentales de delfines por la pesquería de cerco durante 1994-2024, por tipo de lance y población en el Océano Pacífico oriental. Tipos de lances de cerco: sobre objetos flotantes (OBJ), no asociados (NOA) y sobre delfines (DEL). Los datos de 2023–2024 se consideran preliminares.

	Northeastern spotted Purse seine			Western-southern spotted Purse seine			Eastern spinner Purse seine			Whitebelly spinner Purse seine		
Year	DEL	NOA	OBJ	DEL	NOA	OBJ	DEL	NOA	OBJ	DEL	NOA	OBJ
1994	847	-	-	1,228	-	-	828	-	-	640	-	-
1995	952	-	-	859	-	-	654	-	-	431	5	-
1996	818	-	-	545	-	-	450	-	-	447	-	-
1997	718	3	-	1,044	-	-	391	-	-	498	-	-
1998	298	-	-	341	-	-	422	-	-	249	-	-
1999	358	-	-	253	-	-	363	-	-	192	-	-
2000	295	-	-	435	-	-	275	-	-	262	-	-
2001	592	-	-	315	-	-	470	-	-	374	-	-
2002	435	-	-	203	-	-	403	-	-	182	-	-
2003	288	-	-	335	-	-	290	-	-	170	-	-
2004	261	-	-	256	-	-	223	-	-	214	-	-
2005	273	-	-	100	-	-	275	-	-	108	-	-
2006	147	-	-	135	-	-	160	-	-	144	-	-
2007	189	-	-	116	-	-	175	-	-	113	-	-
2008	184	-	-	167	-	-	349	-	-	171	-	-
2009	266	-	-	254	-	-	288	-	-	222	-	-
2010	170	-	-	135	-	-	510	-	-	92	-	-
2011	172	-	-	124	-	-	467	-	-	139	-	-
2012	151	-	-	187	-	-	324	-	-	107	-	-
2013	158	-	-	145	-	-	303	-	-	111	-	-
2014	181	-	-	168	-	-	356	-	-	183	-	-
2015	191	-	-	158	-	-	196	-	-	139	-	-
2016	127	-	-	111	-	-	243	-	-	89	-	-
2017	85	-	-	183	-	-	266	-	-	95	-	-
2018	99	-	-	197	-	-	252	-	-	205	-	-
2019	104	-	-	220	-	-	269	-	-	143	-	-
2020	106	-	-	153	-	-	251	-	-	138	-	-
2021	166	-	-	173	-	-	194	-	-	172	-	-
2022	147	-	-	197	-	-	271	-	-	300	-	-
2023	115	-	-	195	-	-	274	-	-	178	-	-
2024	151	-	-	154	-	-	300	-	-	132	-	-
Total	9,044	3	-	9,086	-	-	10,492	-	-	6,640	5	-

Table L-1a continued

	Northern common Purse seine			Central common Purse seine			Southern common Purse seine			Other dolphins Purse seine		
Year	DEL	NOA	OBJ	DEL	NOA	OBJ	DEL	NOA	OBJ	DEL	NOA	OBJ
1994	75	10	-	170	-	-	-	-	-	291	7	-
1995	9	-	-	192	-	-	-	-	-	171	1	-
1996	77	-	-	51	-	-	30	-	-	129	-	-
1997	9	-	-	114	-	-	58	-	-	150	-	20
1998	256	5	-	172	-	-	14	19	-	84	16	-
1999	85	-	-	34	-	-	1	-	-	59	3	-
2000	54	-	-	223	-	-	10	-	-	57	24	1
2001	94	-	-	205	-	-	46	-	-	44	-	-
2002	69	-	-	155	-	-	3	-	-	34	9	6
2003	133	-	-	140	-	-	97	-	-	37	-	2
2004	148	8	-	97	-	-	225	-	-	37	-	-
2005	114	-	-	57	-	-	154	-	-	70	-	-
2006	129	-	-	86	-	-	40	-	-	43	2	-
2007	55	-	-	69	-	-	95	-	-	25	1	-
2008	103	1	-	14	-	-	137	-	-	43	-	-
2009	107	2	-	30	-	-	49	-	-	21	-	-
2010	124	-	-	116	-	-	8	-	-	14	-	1
2011	25	10	-	12	-	-	9	-	-	28	-	-
2012	49	-	-	4	-	-	30	-	-	18	-	-
2013	69	-	-	-	-	-	8	-	-	6	1	-
2014	49	-	-	13	-	-	9	-	-	15	-	1
2015	43	-	-	21	-	-	12	-	-	5	-	-
2016	82	-	-	36	-	-	9	-	-	4	-	1
2017	24	2	-	9	-	-	16	-	-	3	-	-
2018	41	-	-	1	-	-	18	-	-	6	-	-
2019	25	-	-	3	-	-	2	-	-	10	-	2
2020	1	-	-	18	-	-	3	-	-	19	-	-
2021	3	-	-	6	-	-	5	-	-	6	-	-
2022	23	-	-	2	-	-	20	-	-	5	-	-
2023	29	-	-	26	-	-	7	-	-	4	-	-
2024	86	-	-	30	-	-	3	-	-	3	-	-
Total	2,190	38	-	2,106	-	-	1,118	19	-	1,441	64	34

Table L-1b. Minimum number of marine mammal interactions and mortalities in the eastern Pacific Ocean (EPO) in 2023 reported by observers onboard longline vessels under the current mandate of at least 5% coverage (C-19-08) of each CPC fleet operating in the EPO. Reported marine mammal interactions were precautionarily presumed to be mortalities (i.e., disposition was either not reported or a detailed disposition was not provided e.g., "discarded", "injured") unless release condition was reported as "alive", "alive and healthy", or "released". These data are considered incomplete as data are insufficient for expanding to fleet totals (BYC-10 INF-D) (see section 2.2 for uncertainty and data gaps associated with longline data reporting).

Tabla L-1b. Número mínimo de interacciones con mamíferos marinos y mortalidades en el Océano Pacífico oriental (OPO) en 2023 reportadas por observadores a bordo de buques palangreros bajo el mandato actual de al menos 5% de cobertura (C-19-08) de cada flota de los CPC que opera en el OPO. Se supuso precautoriamente que las interacciones con mamíferos marinos reportadas resultaron en mortalidades (es decir, no se reportó la disposición o no se proporcionó una disposición detallada, por ejemplo, "descartado", "herido", a menos que la condición de liberación fuera reportada como "vivo", "vivo y sano" o "liberado"). Estos datos se consideran incompletos ya que son insuficientes para expandirlos a totales de la flota (BYC-10 INF-D) (ver Sección 2.2. para consultar información sobre la incertidumbre y las deficiencias de los datos asociadas a la notificación de datos de palangre)

Common name	Scientific name	Interactions	Mortalities
Roughtoothed dolphin	*Steno bredanensis*	1	1
Risso's dolphin	*Grampus griseus*	1	1
False killer whale	*Pseudorca crassidens*	1	1
Franciscana	*Pontoporia blainvillei*	1	1
Total numbers		4	4

Table L-2a. Estimated number of turtle interactions and mortalities by observers onboard purse-seine size-class 6 vessels with a carrying capacity >363 t (1994–2024). Purse-seine set types: floating object (OBJ), unassociated tuna schools (NOA) and dolphins (DEL). Data for 2023–2024 are considered preliminary.

Tabla L-2a. Número estimado de mortalidades e interacciones de tortugas por observadores a bordo de buques cerqueros de clase 6 con una capacidad de acarreo >363 t (1994–2024). Tipos de lances cerqueros: objeto flotante (OBJ), atunes no asociados (NOA) y delfines (DEL). Los datos de 2023–2024 se consideran preliminares.

	Lepidochelys olivacea, Olive ridley (LKV)						*Chelonia agassizii, Chelonia mydas*, eastern Pacific green (TUG)						*Caretta caretta*, loggerhead (TTL)					
	Purse seine						Purse seine						Purse seine					
	interactions			mortality			interactions			mortality			interactions			mortality		
Year	**OBJ**	**NOA**	**DEL**	**OBJ**	**NOA**	**DEL**	**OBJ**	**NOA**	**DEL**	**OBJ**	**NOA**	**DEL**	**OBJ**	**NOA**	**DEL**	**OBJ**	**NOA**	**DEL**
1994	455	114	137	50	17	13	132	170	12	7	9	-	6	15	2	-	2	-
1995	537	89	117	66	11	14	181	196	8	10	2	1	9	52	3	-	2	-
1996	520	97	96	47	9	9	138	63	4	11	1	-	12	18	2	-	-	-
1997	544	439	112	54	33	7	164	59	16	8	3	2	7	38	3	1	3	1
1998	649	116	209	66	22	20	141	13	20	7	1	1	15	5	4	1	-	-
1999	1,005	140	160	82	18	9	130	16	21	5	2	4	9	9	2	1	3	-
2000	463	248	139	46	29	11	93	17	5	6	-	-	4	6	1	2	-	-
2001	802	162	136	51	11	4	164	24	8	6	2	-	10	1	2	1	-	-
2002	767	97	165	23	3	7	110	11	15	3	-	-	14	5	8	-	-	-
2003	762	147	168	16	4	3	107	25	15	-	-	-	14	4	6	-	-	-
2004	624	110	120	8	3	2	65	38	8	-	-	-	10	11	13	-	-	-
2005	606	872	249	7	6	4	101	122	21	1	1	-	5	15	14	-	-	-
2006	595	337	140	8	4	3	106	119	23	2	-	-	39	19	14	1	-	-
2007	450	494	210	6	1	3	83	56	31	-	1	-	56	38	12	1	-	-
2008	408	27	147	4	-	-	54	20	12	-	-	-	45	5	12	1	-	-
2009	464	30	110	10	-	2	56	12	19	1	-	-	30	5	20	-	-	-
2010	424	128	212	4	3	1	71	20	23	-	2	-	34	24	23	1	-	-
2011	502	96	115	6	-	1	70	89	25	1	1	-	29	46	16	-	1	-
2012	388	53	91	5	-	-	77	42	5	-	-	-	19	19	17	-	-	-
2013	454	20	66	7	1	-	61	10	7	1	-	-	24	9	8	-	-	-
2014	304	19	83	3	-	-	69	16	10	-	-	-	27	1	4	1	-	-
2015	195	49	78	2	-	1	54	12	21	-	-	-	28	6	13	-	-	-
2016	333	49	113	4	-	-	78	35	17	-	-	-	19	21	9	-	-	-
2017	285	24	72	2	-	1	39	21	34	-	-	-	31	20	7	-	-	-
2018	150	5	147	2	-	-	50	24	96	2	-	-	17	7	4	-	-	-
2019	170	28	129	1	-	-	72	13	10	-	-	-	14	46	9	-	-	-
2020	91	14	197	-	-	-	29	4	11	-	-	-	17	3	4	-	-	-
2021	191	2	54	1	-	1	32	17	3	-	-	-	13	5	11	-	-	-
2022	133	2	33	-	-	-	40	-	4	-	-	-	19	3	6	-	-	-
2023	65	14	47	-	-	-	13	2	6	-	-	-	12	-	2	-	-	-
2024	154	29	73	1	-	-	19	22	7	-	-	-	14	7	14	-	-	-
Total	13,491	4,052	3,926	583	174	117	2,597	1,288	517	71	25	8	602	463	265	11	10	1

Table L-2a continued

	Eretmochelys imbricata, hawksbill (TTH)						*Dermochelys coriacea*, leatherback (DKK)						Unidentified turtles					
	Purse seine						Purse seine						Purse seine					
	interactions			mortality			interactions			mortality			interactions			mortality		
Year	**OBJ**	**NOA**	**DEL**	**OBJ**	**NOA**	**DEL**	**OBJ**	**NOA**	**DEL**	**OBJ**	**NOA**	**DEL**	**OBJ**	**NOA**	**DEL**	**OBJ**	**NOA**	**DEL**
1994	5	5	4	-	2	-	3	2	-	1	-	-	151	27	83	34	2	9
1995	8	2	-	-	-	-	-	-	-	-	-	-	130	27	52	24	7	3
1996	8	-	6	-	-	1	5	-	-	-	-	-	151	58	37	30	6	2
1997	4	2	-	-	-	-	3	1	1	-	-	-	180	72	46	25	15	2
1998	7	-	3	3	-	-	1	2	1	-	-	-	121	24	97	26	8	7
1999	4	5	2	1	-	1	-	-	-	-	-	-	202	28	65	39	4	3
2000	4	1	3	1	-	-	1	1	1	-	-	-	92	68	74	17	9	2
2001	5	1	3	1	-	-	-	-	1	-	-	-	206	43	96	22	14	5
2002	8	1	2	-	-	-	1	1	-	-	-	-	175	33	82	6	5	2
2003	6	1	6	-	-	-	-	1	1	-	-	-	169	40	117	5	-	3
2004	12	4	3	-	-	-	1	4	4	-	-	-	151	53	48	4	2	-
2005	1	2	9	-	-	-	1	1	3	-	-	-	103	126	73	4	7	1
2006	12	11	4	-	-	-	1	3	2	-	-	-	184	64	77	1	-	-
2007	9	8	2	1	2	-	3	2	2	-	-	-	130	240	191	7	-	2
2008	7	-	12	-	-	-	2	3	2	-	-	-	182	18	107	1	-	-
2009	8	-	6	-	-	-	1	-	2	-	-	-	141	16	95	3	1	1
2010	11	-	4	1	-	-	3	-	-	-	-	-	122	24	187	3	1	1
2011	5	5	4	-	-	-	1	1	1	-	-	-	125	28	63	-	1	-
2012	4	-	2	-	-	-	1	1	-	-	-	-	99	19	40	3	-	-
2013	7	-	2	1	-	-	1	2	2	-	-	-	175	13	51	2	-	-
2014	7	1	2	-	-	1	7	1	2	-	-	-	132	18	53	1	-	-
2015	2	1	2	-	-	-	4	2	-	-	-	-	174	152	42	-	4	-
2016	14	3	5	-	-	-	2	1	-	-	-	-	307	59	120	2	-	-
2017	7	3	5	-	-	-	2	1	1	-	-	-	243	43	83	-	-	-
2018	7	2	1	-	-	-	3	-	1	-	-	-	160	22	169	-	-	-
2019	5	2	-	-	-	-	-	-	-	-	-	-	193	155	59	-	1	-
2020	5	1	-	-	-	-	2	1	-	-	-	-	108	8	45	1	-	1
2021	4	1	-	-	-	-	1	-	-	-	-	-	102	5	53	-	-	-
2022	10	1	-	-	-	-	2	1	1	-	-	-	92	1	23	-	-	-
2023	2	-	2	-	-	-	3	1	1	-	-	-	55	6	42	-	-	-
2024	5	-	1	-	-	-	3	-	-	-	-	-	102	21	46	-	-	-
Total	203	63	95	9	4	3	58	33	29	1	-	-	4,658	1,509	2,415	261	87	44

Table L-2b. Minimum number of sea turtle interactions and mortalities in the eastern Pacific Ocean (EPO) in 2023 reported by observers onboard longline vessels under the current mandate of at least 5% coverage (C-19-08) of each CPC fleet operating in the EPO. Dispositions considered to indicate a survival event are those reported by observers as "Alive and Healthy", "Light injuries", "Released" and "Released with a hook", while those considered to indicate a mortality event are dispositions reported as "Dead", "Discarded", "Grave Injuries", "Injured", "Alive and injured", or precautionarily where disposition was not reported. These data are considered incomplete as data are insufficient for expanding to fleet totals (BYC-10 INF-D) (see section 2.2 for uncertainty and data gaps associated with longline data reporting).
Tabla L-2b. Número mínimo de interacciones con tortugas marinas y mortalidades en el Océano Pacífico oriental (OPO) en 2023 reportadas por observadores a bordo de buques palangreros bajo el mandato actual de al menos 5% de cobertura (C-19-08) de cada flota de los CPC que opera en el OPO. Las disposiciones que se considera que indican un evento de supervivencia son las reportadas por los observadores como "Viva y sana", "Heridas leves", "Liberada" y "Liberada con un anzuelo", mientras que las que se considera que indican un evento de mortalidad son las disposiciones reportadas como "Muerta", "Descartada", "Heridas graves", "Herida", "Viva y herida" o, de manera precautoria, cuando la disposición no fue reportada. Estos datos se consideran incompletos ya que son insuficientes para expandirlos a totales de la flota (BYC-10 INF-D) (ver Sección 2.2. para consultar información sobre la incertidumbre y las deficiencias de los datos asociadas a la notificación de datos de palangre).

Common name	Scientific name	Interactions	Mortalities
Black/Green turtle	*Chelonia mydas*	50	6
Olive ridley turtle	*Lepidochelys olivacea*	16	-
Loggerhead turtle	*Caretta caretta*	11	4
Leatherback turtle	*Dermochelys coriacea*	10	3
Hawksbill turtle	*Eretmochelys imbricata*	1	-
Total numbers		88	13

Table L-3. Minimum number of seabird interactions in the eastern Pacific Ocean (EPO) in 2023 reported by observers onboard longline vessels under the current mandate of at least 5% coverage (C-19-08) of each CPC fleet operating in the EPO. Seabird interactions with reported dispositions as “discarded” was precautionarily presumed to be mortalities; one interaction reported as “released” was presumed to indicate survival. These data are considered incomplete as data are insufficient for expanding to fleet totals (BYC-10 INF-D) (see section 2.2 for uncertainty and data gaps associated with longline data reporting).

Tabla L-3. Número mínimo de interacciones con aves marinas en el Océano Pacífico oriental (OPO) en 2022 reportadas por observadores a bordo de buques palangreros bajo el mandato actual de al menos 5% de cobertura (C-19-08) de cada flota de los CPC que opera en el OPO. Se supone precautoriamente que las interacciones con aves marinas con disposiciones reportadas como "descartada” son mortalidades; se supuso que una interacción reportada como “liberada” indicaba supervivencia. Estos datos se consideran incompletos ya que son insuficientes para expandirlos a totales de la flota (BYC-10 INF-D) (ver Sección 2.2. para consultar información sobre la incertidumbre y las deficiencias de los datos asociadas a la notificación de datos de palangre).

Common name	Scientific name	Interactions	Mortalities
Black-footed albatross	*Phoebastria nigripes*	10	10
Albatross nei	*Diomedea* spp.	5	4
Total numbers		15	14

Table L-4a. Estimated purse-seine catches by set type in metric tons (t) of sharks by observers onboard size-class 6 vessels with a carrying capacity >363 t (1994–2024) and minimum reported longline (LL) catches of sharks (gross-annual removals in t) (1994–2023, *data not available; see section 2.2. for uncertainty and data gaps in reporting of bycatch caught by longline). Purse-seine set types: floating object (OBJ), unassociated tuna schools (NOA) and dolphins (DEL). Species highlighted bold are discussed in main text. Data for 2019–2023 (longline) and 2023–2024 (purse-seine) are considered preliminary.

Tabla L-4a. Capturas cerqueras estimadas de tiburones, por tipo de lance, en toneladas (t), por observadores a bordo de buques de clase 6 con una capacidad de acarreo >363 t (1994–2024) y capturas palangreras (LL) mínimas reportadas de tiburones (extracciones anuales brutas en t) (1994–2023, *datos no disponibles; ver Sección 2.2. para consultar información sobre la incertidumbre y las deficiencias de los datos en la notificación de especies capturadas incidentalmente con palangre). Tipos de lances cerqueros: objeto flotante (OBJ), atunes no asociados (NOA) y delfines (DEL). Las especies en negritas se discuten en el texto principal. Los datos de 2019–2023 (palangre) y 2023–2024 (cerco) se consideran preliminares.

	Carcharhinidae															
	***Carcharhinus falciformis*, silky shark**				***Carcharhinus longimanus*, oceanic whitetip**				***Prionace glauca*, blue shark**				Other Carcharhinidae, requiem sharks			
	Purse seine				Purse seine				Purse seine				Purse seine			
Year	**OBJ**	**NOA**	**DEL**	**LL**	**OBJ**	**NOA**	**DEL**	**LL**	**OBJ**	**NOA**	**DEL**	**LL**	**OBJ**	**NOA**	**DEL**	**LL**
1994	439	244	38	-	119	9	4	-	<1	1	<1	209	24	14	5	-
1995	471	120	162	-	200	36	18	-	<1	5	<1	280	4	2	11	-
1996	442	107	47	-	209	5	12	-	2	<1	<1	606	12	<1	7	-
1997	843	188	42	-	236	11	6	-	2	<1	<1	425	18	3	5	-
1998	710	59	171	-	211	7	5	-	1	<1	<1	1,164	4	<1	<1	-
1999	460	100	74	-	163	7	2	-	<1	<1	<1	2,185	9	<1	<1	-
2000	308	97	30	-	98	9	2	-	<1	<1	<1	2,112	5	<1	<1	-
2001	399	76	53	-	96	<1	<1	-	4	<1	<1	2,304	9	<1	-	-
2002	291	142	35	-	31	6	<1	<1	1	<1	<1	2,356	4	17	<1	-
2003	320	102	59	-	19	<1	<1	-	<1	<1	<1	2,054	7	6	<1	-
2004	247	68	76	-	9	<1	<1	<1	<1	<1	-	2,325	5	3	<1	-
2005	322	41	51	-	2	-	<1	-	<1	<1	-	2,825	4	2	3	-
2006	361	46	27	13,053	5	<1	<1	46	<1	1	<1	1,341	13	3	8	280
2007	316	156	41	12,771	2	-	<1	136	<1	1	-	3,169	8	24	11	419
2008	577	27	25	11,205	2	-	<1	55	<1	1	<1	6,838	11	<1	1	741
2009	339	31	33	14,042	4	<1	<1	294	<1	<1	<1	6,678	29	4	20	431
2010	347	66	70	12,510	2	-	<1	94	<1	1	1	10,130	17	10	21	4,259
2011	266	26	55	12,866	2	-	<1	63	<1	<1	1	13,863	20	6	4	4,730
2012	200	33	52	10,585	<1	<1	-	1	<1	2	<1	12,565	8	<1	1	4,082
2013	212	55	38	14,762	<1	<1	-	5	<1	<1	1	12,237	12	2	3	753
2014	422	68	45	5,511	2	-	-	25	1	<1	<1	10,728	13	<1	5	1,515
2015	540	133	48	5,690	3	<1	<1	647	<1	<1	<1	13,194	31	7	2	1,901
2016	488	36	63	9,610	5	<1	<1	755	<1	2	1	12,381	35	<1	3	2,755
2017	665	12	21	15,893	4	<1	<1	3	<1	<1	-	11,086	54	<1	2	2,562
2018	397	12	16	15,072	3	-	<1	19	<1	<1	<1	12,499	28	3	1	1,360
2019	392	13	25	2,599	5	<1	<1	-	<1	<1	<1	11,070	26	4	6	10
2020	345	11	33	14,752	4	-	<1	-	<1	<1	-	15,080	87	5	4	2,896
2021	542	10	21	12	12	<1	<1	-	<1	<1	<1	8,920	30	<1	<1	-
2022	614	23	7	37	12	<1	<1	-	1	<1	-	10,563	30	2	2	-
2023	473	10	24	55	12	<1	<1	-	<1	<1	-	10,268	26	<1	2	-
2024	626	78	23	*	21	<1	<1	*	<1	1	-	*	25	<1	1	*
Total	13,377	2,190	1,504	171,025	1,494	95	56	2,143	23	24	9	201,459	607	126	131	28,694

Table L-4a Continued

	Sphyrnidae															
	***Sphyrna zygaena*, smooth hammerhead**				*Sphyrna lewini*, scalloped hammerhead				*Sphyrna mokarran*, great hammerhead				*Sphyrna* spp., hammerheads, nei			
	Purse seine				Purse seine				Purse seine				Purse seine			
Year	**OBJ**	**NOA**	**DEL**	**LL**	**OBJ**	**NOA**	**DEL**	**LL**	**OBJ**	**NOA**	**DEL**	**LL**	**OBJ**	**NOA**	**DEL**	**LL**
1994	1	2	<1	-	<1	4	<1	-	-	-	-	-	102	24	2	-
1995	2	2	-	-	<1	<1	<1	-	<1	-	-	-	71	15	4	-
1996	4	2	-	-	1	<1	-	-	<1	-	-	-	87	39	5	-
1997	21	2	<1	-	10	3	<1	-	1	<1	<1	-	63	10	3	-
1998	18	5	1	-	8	9	<1	-	3	<1	3	-	37	12	5	-
1999	21	3	<1	-	16	3	1	-	1	<1	<1	-	18	5	3	-
2000	11	4	<1	-	7	15	1	-	7	<1	<1	-	7	2	7	-
2001	24	1	<1	-	12	1	<1	-	5	-	<1	-	23	<1	1	-
2002	24	3	1	-	47	<1	1	-	7	-	<1	-	46	4	2	-
2003	49	6	1	-	38	3	3	-	13	<1	<1	-	52	3	2	-
2004	51	11	3	-	25	3	2	-	3	<1	<1	-	60	2	<1	-
2005	34	2	<1	-	25	10	3	-	2	-	<1	-	19	<1	<1	<1
2006	33	6	2	58	19	3	1	-	1	<1	<1	-	3	<1	<1	5
2007	27	5	<1	200	12	3	1	<1	-	<1	<1	-	1	1	<1	43
2008	16	<1	<1	381	16	11	<1	64	<1	-	<1	-	6	<1	1	42
2009	22	<1	<1	423	13	2	1	50	<1	-	-	-	5	1	<1	22
2010	28	1	2	508	13	1	1	143	<1	-	<1	-	3	<1	<1	118
2011	49	2	2	443	13	6	2	191	3	<1	<1	-	12	<1	1	131
2012	32	2	<1	118	9	4	<1	89	<1	<1	<1	-	5	2	1	130
2013	47	2	<1	311	22	2	<1	87	<1	<1	<1	-	9	1	<1	296
2014	35	<1	<1	593	23	2	<1	5	1	<1	<1	-	14	<1	<1	208
2015	32	1	<1	1,961	9	<1	<1	11	<1	<1	-	-	9	<1	<1	392
2016	24	1	<1	4,052	12	1	<1	6	5	<1	-	-	11	1	<1	338
2017	11	<1	<1	3,495	8	3	<1	83	<1	<1	<1	-	6	<1	<1	197
2018	11	<1	<1	851	7	<1	<1	<1	<1	-	-	-	6	<1	<1	173
2019	17	<1	<1	33	11	2	<1	43	1	-	<1	-	5	<1	<1	5
2020	7	<1	<1	941	13	<1	<1	39	<1	-	<1	-	5	<1	<1	1,021
2021	13	<1	<1	37	31	<1	<1	<1	2	-	<1	-	7	-	<1	-
2022	11	-	<1	7	47	<1	<1	<1	<1	-	-	-	9	<1	<1	-
2023	15	<1	<1	17	19	<1	<1	40	<1	<1	-	-	8	<1	<1	-
2024	11	<1	<1	*	15	<1	<1	*	3	1	<1	*	4	<1	<1	*
Total	702	68	22	14,430	503	97	27	854	65	5	5	-	712	130	45	3,122

Table L-4a Continued

	Alopiidae															
	***Alopias pelagicus*, pelagic thresher**				*Alopias superciliosus*, bigeye thresher				*Alopias vulpinus*, thresher shark				*Alopias* spp., thresher shark, nei			
	Purse seine				Purse seine				Purse seine				Purse seine			
Year	**OBJ**	**NOA**	**DEL**	**LL**	**OBJ**	**NOA**	**DEL**	**LL**	**OBJ**	**NOA**	**DEL**	**LL**	**OBJ**	**NOA**	**DEL**	**LL**
1994	-	<1	<1	-	-	6	<1	-	-	3	<1	-	<1	11	3	87
1995	<1	<1	<1	-	<1	2	<1	-	<1	1	1	-	1	6	3	200
1996	-	1	-	-	<1	1	<1	-	<1	<1	<1	-	<1	2	4	28
1997	<1	<1	-	-	<1	1	<1	-	<1	<1	<1	-	<1	4	<1	5
1998	<1	2	<1	-	<1	4	1	-	<1	2	<1	-	<1	5	3	5
1999	<1	4	2	-	<1	1	6	-	<1	<1	<1	-	<1	3	2	5
2000	<1	<1	<1	-	<1	8	1	-	<1	<1	<1	-	<1	<1	6	64
2001	<1	<1	<1	-	<1	4	2	-	<1	<1	<1	-	<1	4	1	172
2002	<1	<1	<1	-	2	8	1	-	<1	2	<1	-	<1	6	4	88
2003	1	5	3	-	<1	8	6	-	<1	<1	<1	-	<1	4	3	134
2004	6	3	2	-	<1	16	1	-	<1	2	<1	-	<1	4	2	43
2005	1	3	2	-	<1	6	3	-	<1	1	2	-	<1	<1	<1	12
2006	2	23	2	-	<1	22	3	187	<1	7	<1	60	<1	3	<1	8
2007	3	3	6	1,133	2	3	3	115	<1	<1	<1	35	<1	1	1	15
2008	1	3	3	4,323	<1	3	3	240	<1	2	<1	38	<1	1	2	17
2009	<1	<1	1	4,909	<1	<1	2	343	<1	<1	<1	76	<1	<1	1	4
2010	<1	<1	3	7,828	<1	<1	2	373	1	<1	<1	34	<1	<1	1	389
2011	<1	2	2	7,302	<1	2	2	458	<1	<1	<1	61	<1	1	<1	430
2012	<1	1	2	7	<1	1	2	326	<1	<1	<1	86	<1	1	<1	526
2013	<1	<1	3	46	<1	<1	2	543	<1	<1	<1	49	<1	<1	1	109
2014	<1	1	2	36	<1	3	2	636	<1	<1	<1	2	<1	<1	<1	850
2015	<1	2	1	463	<1	1	<1	859	<1	-	<1	13	<1	<1	<1	283
2016	<1	2	3	1,045	<1	<1	4	944	<1	1	<1	549	<1	<1	1	96
2017	<1	<1	<1	582	<1	<1	<1	1,148	-	<1	<1	1,682	<1	<1	<1	153
2018	<1	2	<1	464	<1	<1	<1	32	<1	<1	<1	1,684	<1	<1	<1	39
2019	1	<1	<1	444	<1	<1	<1	17	-	-	<1	<1	<1	<1	<1	31
2020	<1	<1	2	342	<1	<1	1	1,273	-	-	<1	745	<1	<1	<1	6
2021	<1	<1	<1	1	<1	<1	<1	3	<1	<1	<1	<1	<1	<1	<1	1
2022	<1	<1	<1	4	<1	<1	<1	85	<1	<1	<1	-	<1	<1	<1	3
2023	<1	<1	2	19	<1	<1	6	90	-	<1	<1	-	<1	<1	<1	<1
2024	<1	<1	<1	*	<1	<1	<1	*	-	<1	-	*	<1	<1	<1	*
Total	23	65	47	28,947	17	106	59	7,671	5	29	13	5,114	13	63	47	3,803

Table L-4a Continued

	Lamnidae								Triakidae											
	***Isurus* spp., mako sharks**				Lamnidae spp., mackerel sharks, porbeagles nei				Triakidae spp., houndsharks, nei				Other sharks				All sharks			
	Purse seine				Purse seine				Purse seine				Purse seine				Purse seine			
Year	**OBJ**	**NOA**	**DEL**	**LL**	**OBJ**	**NOA**	**DEL**	**LL**	**OBJ**	**NOA**	**DEL**	**LL**	**OBJ**	**NOA**	**DEL**	**LL**	**OBJ**	**NOA**	**DEL**	**LL**
1994	2	<1	<1	156	-	-	-	-	-	-	-	-	69	47	7	782	759	367	62	1,234
1995	2	<1	<1	216	-	-	-	-	-	-	-	-	103	29	13	226	856	220	213	922
1996	1	<1	<1	318	-	-	-	-	-	-	-	-	69	41	34	168	830	202	110	1,120
1997	2	1	-	361	-	-	-	-	-	-	-	-	88	4	2	166	1,287	230	62	956
1998	1	<1	<1	693	-	-	-	-	-	-	-	-	90	10	6	237	1,085	116	198	2,099
1999	<1	<1	<1	460	-	-	-	-	-	-	-	-	50	12	4	3,347	739	140	97	5,997
2000	2	<1	-	502	-	-	-	-	-	-	-	-	21	67	178	5,740	466	207	227	8,418
2001	2	<1	<1	1,168	-	-	-	-	-	-	-	-	29	4	2	8,896	605	94	62	12,540
2002	4	<1	<1	1,131	-	-	-	-	-	-	-	1,484	40	11	3	7,339	497	201	51	12,398
2003	2	<1	<1	1,156	-	-	-	-	-	-	-	1,287	12	37	4	9,866	516	177	83	14,498
2004	1	<1	<1	1,374	-	-	-	-	-	-	-	846	36	10	5	6,684	446	125	95	11,273
2005	1	2	<1	1,367	-	-	-	-	-	-	-	838	5	1	1	7,075	417	71	67	12,117
2006	2	4	<1	95	-	-	-	2	-	-	-	674	8	<1	<1	4,770	449	118	46	20,579
2007	2	2	-	181	-	-	-	1	-	-	-	996	5	3	1	5,786	380	203	67	25,000
2008	<1	2	<1	707	-	-	-	1	-	-	-	1,398	12	<1	2	4,091	644	52	40	30,141
2009	1	<1	<1	534	-	-	-	7	-	-	-	695	19	3	1	2,478	434	46	63	30,988
2010	3	<1	<1	1,901	-	-	-	<1	-	-	-	<1	17	4	2	2,246	433	87	104	40,533
2011	3	2	<1	2,802	-	-	-	26	-	-	-	7	30	<1	<1	2,074	401	51	72	45,449
2012	2	2	<1	2,120	-	-	-	12	-	-	-	-	10	<1	<1	1,242	272	50	62	31,889
2013	1	<1	<1	2,121	-	-	-	44	-	-	-	211	45	2	<1	1,517	351	67	49	33,090
2014	2	<1	<1	2,778	-	-	-	51	-	-	-	4,067	24	<1	<1	2,075	540	78	56	29,081
2015	<1	<1	<1	3,118	-	-	-	79	-	-	-	621	18	3	3	10,593	645	151	58	39,825
2016	1	<1	<1	2,476	-	-	-	91	-	-	-	538	19	3	<1	2,245	602	50	78	37,880
2017	<1	<1	-	3,256	-	-	-	112	-	-	-	987	16	1	<1	1,267	766	21	27	42,506
2018	2	<1	<1	3,161	-	-	-	111	-	-	-	730	5	<1	<1	1,161	460	21	20	37,357
2019	<1	<1	<1	2,021	-	-	-	8	-	-	-	<1	6	<1	<1	53	465	23	34	16,335
2020	2	<1	-	3,693	-	-	-	95	-	-	-	1,032	3	2	<1	2,381	467	21	42	44,297
2021	2	<1	-	1,604	-	-	-	7	-	-	-	2	6	<1	<1	162	646	12	24	10,750
2022	1	<1	-	1,324	-	-	-	5	-	-	-	-	2	<1	<1	121	729	27	11	12,150
2023	1	-	<1	1,220	-	-	-	6	-	-	-	-	1	<1	<1	4	557	13	36	11,719
2024	<1	<1	<1	*	-	-	-	*	-	-	-	*	2	1	<1	*	709	86	26	*
Total	50	26	3	44,013	-	-	-	660	-	-	-	16,414	860	301	274	94,793	18,451	3,325	2,242	623,140

Table L-4b. Minimum number of shark interactions and mortalities in the eastern Pacific Ocean (EPO) in 2023 reported by observers onboard longline vessels under the current mandate of at least 5% coverage (C-19-08) of each CPC fleet operating in the EPO. Data are considered incomplete and are deemed by the staff to be insufficient for expanding to fleet totals (BYC-10 INF-D) (see section 2.2 for uncertainty and data gaps associated with longline data reporting). Dispositions considered to indicate a survival event are those reported by observers as “Alive and Healthy”, “Alive with light injuries” and “Alive”, while those considered to indicate a mortality event are dispositions reported as “Dead”, “Alive mortal”, “Alive injured”, “Discarded”, “Unknown”, or precautionarily where disposition was not reported.

Tabla L-4b. Número mínimo de interacciones con tiburones y mortalidades en el Océano Pacífico oriental en 2023 reportadas por observadores a bordo de buques palangreros bajo el mandato actual de al menos 5% de cobertura (C-19-08) de cada flota de los CPC que opera en el OPO. Los datos se consideran incompletos y el personal considera que son insuficientes para expandirlos a totales de la flota (BYC-10 INF-D) (ver Sección 2.2. para consultar información sobre la incertidumbre y las deficiencias de los datos asociadas a la notificación de datos de palangre). Las disposiciones que se considera que indican un evento de supervivencia son las reportadas por los observadores como "Vivo y sano", "Vivo con heridas leves" y "Vivo", mientras que las que se considera que indican un evento de mortalidad son las disposiciones reportadas como "Muerto", "Vivo, mortalidad probable", “Vivo herido", “Descartado", "Desconocida" o precautoriamente cuando la disposición no fue reportada.

Common name	Scientific name	Interactions	Mortalities
Blue shark	*Prionace glauca*	4,508	4,179
Crocodile shark	*Pseudocarcharias kamoharai*	545	152
Short fin mako shark	*Isurus oxyrinchus*	225	225
Bigeye thresher shark	*Alopias superciliosus*	119	111
Velvet dogfish	*Zameus squamulosus*	115	106
Various sharks nei	Euselachii	98	98
Pelagic thresher shark	*Alopias pelagicus*	76	44
Thresher shark, nei	*Alopias* spp.	35	31
Oceanic whitetip shark	*Carcharhinus longimanus*	26	22
Longfin mako shark	*Isurus paucus*	21	20
Shark - identified	Euselachii	21	21
Silky shark	*Carcharhinus falciformis*	12	8
Other sharks*		29	26
Total numbers		5,830	5,043

*"Other sharks" include those with ≤10 interactions from 11 taxa in 2023

Table L-5a. Estimated purse-seine catches by set type in numbers of rays by observers onboard size-class 6 vessels with a carrying capacity >363 t (1994–2024). Purse-seine set types: floating object (OBJ), unassociated tuna schools (NOA) and dolphins (DEL). Species highlighted bold are discussed in main text. Data for 2023–2024 are considered preliminary.

Tabla L-5a. Capturas cerqueras estimadas de rayas, por tipo de lance, en número de rayas, por observadores a bordo de buques de clase 6 con una capacidad de acarreo >363 t (1994–2024). Tipos de lances cerqueros: objeto flotante (OBJ), atunes no asociados (NOA) y delfines (DEL). Las especies en negritas se discuten en el texto principal. Los datos de 2023–2024 se consideran preliminares.

	Mobulidae														
	***Mobula thurstoni*, smoothtail manta**			***Mobula mobular*, spinetail manta**			*Mobula munkiana*, munk's devil ray			*Mobula tarapacana*, Chilean devil ray			***Mobula birostris*, giant manta**		
	Purse seine			Purse seine			Purse seine			Purse seine			Purse seine		
Year	OBJ	NOA	DEL	OBJ	NOA	DEL	OBJ	NOA	DEL	OBJ	NOA	DEL	OBJ	NOA	DEL
1994	-	3	-	-	-	-	-	-	-	-	-	-	1	-	-
1995	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-
1996	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1997	-	-	-	-	-	-	-	-	-	-	-	-	-	2	-
1998	-	8	-	-	-	-	-	-	-	-	-	-	4	94	1
1999	-	2	1	-	-	-	-	-	-	-	-	-	10	63	1
2000	34	121	101	-	-	-	-	-	-	-	-	-	1	12	2
2001	7	185	98	2	8	16	-	-	3	4	-	-	2	6	6
2002	18	2,048	72	7	8	96	1	3	10	7	15	7	2	6	5
2003	37	707	141	6	79	11	7	35	26	-	-	8	3	10	1
2004	8	429	86	2	30	57	-	15	17	1	28	4	2	47	15
2005	14	72	205	16	111	126	-	21	14	3	42	79	10	23	36
2006	14	572	43	19	473	187	-	65	31	5	52	45	30	37	219
2007	14	64	105	32	202	148	2	29	24	24	37	55	5	17	8
2008	14	126	50	30	247	87	8	127	36	10	276	30	3	61	18
2009	22	31	93	17	56	243	9	45	6	2	21	190	1	11	6
2010	39	123	132	22	334	303	1	48	33	7	12	148	2	1,163	4
2011	6	397	27	18	104	152	11	58	29	9	28	78	5	9	1
2012	15	1,435	67	48	243	34	3	63	6	7	94	21	6	949	13
2013	25	180	40	18	112	62	6	55	6	7	29	26	1	24	21
2014	22	29	75	179	87	57	6	4	15	5	10	18	7	9	-
2015	14	41	101	61	21	338	6	11	74	12	25	93	1	67	38
2016	18	31	166	5	26	115	2	236	86	13	17	26	7	68	3
2017	11	52	43	45	26	15	8	15	10	10	-	11	8	53	11
2018	6	29	5	37	48	56	22	4	12	8	2	2	11	7	1
2019	7	214	11	35	167	61	9	-	8	24	8	18	2	11	3
2020	9	4	12	19	113	37	1	-	47	5	2	7	7	-	1
2021	8	-	-	34	46	16	10	5	-	11	3	13	1	26	-
2022	5	-	98	43	8	25	12	-	4	23	-	12	3	-	8
2023	28	6	90	25	4	37	5	8	220	73	8	14	2	5	3
2024	12	171	67	73	328	33	2	32	69	39	23	12	4	6	3
Total	408	7,081	1,928	792	2,881	2,313	132	879	787	310	733	918	141	2,788	428

Table L-5a Continued

	Mobulidae			Dasyatidae											
	Mobulidae spp., mobulid rays, nei			***Pteroplatytrygon violacea*, pelagic stingray**			**Dasyatidae spp., stingrays, nei**			Other rays			All rays		
	Purse seine			Purse seine			Purse seine			Purse seine			Purse seine		
Year	OBJ	NOA	DEL	OBJ	NOA	DEL	OBJ	NOA	DEL	OBJ	NOA	DEL	OBJ	NOA	DEL
1994	52	1,266	375	140	1,632	337	-	-	-	-	-	-	193	2,901	712
1995	69	2,248	500	159	151	144	-	-	-	-	-	-	228	2,400	643
1996	124	1,341	385	101	165	176	-	-	-	-	-	-	225	1,506	561
1997	126	707	396	106	106	993	-	-	-	-	-	-	232	816	1,390
1998	73	2,906	337	95	258	170	-	1,136	-	2	1	-	174	4,403	508
1999	140	1,498	474	164	403	151	-	-	-	-	-	-	314	1,966	627
2000	36	1,805	1,276	104	221	159	-	-	-	-	-	-	175	2,159	1,537
2001	50	289	447	150	64	174	-	-	-	-	-	-	215	553	744
2002	40	1,994	723	113	60	153	2	-	-	-	-	-	190	4,133	1,066
2003	130	1,005	904	94	9,188	135	-	-	-	-	-	-	277	11,025	1,226
2004	63	656	351	138	39	86	4	282	5	-	-	-	218	1,526	620
2005	36	259	177	91	52	173	9	13	20	-	1,724	-	179	2,317	831
2006	43	340	295	153	91	202	29	764	30	-	-	160	293	2,394	1,213
2007	40	205	237	98	54	132	9	931	21	-	19	-	225	1,557	730
2008	41	145	91	97	19	87	14	20	28	-	-	-	217	1,022	427
2009	37	107	270	116	17	105	5	4	68	-	-	-	209	292	981
2010	97	629	256	101	21	901	5	-	60	-	1,596	-	274	3,926	1,837
2011	27	227	81	92	193	90	13	114	18	-	24	-	181	1,154	476
2012	18	186	41	121	30	100	13	17	3	1	12	7	232	3,029	292
2013	15	121	323	90	59	255	27	2	6	-	-	403	189	582	1,142
2014	24	72	24	173	43	108	19	22	18	-	-	-	436	277	315
2015	20	54	141	82	65	163	11	5	32	-	-	-	207	289	980
2016	41	248	162	60	37	352	12	-	70	-	-	-	159	663	980
2017	141	290	100	258	76	130	31	68	144	-	-	137	512	580	601
2018	102	117	155	247	61	123	62	17	14	-	-	-	495	286	368
2019	87	484	165	255	185	143	40	38	27	-	8	1	460	1,114	437
2020	62	67	163	260	145	160	17	14	41	-	-	-	380	345	468
2021	85	73	154	388	178	117	46	3	14	-	25	-	584	360	314
2022	128	23	95	422	76	187	34	9	7	-	-	-	671	116	437
2023	112	20	81	333	37	173	40	12	5	1	-	20	618	100	643
2024	144	367	101	349	304	291	42	60	88	-	1	-	665	1,292	664
Total	2,203	19,750	9,280	5,150	14,029	6,669	485	3,531	719	4	3,410	729	9,626	55,082	23,771

Table L-5b. Minimum number of ray interactions and mortalities in the eastern Pacific Ocean (EPO) in 2023 reported by observers onboard longline vessels under the current mandate of at least 5% coverage (C-19-08) of each CPC fleet operating in the EPO. Data are considered incomplete as data are insufficient for expanding to fleet totals (BYC-10 INF-D) (see section 2.2 for uncertainty and data gaps associated with longline data reporting). Dispositions considered to indicate a survival event are those reported by observers as "Alive and Healthy", "Alive with light injuries", "Alive" and "Escaped", while those considered to indicate a mortality event are dispositions reported as "Dead", "Alive mortal", Alive injured", Discarded", "Unknown", or precautionarily where disposition was not reported.
Tabla L-5b. Número mínimo de interacciones con rayas y mortalidades en el Océano Pacífico oriental en 2023 reportadas por observadores a bordo de buques palangreros bajo el mandato actual de al menos 5% de cobertura (C-19-08) de cada flota de los CPC que opera en el OPO. Los datos se consideran incompletos ya que los datos son insuficientes para expandirlos a totales de la flota (BYC-10 INF-D) (ver Sección 2.2. para consultar información sobre la incertidumbre y las deficiencias de los datos asociadas a la notificación de datos de palangre). Las disposiciones que se considera que indican un evento de supervivencia son las reportadas por los observadores como "Viva y sana", "Viva con heridas leves", "Viva" y "Escapada", mientras que las que se considera que indican un evento de mortalidad son las disposiciones reportadas como "Muerta", "Viva, mortalidad probable", "Viva herida", "Descartada", "Desconocida" o precautoriamente cuando la disposición no fue reportada.

Common name	Scientific name	Total interactions	Mortalities
Pelagic stingray	*Pteroplatytrygon violacea*	3,832	3,634
Rays, skates, nei	Rajiformes	6	1
Giant manta	*Mobula birostris*	4	3
Manta rays	Mobulidae	4	4
Manta ray, nei	*Mobula* spp.	1	1
Total numbers		3,847	3,643

Table L-6a. Estimated purse-seine catches by set type in metric tons (t) of large fishes by observers onboard size-class 6 vessels with a carrying capacity >363 t (1994–2024) and minimum reported longline (LL) catches of large fishes (gross-annual removals in t) (1994–2023, *data not available, see section 2.2. for uncertainty and data gaps in reporting of bycatch caught by longline). Purse-seine set types: floating object (OBJ), unassociated tuna schools (NOA) and dolphins (DEL). Species highlighted bold are discussed in main text. Data for 2019–2023 (longline) and 2023–2024 (purse-seine) are considered preliminary.

Tabla L-6a. Capturas cerqueras estimadas de peces grandes, por tipo de lance, en toneladas (t), por observadores a bordo de buques de clase 6 con una capacidad de acarreo >363 t (1994–2024) y capturas palangreras (LL) mínimas reportadas de peces grandes (extracciones anuales brutas en t) (1994–2023, *datos no disponibles; ver Sección 2.2. para consultar información sobre la incertidumbre y las deficiencias de los datos en la notificación de especies capturadas incidentalmente con palangre). Tipos de lances cerqueros: objeto flotante (OBJ), atunes no asociados (NOA) y delfines (DEL). Las especies en negritas se discuten en el texto principal. Los datos de 2019–2023 (palangre) y 2023–2024 (cerco) se consideran preliminares.

	Coryphaenidae				Scombridae				Carangidae											
	Coryphaenidae spp., dorado				***Acanthocybium solandri*, wahoo**				***Elagatis bipinnulata*, rainbow runner**				*Seriola spp.*, amberjacks, nei				*Caranx* spp., jacks, crevalles, nei			
	Purse seine				Purse seine				Purse seine				Purse seine				Purse seine			
Year	OBJ	NOA	DEL	LL	OBJ	NOA	DEL	LL	OBJ	NOA	DEL	LL	OBJ	NOA	DEL	LL	OBJ	NOA	DEL	LL
1994	1,221	20	<1	46	472	1	1	<1	14	<1	<1	-	<1	-	-	-	-	-	-	-
1995	1,071	22	3	39	379	<1	<1	1	11	<1	<1	-	<1	<1	-	-	-	-	-	-
1996	1,312	18	<1	43	271	<1	<1	1	28	3	<1	-	4	-	-	-	-	-	-	-
1997	1,225	12	<1	6,866	475	3	1	<1	60	2	<1	-	1	-	-	-	<1	-	-	-
1998	816	18	<1	2,528	396	<1	4	2	93	<1	<1	-	4	-	-	-	<1	-	-	-
1999	1,238	4	<1	6,283	161	<1	<1	2	110	<1	<1	-	<1	-	-	-	<1	-	-	-
2000	1,437	51	2	3,537	277	2	<1	2	53	5	<1	-	<1	-	-	-	<1	-	-	-
2001	2,202	17	3	15,942	1,023	2	<1	6	90	<1	<1	-	1	-	-	-	<1	-	-	-
2002	1,815	8	<1	9,464	571	<1	<1	18	94	1	<1	-	<1	<1	-	-	<1	-	-	-
2003	894	11	1	5,301	428	<1	<1	164	108	2	-	-	1	<1	-	-	<1	-	-	-
2004	1,018	17	1	3,986	380	<1	<1	155	62	<1	-	-	56	9	<1	1	2	<1	-	-
2005	972	75	1	3,854	420	<1	<1	155	66	<1	<1	-	26	2	<1	-	2	1	-	-
2006	1,197	58	<1	3,408	424	1	<1	167	73	<1	<1	-	53	8	<1	-	10	220	<1	-
2007	1,235	47	1	6,907	421	2	<1	221	157	<1	-	-	18	80	<1	-	1	11	-	-
2008	1,112	17	2	15,845	249	1	<1	213	40	<1	<1	-	27	<1	-	-	17	18	-	-
2009	1,722	7	<1	17,136	547	<1	<1	336	28	<1	<1	-	13	<1	-	-	11	8	-	-
2010	912	3	<1	9,484	373	1	<1	284	17	<1	<1	-	3	23	-	-	1	48	-	-
2011	1,410	7	<1	12,438	169	2	<1	242	22	<1	-	-	7	33	-	<1	4	14	-	1
2012	1,705	18	<1	17,255	313	<1	<1	230	13	1	-	-	10	7	-	-	2	15	<1	-
2013	1,455	7	<1	11,249	518	1	<1	291	19	<1	-	-	6	<1	<1	-	4	2	<1	-
2014	1,779	9	<1	3,342	517	2	<1	287	15	<1	<1	-	6	2	-	-	3	<1	<1	-
2015	1,167	8	<1	1,206	357	1	<1	285	15	<1	-	-	6	<1	-	-	9	8	<1	-
2016	949	7	<1	446	318	2	<1	321	26	<1	<1	-	12	<1	<1	-	4	<1	8	-
2017	1,557	11	<1	2,118	335	<1	<1	319	18	<1	<1	-	12	5	<1	-	4	12	-	-
2018	1,483	5	5	3,932	230	<1	<1	366	20	<1	-	-	62	<1	-	-	9	<1	-	-
2019	1,208	29	<1	1,971	201	<1	<1	331	21	<1	<1	-	12	4	<1	-	5	<1	-	-
2020	783	4	<1	2,507	130	<1	<1	309	23	-	<1	-	9	1	-	<1	3	<1	<1	-
2021	2,183	13	<1	1,431	132	<1	<1	214	28	<1	<1	-	81	3	-	-	3	<1	-	-
2022	2,325	12	2	738	164	<1	<1	178	35	<1	-	-	25	4	-	-	6	<1	-	-
2023	1,457	4	2	421	264	<1	<1	256	45	<1	<1	-	9	<1	-	-	3	-	-	-
2024	865	5	<1	*	232	<1	<1	*	86	<1	<1	*	16	-	-	*	7	<1	<1	*
Total	41,727	545	36	169,724	11,150	32	10	5,358	1,491	20	<1	-	484	183	<1	2	111	360	9	1

Table L-6a Continued

	Carangidae				Molidae				Lobotidae				Sphyraenidae				Lampridae			
	Seriola, Caranx spp., amberjacks, jacks, crevalles, nei				*Molidae* spp., molas, nei				*Lobotes surinamensis,* tripletail				*Sphyraenidae spp.,* barracudas				***Lampris* spp., opahs**			
	Purse seine				Purse seine				Purse seine				Purse seine				Purse seine			
Year	OBJ	NOA	DEL	LL	OBJ	NOA	DEL	LL	OBJ	NOA	DEL	LL	OBJ	NOA	DEL	LL	OBJ	NOA	DEL	LL
1994	19	6	<1	-	1	3	2	-	<1	-	-	-	<1	34	-	-	-	-	-	23
1995	17	19	-	-	2	4	<1	-	<1	<1	-	-	<1	3	-	-	-	-	-	33
1996	29	153	-	-	5	6	<1	-	<1	-	-	-	<1	<1	-	-	-	-	-	33
1997	68	16	3	-	5	4	3	-	1	<1	<1	-	<1	<1	-	-	-	-	-	40
1998	72	7	<1	-	2	2	1	-	16	<1	-	-	<1	<1	-	-	-	-	-	54
1999	52	46	-	-	2	5	1	-	8	<1	-	-	-	-	-	-	-	-	-	68
2000	29	19	<1	4	2	4	1	-	4	<1	-	-	<1	-	<1	-	-	-	-	88
2001	70	<1	<1	18	6	2	1	-	<1	-	-	-	<1	<1	-	-	-	-	-	73
2002	26	9	<1	15	6	2	1	-	3	-	-	-	<1	-	-	-	-	-	-	6
2003	43	<1	<1	54	<1	4	<1	-	3	<1	-	-	<1	-	-	-	-	-	-	132
2004	8	7	<1	-	6	<1	1	-	1	<1	-	-	<1	-	-	-	-	-	-	139
2005	1	<1	-	-	2	9	2	-	7	<1	<1	-	<1	-	<1	-	-	-	-	159
2006	29	-	-	-	26	14	2	-	9	<1	<1	-	<1	-	-	-	-	-	-	109
2007	2	2	-	6	9	8	2	-	3	<1	<1	-	<1	1	-	-	-	-	-	370
2008	4	-	-	5	9	6	4	-	2	<1	-	-	<1	-	<1	-	-	-	-	308
2009	3	<1	<1	10	6	5	1	-	7	<1	<1	-	1	<1	-	-	-	-	-	488
2010	<1	4	-	8	9	44	1	-	<1	-	-	-	<1	-	<1	-	-	<1	-	539
2011	<1	4	-	7	4	113	<1	-	3	<1	-	-	<1	2	<1	8	-	-	-	539
2012	7	1	-	1	9	12	<1	-	3	<1	-	-	<1	<1	-	-	-	<1	-	425
2013	2	<1	-	<1	9	28	2	-	2	-	<1	-	<1	-	<1	-	-	<1	-	648
2014	2	2	-	11	3	9	1	-	2	-	<1	-	<1	<1	-	-	-	<1	-	818
2015	2	-	<1	11	6	12	1	87	2	<1	-	-	<1	-	-	-	-	-	-	1,039
2016	7	5	<1	11	10	7	<1	275	2	-	-	-	<1	<1	-	-	-	-	-	741
2017	4	4	-	-	8	4	<1	<1	5	-	<1	-	<1	-	-	-	-	-	-	846
2018	2	-	-	-	5	2	<1	-	3	<1	-	-	<1	<1	-	-	-	-	-	1,102
2019	3	<1	-	-	2	6	<1	-	2	-	<1	-	<1	-	-	-	-	-	<1	740
2020	<1	1	-	-	1	<1	<1	-	2	<1	-	-	<1	-	-		-	-	-	684
2021	2	<1	-	-	<1	2	<1	-	1	<1	-	-	1	<1	-	-	-	-	-	454
2022	4	<1	-	-	2	2	<1	-	4	<1	<1	-	<1	-	-	-	-	-	-	279
2023	1	-	-	-	2	<1	<1	4	2	-	<1	-	2	-	<1	<1	-	-	-	250
2024	9	<1	<1	*	<1	6	<1	*	3	<1	-	*	<1	-	-	*	-	-	-	*
Total	520	307	4	162	162	325	35	366	102	<1	<1	-	13	41	<1	8	-	<1	<1	11,226

Table L-6a Continued	***Gempylidae* spp., snake mackerels, nei**				***Bramidae* spp., pomfrets, nei**				Other large fishes				Unidentified fishes				All fishes			
	Purse seine				Purse seine				Purse seine				Purse seine				Purse seine			
Year	OBJ	NOA	DEL	LL	OBJ	NOA	DEL	LL	OBJ	NOA	DEL	LL	OBJ	NOA	DEL	LL	OBJ	NOA	DEL	LL
1994	-	-	-	-	-	-	-	2	3	87	<1	-	<1	<1	12	250	1,731	152	16	321
1995	-	-	-	-	-	-	-	2	<1	3	<1	-	3	1	<1	209	1,485	53	4	285
1996	-	-	-	-	-	-	-	2	3	125	<1	-	3	<1	<1	456	1,655	306	1	535
1997	-	-	-	-	-	-	-	6	7	5	<1	-	7	2	-	847	1,850	44	7	7,760
1998	-	-	-	-	-	-	-	9	13	10	<1	-	7	<1	<1	1,338	1,420	38	7	3,931
1999	-	-	-	-	-	-	-	3	4	54	<1	-	22	4	<1	974	1,599	114	2	7,330
2000	-	-	-	-	-	-	-	4	1	1	-	-	1	<1	<1	1,485	1,804	82	4	5,119
2001	-	-	-	-	-	-	-	5	2	9	<1	-	3	<1	<1	1,720	3,398	30	4	17,763
2002	-	-	-	-	-	-	-	<1	2	<1	<1	-	2	6	<1	1,895	2,521	27	2	11,399
2003	-	-	-	-	-	-	-	-	4	<1	-	-	2	2	-	4,386	1,484	19	2	10,037
2004	-	-	-	-	-	-	-	-	4	<1	<1	-	10	<1	<1	377	1,548	35	3	4,658
2005	-	-	-	-	-	-	-	18	<1	<1	<1	-	3	<1	<1	303	1,501	89	3	4,489
2006	-	-	-	18	-	<1	-	17	<1	<1	<1	7	3	<1	<1	285	1,824	302	3	4,011
2007	-	-	-	65	-	-	-	57	1	<1	<1	5	1	5	<1	1,763	1,848	158	4	9,394
2008	-	-	-	144	-	-	-	68	1	<1	<1	-	<1	<1	<1	793	1,462	44	6	17,375
2009	-	-	-	412	-	-	-	56	1	<1	<1	67	2	-	<1	1,077	2,343	21	2	19,581
2010	-	-	-	575	-	-	-	64	<1	-	<1	-	<1	<1	-	879	1,318	122	2	11,833
2011	-	-	-	506	-	<1	-	50	<1	<1	-	15	<1	-	<1	612	1,621	175	<1	14,418
2012	-	-	-	661	-	-	-	61	<1	2	<1	11	1	<1	-	1,305	2,065	57	1	19,949
2013	-	-	-	574	-	-	-	134	<1	<1	<1	36	<1	<1	-	1,112	2,016	40	3	14,045
2014	-	-	-	431	-	-	-	138	<1	<1	-	77	<1	-	-	1,013	2,329	25	2	6,116
2015	-	-	-	321	<1	-	-	172	<1	<1	-	7	2	<1	-	1,367	1,568	30	2	4,495
2016	<1	-	-	730	-	-	-	108	<1	<1	<1	100	<1	1	-	506	1,328	23	9	3,238
2017	-	-	-	301	-	-	-	126	<1	<1	-	62	1	-	-	1,532	1,946	36	1	5,304
2018	-	-	-	260	-	-	-	125	<1	-	-	1	-	-	-	222	1,816	9	6	6,009
2019	-	-	-	338	-	-	-	81	<1	-	-	26	<1	<1	<1	272	1,455	41	1	3,759
2020	-	-	-	288	-	-	-	70	<1	-	-	213	<1	<1	<1	462	953	9	<1	4,534
2021	-	-	-	302	-	-	-	50	<1	<1	-	<1	<1	<1	-	1,153	2,432	19	1	3,607
2022	-	-	-	212	<1	-	-	53	<1	<1	-	<1	<1	-	-	1,902	2,564	19	3	3,364
2023	-	-	-	288	<1	<1	-	64	<1	-	-	7	-	-	-	2,326	1,785	5	3	3,616
2024	-	-	-	*	-	-	-	*	<1	<1	<1	*	<1	-	-	*	1,220	13	1	*
Total	<1	-	-	6,427	<1	<1	-	1,544	54	298	<1	636	75	24	12	32,822	55,888	2,136	108	228,276

Table L-6b. Minimum number of interactions and mortalities of large fishes in the eastern Pacific Ocean (EPO) in 2023 reported by observers onboard longline vessels under the current mandate of at least 5% coverage (C-19-08) of each CPC fleet operating in the EPO. Data are incomplete and considered insufficient for expanding to fleet totals (BYC-10 INF-D) (see section 2.2 for uncertainty and data gaps associated with longline data reporting). Dispositions considered to indicate a survival event are those reported by observers as “Alive and Healthy”, “Alive with light injuries” and “Alive”, while those considered to indicate a mortality event are dispositions reported as “Dead”, “Alive mortal”, Alive injured”, Discarded”, “Unknown”, or where disposition was not reported.

Tabla L-6b. Número mínimo de interacciones y mortalidades de peces grandes en el Océano Pacífico oriental en 2023 reportadas por observadores a bordo de buques palangreros bajo el mandato actual de al menos 5% de cobertura (C-19-08) de cada flota de los CPC que opera en el OPO. Los datos se consideran incompletos y se consideran insuficientes para expandirlos a totales de la flota (BYC-10 INF-D) (ver Sección 2.2. para consultar información sobre la incertidumbre y las deficiencias de los datos asociadas a la notificación de datos de palangre). Las disposiciones que se considera que indican un evento de supervivencia son las reportadas por los observadores como "Vivo y sano", "Vivo con heridas leves" y "Vivo", mientras que las que se considera que indican un evento de mortalidad son las disposiciones reportadas como "Muerto", "Vivo, mortalidad probable", “Vivo herido", “Descartado", "Desconocida" o cuando la disposición no fue reportada.

Common name	Scientific name	Interactions	Mortalities
Long snouted lancetfish	*Alepisaurus ferox*	8,501	8,501
Escolar	*Lepidocybium flavobrunneum*	3,165	3,164
Snake mackerel	*Gempylus serpens*	2,581	2,544
Dorado, mahi mahi, dolphin fish, nei	Coryphaenidae	2,468	2,468
Wahoo	*Acanthocybium solandri*	1,707	1,703
Opah	*Lampris guttatus*	1,171	1,167
Sickle pomfret	*Taractichthys steindachneri*	700	697
Common dolphinfish	*Coryphaena hippurus*	505	502
Oilfish	*Ruvettus pretiosus*	316	316
Pomfrets, ocean breams nei	Bramidae	275	267
Lancetfishes nei	*Alepisaurus* spp.	247	247
Snake mackerels, escolars nei	Gempylidae	73	73
Pompano dolphinfish	*Coryphaena equiselis*	52	52
Atlantic pomfret	*Brama brama*	27	27
Other large fishes*		97	95
Total numbers		21,885	21,823

*"Other large fishes" includes those with ≤15 interactions from 21 taxa in 2023.

Table L-7. Estimated purse-seine catches by set type in metric tons (t) of small forage fishes by observers onboard size-class 6 vessels with a carrying capacity >363 t (1994–2024) and minimum reported longline (LL) catches of small forage fishes (gross-annual removals in t) (1994–2023, *data not available, see section 2.2. for uncertainty and data gaps in reporting of bycatch caught by longline). Purse-seine set types: floating object (OBJ), unassociated tuna schools (NOA) and dolphins (DEL). Species highlighted bold are discussed in main text. Data for 2019–2023 (longline) and 2023–2024 (purse seine) are considered preliminary. “Epipelagic forage fishes” include various mackerels and scad (*Decapterus* spp., *Trachurus* spp., *Selar crumenophthalmus*), Pacific saury (*Cololabis saira*), and tropical two-wing flyingish (*Exocoetus volitans*).

Tabla L-7. Capturas cerqueras estimadas de peces forrajeros pequeños, por tipo de lance, en toneladas (t), por observadores a bordo de buques de clase 6 con una capacidad de acarreo >363 t (1994–2024) y capturas palangreras (LL) mínimas reportadas de peces forrajeros pequeños (extracciones anuales brutas en t) (1994-2023, *datos no disponibles; ver Sección 2.2. para consultar información sobre la incertidumbre y las deficiencias de los datos en la notificación de especies capturadas incidentalmente con palangre). Tipos de lances cerqueros: objeto flotante (OBJ), atunes no asociados (NOA) y delfines (DEL). Las especies en negritas se discuten en el texto principal. Los datos de 2019–2023 (palangre) y 2023–2024 (cerco) se consideran preliminares. “Peces epipelágicos de forraje” incluyen varias caballas y jureles (*Decapterus* spp., *Trachurus* spp., *Selar crumenophthalmus*), paparda del Pacífico (*Cololabis saira*), y volador tropical (*Exocoetus volitans*).

	***Auxis* spp., bullet and frigate tunas**				**Balistidae, Monacanthidae spp., triggerfishes and filefishes**				**Kyphosidae, sea chubs**				**Epipelagic forage fishes**				Small Carangidae spp., carangids, nei				Other small fishes			
	Purse seine				Purse seine				Purse seine				Purse seine				Purse seine				Purse seine			
Year	OBJ	NOA	DEL	LL	OBJ	NOA	DEL	LL	OBJ	NOA	DEL	LL	OBJ	NOA	DEL	LL	OBJ	NOA	DEL	LL	OBJ	NOA	DEL	LL
1994	294	200	2	-	114	<1	<1	-	<1	-	-	-	-	-	-	-	<1	-	-	-	53	15	2	-
1995	501	119	6	-	208	4	<1	-	<1	-	-	-	-	-	-	-	<1	-	-	-	319	4	4	-
1996	761	234	33	-	113	2	<1	-	-	-	-	-	-	-	-	-	-	<1	-	-	55	8	25	-
1997	2,734	623	25	-	219	<1	<1	-	-	-	-	-	-	-	-	-	<1	-	-	-	151	12	2	-
1998	1,033	168	32	-	801	2	1	-	<1	-	-	-	<1	-	-	-	<1	-	-	-	91	15	3	-
1999	2,589	473	29	-	551	3	<1	-	<1	<1	-	-	<1	-	-	-	<1	<1	-	-	85	3	2	-
2000	1,210	181	19	-	168	<1	9	-	2	-	-	-	-	-	-	-	<1	-	-	-	68	8	6	-
2001	641	38	-	-	426	1	-	-	<1	-	-	-	-	-	-	-	<1	-	-	-	27	2	<1	-
2002	1,382	234	248	-	453	<1	-	-	<1	-	-	-	-	-	-	-	<1	-	-	-	25	3	<1	-
2003	944	278	16	-	157	4	<1	-	<1	-	-	-	<1	-	-	-	<1	-	-	-	75	1	1	-
2004	834	115	24	-	914	7	2	-	8	<1	<1	-	<1	<1	-	-	<1	<1	-	-	22	1	<1	-
2005	1,606	309	6	-	129	<1	<1	-	23	<1	<1	-	6	<1	<1	-	2	<1	<1	-	<1	9	<1	-
2006	1,300	591	19	-	145	<1	<1	-	79	<1	<1	-	7	1	-	-	2	<1	<1	-	5	1	<1	-
2007	868	336	18	-	544	1	<1	-	12	<1	<1	-	2	5	-	-	<1	<1	<1	-	4	<1	<1	-
2008	759	619	2	-	276	7	2	-	68	<1	<1	-	3	<1	-	-	10	<1	-	-	2	<1	<1	-
2009	303	165	1	-	174	1	<1	-	47	<1	-	-	<1	<1	-	-	<1	<1	<1	-	1	<1	<1	-
2010	474	234	<1	-	69	<1	<1	-	16	-	<1	-	4	<1	<1	-	1	<1	-	-	<1	-	<1	-
2011	677	97	11	-	31	<1	-	-	48	<1	-	-	2	<1	<1	-	<1	<1	-	-	<1	<1	<1	-
2012	173	179	1	-	110	<1	-	-	39	-	-	-	13	12	-	-	<1	<1	-	-	4	2	-	-
2013	385	77	-	-	228	<1	<1	-	18	-	<1	-	4	-	<1	-	<1	4	<1	-	2	<1	<1	-
2014	297	30	<1	-	325	<1	<1	-	16	-	-	-	3	<1	<1	-	<1	<1	-	-	1	<1	<1	-
2015	177	64	-	-	140	4	<1	-	5	-	<1	-	6	-	-	-	<1	<1	-	-	1	<1	<1	-
2016	189	23	<1	-	416	2	<1	-	8	-	-	-	21	-	<1	<1	<1	<1	-	-	3	<1	<1	77
2017	131	172	-	-	83	<1	-	-	8	-	-	-	3	-	-	-	<1	<1	-	-	<1	<1	-	-
2018	276	172	-	-	54	<1	<1	-	10	-	-	-	5	<1	-	-	<1	-	-	-	<1	<1	<1	-
2019	182	94	<1	-	57	<1	<1	-	7	<1	<1	-	5	8	<1	-	<1	<1	-	-	<1	5	-	-
2020	435	44	<1	-	47	<1	<1	-	2	-	<1	-	4	<1	-	<1	<1	<1	-	<1	<1	<1	<1	<1
2021	423	18	-	-	50	<1	-	-	6	-	<1	-	15	-	-	-	<1	<1	-	-	<1	1	<1	<1
2022	687	17	<1	-	543	2	<1	-	21	1	-	-	15	-	<1	-	<1	<1	-	-	1	3	<1	-
2023	588	<1	<1	-	518	<1	<1	-	12	-	-	-	10	<1	<1	-	3	<1	<1	-	1	12	<1	<1
2024	446	155	-	*	513	<1	-	*	7	-	-	*	11	<1	-	*	2	<1	-	*	<1	<1	<1	*
Total	23,300	6,060	494	-	8,573	48	16	-	463	2	<1	-	139	29	<1	<1	27	6	<1	<1	1,003	108	47	79

Table L-8a. Minimum nominal purse-seine catches of a) sharks, large fishes and small fishes in metric tons (t) and **b)** rays in numbers of individuals in 2024 for size-class 1–5 vessels with a carrying capacity <363 t as reported by observers in 47% of all trips that carried an observer. Purse-seine set types: floating object (OBJ) and unassociated tuna schools (NOA).

Tabla L-8a. Capturas cerqueras nominales mínimas de a) tiburones, peces grandes y peces pequeños, en toneladas (t), y **b)** rayas en número de individuos en 2024 para buques de clases 1-5 con una capacidad de acarreo <363 t según lo reportado por los observadores en el 47% de todos los viajes que llevaban observador a bordo. Tipo de lances cerqueros: objeto flotante (OBJ) y atunes no asociados (NOA).

a.

			Set type	
Broad group	Common name	Scientific name	OBJ	NOA
Sharks	Silky shark	*Carcharhinus falciformis*	29	<1
	Scalloped hammerhead shark	*Sphyrna lewini*	3	
	Smooth hammerhead shark	*Sphyrna zygaena*	1	
	Oceanic whitetip shark	*Carcharhinus longimanus*	<1	
	Blue shark	*Prionace glauca*	<1	
	Thresher shark	*Alopias vulpinus*	<1	
	Mako shark	*Isurus* spp.	<1	
Large fishes	Dorado	Coryphaenidae spp.	126	<1
	Wahoo	*Acanthocybium solandri*	30	
	Rainbow runner	*Elagatis bipinnulata*	5	
	Amberjack, nei	*Seriola* spp.	2	
	Jacks, crevalles, nei	*Caranx* spp.	<1	
	Amberjack, jack, crevalles, nei	*Seriola*, *Caranx* spp.	<1	
	Tripletail	*Lobotes surinamensis*	<1	
	Mola, nei	Molidae spp.	<1	3
	Other large fish		<1	
Small fishes	Triggerfishes, Filefishes	Balistidae, Monacanthidae spp.	133	
	Bullet and frigate tunas	*Auxis* spp.	95	
	Sea chubs	Kyphosidae spp.	1	
	Small carangid, nei	Carangidae spp.	<1	<1
	Epipelagic forage fishes		<1	
	Other small fish		<1	

b.

Broad group	Common name	Scientific name	OBJ	NOA
Rays	Pelagic stingray	*Pteroplatytrygon violacea*	31	3
	Spinetail manta	*Mobula mobular*	11	2
	Chilean devil ray	*Mobula tarapacana*	9	
	Smoothtail manta	*Mobula thurstoni*	6	
	Munk's devil ray	*Mobula munkiana*	2	
	Mobulidae ray, nei	Mobulidae spp.	1	
	Stingray nei	Dasyatidae spp.	1	