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THE WESTERN AND CENTRAL PACIFIC TUNA FISHERY: 2017 OVERVIEW AND STATUS OF STOCKS

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The Western and Central Pacific Tuna Fishery: 2017 Overview and Status of Stocks

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Preface

Tuna fisheries assessment reports provide current information on the tuna fisheries of the western and central Pacific Ocean and the fish stocks (mainly tuna) that are impacted by them. The information provided in this report is summary in nature, but a list of references (mostly accessible via the internet) is included for those seeking further details. This report is a smart PFD so if you click on a reference within the document it will take you to the figure/section, to return to the page you were on press alt and the left arrow key.

This report focuses on the primary tuna stocks targeted by the main Western and Central Pacific Ocean industrial fisheries - skipjack tuna (*Katsuwonus pelamis*), yellowfin tuna (*Thunnus albacares*), bigeye tuna (*T. obesus*) and South Pacific albacore tuna (*T. alalunga*).

The report is divided into three parts: the first section provides an overview of the fishery, with emphasis on developments over the past few years; the second summarises the most recent information on the status of the stocks; and the third summarises information concerning the interaction between the tuna fisheries, other associated and dependent species and their environment. The data used in compiling the report are those which were available to the Oceanic Fisheries Programme (OFP) at the time of publication, and are subject to change as improvements continue to be made to recent and historical catch statistics from the region. The fisheries statistics presented will usually be complete to the end of the year prior to publication. However, some minor revisions to statistics may be made for recent years from time to time. The stock assessment information presented is the most recent available at the time of publication.

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For further information, including a complete online French version of this report, see the OFP webpage: http://www.spc.int/oceanfish/

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Contents

1 The western and central Pacific tuna fishery

The tuna fisheries in the western and central Pacific Ocean (WCPO), encompassed by the Convention Area of the Western and Central Pacific Fisheries Commission (WCP-CA) (Figure 1), are diverse, ranging from small-scale, artisanal operations in the coastal waters of Pacific states, to large-scale, industrial purse seine, pole-and-line and longline operations in the exclusive economic zones (EEZs) of Pacific states and in international waters (high seas). The main species targeted by these fisheries are skipjack tuna (*Katsuwonus pelamis*), yellowfin tuna (*Thunnus albacares*), bigeye tuna (*T. obesus*) and albacore tuna (*T. alalunga*).

The current fishery characterisation includes updates to historical data, which show that the highest catch year was 2014. We expect revisions to the 2017 catch estimates in next year's report, as catch estimates in the most recent year are preliminary.

Annual total catch of the four main tuna species (skipjack, yellowfin, bigeye and albacore) in the WCP-CA increased steadily during the 1980s as the purse seine fleet expanded, and remained relatively stable during most of the 1990s until the sharp increase in catch in 1998. Since then there has been an upward trend in total tuna catch, primarily due to increases in purse seine catch with some stabilisation since 2009 (Figure 2 and Table 1). The provisional total WCP-CA tuna catch for 2017 was estimated at 2,557,611 tonnes (t) - a small drop from the record high of, 2,883,204t experienced in 2014. In 2017 the purse seine fishery accounted for an estimated 1,825,444t (71% of the total catch), a drop from the record high of, 2,059,008t experienced in 2014 for this fishery. The pole-and-line fishery landed an estimated 151,232t (6% of the catch - a drop from the highest value (415,016t), recorded in 1984). The longline fishery in 2017 accounted for an estimated 243,276t (10% of the catch) - a decrease from the highest value (284,782t) recorded in 2004. Troll gear accounted for <1% of the total catch (10,972t), a decrease from the highest value (141,117t), recorded in 2016, this was mainly due to a separation of the Indonesian troll catch from their combined artisanal gear catch. The remaining 13% was taken by a variety of artisanal gear, mostly in eastern Indonesia, the Philippines and Vietnam, which is a record catch. The WCP-CA tuna catch for 2017 represented 78% of the total Pacific Ocean catch (3,262,111t) and 54% of the global tuna catch (the provisional estimate for 2017 being 4,738,243t).

The 2017 WCP-CA catch of skipjack (1,627,971t - 64% of the total catch) was a drop from the highest value (2,008,929t), recorded in 2014; and a decrease of 10% from 2016 (Table 2). The WCP-CA yellowfin catch for 2017 (681,444t - 27%) is a record catch. The WCP-CA bigeye catch for 2017 (129,173t - 5%) was a drop from the highest value (192,564t), recorded in 2004, and a 6% increase over the 2016 catch. The 2017 WCP-CA albacore catch (90,664t - 4%) was a record catch.

The 2017 purse seine catch of 1,825,444t was lower than the previous year (Figure 3 and Table 1). The 2017 purse seine skipjack catch (1,283,336t - 79% of the total skipjack catch) was 7% lower than the 2016 catch. The 2017 purse seine catch of yellowfin tuna (480,129t) was a 25% increase from 2016. The purse seine catch estimate for bigeye tuna for 2017 (58,289t) was 14% lower than in 2016, and represented 45% of the total 2017 bigeye catch. It is important to note that the purse seine species composition for 2017 will be revised once all observer data for 2017 have been received and processed, and the current estimate should therefore be considered preliminary.

The 2017 longline catch of 243,276t represents a decrease from the highest value (284,782t) recorded in 2004 (Figure 4 and Table 1). The recent longline catch estimates are often uncertain and subject to revision due to delays in reporting. Nevertheless, the bigeye (58,332t) catch was low relative to the previous 15 years, while the yellowfin (84,790t) catch for 2017 was the highest since 2004.

The 2017 pole-and-line catch of 151,232t was low, and represented a 31% decrease from the 2016 catch (Figure 5 and Table 1). Skipjack accounts for the majority of the catch (90%). Yellowfin tuna (9%) make up the bulk of the remaining pole-and-line catch. The Japanese distant-water and offshore fleet and the Indonesian fleet account for most of the WCP-CA pole-and-line catch.

The 2017 troll catch in the WCPO of 10,972t, most of the catch being skipjack tuna, was lower than the 2013-2016 estimates. This is largely due to changes in reporting in Indonesia, these estimates are likely to be high and are currently under investigation. South Pacific albacore are also taken by troll gear. Since 2007 New Zealand (averaging about 2,359t catch per year) has had the most consistent effort in the south Pacific albacore troll fishery, with the United States landing a small catch (average 293t per year) in the south Pacific.

2 Status of tuna stocks

The sections below provide a summary of the recent developments in fisheries for each species, and the results from the most recent stock assessments. A summary of the important biological reference points for the four stocks is provided in Table 3. Bigeye and albacore tuna stocks were assessed in 2018, yellowfin stock in 2017, and skipjack tuna stock was assessed in 2016. Due to uncertainty in the data for the most recent year in each assessment, for the bigeye, skipjack and yellowfin tuna assessments only fisheries data through to 2015 were used, while albacore assessment used data through to 2016. Information on the status of other oceanic fisheries resources (e.g., billfishes and sharks) is provided in the *Ecosystem Considerations* section.

2.1 Skipjack tuna

The 2017 WCP-CA skipjack catch of 1,627,971t was a drop from the highest value (2,008,929t), recorded in 2014 (Figure 6 and Table 4). As has been the case in recent years, the main contributor to the overall catch of skipjack was that taken in the purse seine fishery (1,283,336t in 2017 - 79% of total skipjack catch). The next-highest proportion of the catch was by pole-and-line gear (123,132t - 8%). The longline fishery accounted for less than 1% of the total catch. The vast majority of skipjack are taken in equatorial areas, and most of the remainder is taken in the seasonal domestic fishery off Japan (Figure 6).

The dominant size mode of the WCP-CA skipjack catch (by weight) typically falls in the size range between 40 cm and 60 cm, corresponding to 1-2+ year-old fish (Figure 6). For pole-and-line the fish typically range between 40 cm and 55 cm, while for the domestic fisheries of Indonesia and the Philippines they are much smaller (20-40 cm). It is typically found that skipjack taken in unassociated (free-swimming) schools are larger than those taken in associated schools.

Stock assessment

The most recent assessment of skipjack in the WCPO was conducted in 2016, and included data from 1972 to 2015 (McKechnie *et al.* 2016). While estimates of fishing mortality for skipjack have increased over time, current fishing mortality rates for skipjack tuna are estimated to be about 0.45 times the level of fishing mortality associated with maximum sustainable yield (F_{MSY}). Therefore, overfishing is not occurring (i.e. $F_{recent} < F_{MSY}$) (Figure 7). Estimated recruitment shows an upward trend over time, and spawning biomass is estimated to be at 58% of the level predicted in the absence of fishing. Recent spawning biomass levels are estimated to be well above the limit reference point of 20% of the level predicted in the absence of fishing ($SB/SB_{F=0} = 0.2$) and close to the target reference point of $SB/SB_{F=0} = 0.5$.

The conclusions of the Western and Central Pacific Fisheries Commission (WCPFC) Scientific Committee at its 12^{th} Regular Session (SC12), which were presented as recommendations to the Commission, are reproduced below:

- Dynamics of most model quantities are relatively consistent with the results of the 2014 stock assessment, although there has been a period of several subsequent years with high recruitments and increased spawning biomass.
- Fishing mortality of all age-classes is estimated to have increased significantly since the beginning of industrial tuna fishing, but fishing mortality still remains below the level that would result in the MSY ($F_{recent}/F_{MSY} = 0.45$ for the reference case), and is estimated to have decreased moderately in the last several years. Across the reference case and the structural uncertainty grid F_{recent}/F_{MSY} varied between 0.38 (5% quantile) to 0.64 (95% quantile). This indicates that overfishing is not occurring for the WCPO skipjack tuna stock.
- The estimated MSY of 1,891,600t is moderately higher than the 2014 estimate due to the adoption of an annual, rather than quarterly, stock-recruitment relationship. Recent catches are lower than, but approaching, this MSY value.
- The latest (2015) estimate of spawning biomass is well above both the level that will support MSY ($SB_{latest}/SB_{MSY} = 2.56$, for the reference case model) and the adopted LRP of 0.2 $SB_{F=0}$ ($SB_{latest}/SB_{F=0} = 0.58$, for the reference case model), and $SB_{latest}/SB_{F=0}$ was relatively close to the adopted interim target reference point (0.5 $SB_{F=0}$) for all models explored in the assessment (structural uncertainty grid: median = 0.51, 95% quantiles = 0.39 and 0.67).

Note: China, Japan and Chinese Taipei considered that it is not possible to select a base-case model from various sensitivity models in the 2016 assessment, given the advice from the Scientific Service Provider that a suite of the sensitivity models were plausible. Therefore, these members considered that it would be more appropriate to provide advice on skipjack stock status based on the range of uncertainty expressed by the alternative model runs in the sensitivity analysis rather than based on the single base case model.

In this case the estimated MSY of the WCPO skipjack stock ranges from 1,641,200 to 2,076,800t across the alternative skipjack stock assessment models represented in the sensitivity grid. China, Japan and Chinese Taipei also noted that some alternative models indicate that the 2015 biomass is below the adopted TRP of 0.5 $SB_{F=0}$.

2.2 Yellowfin tuna

The WCPC-CA yellowfin catch in 2017, of 681,444t, was a record catch (Figure 8 and Table 5). The purse seine catch (480,129t) has increased by 25%, and the longline catch (84,790t) has decreased by 5%, from 2016 levels. The remainder of the yellowfin tuna catch comes from pole-and-line and troll, and the domestic fisheries in Indonesia, Vietnam and the Philippines. The purse seine catch of yellowfin tuna is typically around four times the size of the longline catch.

As with skipjack, most of the yellowfin catch is taken in equatorial areas by large purse seine vessels, and a variety of gears in the Indonesian and Philippines fisheries. The domestic surface fisheries of the Philippines and Indonesia take large numbers of small yellowfin in the range 20-50 cm (Figure 8). In the purse seine fishery, greater numbers of smaller yellowfin are caught in log and fish aggregating device (FAD) sets than in unassociated sets. A major proportion (by weight) of the purse seine catch is adult (> 100 cm) yellowfin tuna.

Stock assessment

The most recent assessment of yellowfin tuna in the WCPO was conducted in 2017 (Tremblay-Boyer *et al.* 2017) and included data from 1952 to 2015. The 2017 assessment included investigating an alternative Regional structure with the boundaries between the tropical and northern temperate regions shifted from 20^{o}N to 10^{o}N; and used alternative size data weightings. This analysis presented the results as a structural uncertainty grid from 48 model runs and those results were equally weighted when developing management advice. Across the range of model runs in this assessment, the key factor influencing estimates of stock status was the size data weighting value; two alternatives were included in the grid with weightings such that the maximum effective sample sizes were limited to 20 and 50 fish (Tremblay-Boyer *et al.* 2017).

Fishing mortality on both adults and juvenile fish has increased in recent years (Figure 9). Current fishing mortality rates for yellowfin tuna, however, are mostly estimated to be below level of fishing mortality associated with Maximum Sustainable Yield (F_{MSY}), which indicates that overfishing is not occurring (Figure 9). Spawning potential has shown a long continuous decline from the 1950s to the 2000s, since the early 2000s the spawning potential has declined at a lower rate. Recruitment has been variable throughout the assessment period (Figure 9). Recent spawning biomass levels are mostly (44 out of 48 runs) estimated to be above the SB_{MSY} level and the limit reference point of 20% of the level predicted in the absence of fishing.

The conclusions of the WCPFC Scientific Committee at its 13th Regular Session (SC13), were presented as recommendations to the Commission in 2017, are reproduced below:

- The WCPO yellowfin spawning biomass was characterised using the grid and the median was estimated $\mathrm{SB}_{recent}/\mathrm{SB}_{F=0}$ to be at 0.33 with a range of 0.18 to 0.44 for the 90th percentiles, and there was an 8% probability (4 out of 48 models) that the recent spawning biomass had breached the adopted LRP.
- The median $\mathrm{F}/\mathrm{F}_{MSY}$ was estimated at 0.74, with a 4% probability that the recent fishing mortality was above F_{MSY}.
- The SC also noted that levels of fishing mortality and depletion differ between regions, and that fishery impact was highest in the tropical region (Regions 3, 4, 7, 8 in the stock assessment model), mainly due to the purse seine fisheries in the equatorial Pacific and other fisheries within the Western Pacific.
- SC13 noted that WCPFC could consider reducing fishing mortality on yellowfin, from fisheries that take juveniles, with the goal to increase to maximum fishery yields and reduce any further impacts on the spawning potential for this stock in the tropical regions.
- The SC recommended that measures should be implemented to maintain current spawning biomass levels until the Commission can agree on an appropriate target reference point (TRP).

2.3 Bigeye tuna

The 2017 WCP-CA bigeye tuna catch was 129,173t, which was a drop from the highest value (192,564t), recorded in 2004. A 2,840t decrease in purse seine catch and a 4,382t decrease in the longline fishery (Figure 10 and Table 6) has had the overall effect of a decrease in total bigeye catch relative to 2016. Of the total bigeye catch in 2017, 45% was caught by longline, 45% by purse seine, and the remainder was distributed across troll, pole and line, and other gears.

The majority of the WCP-CA catch is taken in equatorial areas, by both purse seine and longline, but with some longline catch in sub-tropical areas (e.g. east of Japan and off the east coast of Australia) (Figure 4). In the equatorial areas much of the longline catch is taken in the central Pacific, contiguous with the important traditional bigeye longline area in the eastern Pacific.

As with skipjack and yellowfin tuna, the domestic surface fisheries of the Philippines and Indonesia take large numbers of small bigeye in the range 20-50 cm. In addition, large numbers of 25-75 cm bigeye are taken in purse seine fishing in Fish Aggregating Devices (FADs) (Figure 10), which along with the fisheries of the Philippines and Indonesia account for the bulk of the catch by number. The longline fishery, which lands bigeye mostly above 100 cm, accounts for most of the catch by weight in the WCP-CA. This contrasts with large yellowfin tuna, which (in addition to the longline gear) are also taken in significant amounts from unassociated schools in the purse seine fishery and in the Philippines handline fishery. Large bigeye are very rarely taken in the WCPO purse seine fishery, and only a relatively small amount comes from the handline fishery in the Philippines. Bigeye sampled in the longline fishery are predominantly adult fish, with a mean size of approximately 130 cm with most between 80 and 160 cm.

Stock assessment

The most recent assessment of bigeye tuna in the WCPO was conducted in 2018 (Vincent *et al.* 2018), and included data from 1952 to 2015. This assessment was closely based on the 2017 assessment, but with growth estimates based on a newly enhanced set of otolith-based age-at-length data. The 2018 assessment included two alternative spatial structures with the boundaries between the tropical and northern temperate regions shifted from 20^oN to 10^oN; and used a new growth curve based on analyses of recently processed otoliths by Farley *et al.* (2018). The updated growth curve was similar to the 2017 new growth model (McKechnie *et al.* 2017), but in 2018 the 14^{th} Regular Session of the WCPFC Scientific Committee (SC14) agreed to remove the old growth from the structural uncertainty grid. This analysis presented the results as a structural uncertainty grid from 36 model runs for developing management advice where all plausible combinations of the most important axes of uncertainty were included with equal weighting. As a result of removing the old growth models from the uncertainty grid, the assessed status of the stock was more optimistic than the estimated status in 2017.

Fishing mortality is estimated to have increased over time, particularly on juveniles over the last two decades on juvenile fish. The biomass of spawners is estimated to have declined over the duration of the fishery, with current median spawning biomass estimated to be about 36% of the level predicted in the absence of fishing. The median spawning biomass levels estimated by the grid was above the limit reference point (LRP) of 20% of the level predicted in the absence of fishing (Figure 11).

The conclusions of the WCPFC Scientific Committee at its 14^{th} Regular Session, which were based on 36 model runs, will be presented as recommendations to the Commission, and are summarised below:

- SC 14 noted that the median spawning biomass was ($SB_{recent}/SB_{F=0}$) = 0.36 with an upper and lower bound of the 80% probability interval being 0.30 to 0.41 respectively.
- SC14 noted that there was a 0% probability that the recent spawning biomass had breached the adopted LRP.
- The median (F_{recent}/F_{MSY}) was 0.77 with a 6% probability that recent fishing mortality was above F_{MSY}.

- SC14 also noted the higher levels of depletion in the equatorial and western Pacific (specifically Regions 3, 4, 7 and 8) and the associated higher levels of impact in these regions, particularly on juvenile bigeye tuna in these regions, due to the associated purse seine fisheries and the other fisheries within the western Pacific.

2.4 South Pacific albacore tuna

The total South Pacific albacore catch in 2017 (90,664t) represented a record catch (Figure 12 and Table 7). Longline fishing has accounted for most of the catch of this stock (81% in the 1990s, but 95% in the most recent 10 years). The troll catch, covering a season spanning November to April, has generally been in the range of 3,000-8,000t, however it has averaged 2,658t over the past five years.

The longline catch is widely distributed in the South Pacific, but concentrated in the western part of the Pacific. Much of the increase in catch is attributed to that taken by vessels fishing north of latitude 20°S. The Pacific Island domestic longline fleet catch is restricted to latitudes 10°-25°S. Troll catch is distributed in New Zealand's coastal waters, mainly off the South Island, and along the sub-tropical convergence zone (STCZ). In the past less than 20% of the overall South Pacific albacore catch was taken east of 150°W, but in the most recent five years this has increased to over 25%.

The longline fishery takes mainly older adult albacore, mostly in the narrow size range of 90-105 cm, and the troll fishery takes juvenile fish in the range 45-80 cm. Juvenile albacore also occasionally appear in the longline catch in more southern latitudes.

Stock assessment

The most recent stock assessment for South Pacific albacore tuna was undertaken in 2018 (Tremblay-Boyer *et al.* 2018), and was based on data from 1960 to 2016. This analysis presented the results from a structural uncertainty grid based on 72 model runs for developing management advice. All plausible combinations of the most important axes of uncertainty were included with equal weighting in the grid.

The assessment indicates that fishing mortality has generally been increasing over time, with F_{recent} (2012-15 average) estimated to be 0.2 times the fishing mortality that will support the MSY. Across the grid F_{recent}/F_{MSY} ranged from 0.06-0.53. This indicates that overfishing is not occurring (Figure 13). Spawning biomass levels are above both the level that will support the MSY (SB_{recent}/SB_{MSY} = 3.3 for the diagnostic case and range 1.45-10.74 across the grid) and the adopted LRP of $0.2SB_{F=0}$ ($SB_{recent}/SB_{F=0}$ = 0.52 for the base case and range 0.32-0.72 across the grid) indicating that the stock is not overfished.

The SC also considers an index of economic conditions in the South Pacific albacore fishery (Williams and Reid 2018). This index, which integrates fishing costs, catch rates and fish prices, estimates a strong declining trend in economic conditions, reaching an historical low in 2013. While the economic conditions remain relatively poor there was a slight recovery in 2017 due to high CPUE for south Pacific albacore.

The conclusions of the WCPFC Scientific Committee at its 14^{th} Regular Session (SC14), which were based on 72 model runs, will be presented as recommendations to the Commission, and are summarised below:

- SC 14 noted that the median spawning biomass depletion level ($SB_{recent}/SB_{F=0}$) was 0.52 with an upper and lower bound of 0.37 to 0.63 respectively.

- SC14 noted that there was a 0% probability that the recent spawning biomass had breached the adopted LRP.
- The median fishing impact (F_{recent}/F_{MSY}) was 0.2 with a 0% probability that recent fishing mortality was above F_{MSY}.
- For several years, SC has noted that any increases in catch or effort in sub-tropical longline fisheries are likely to lead to declines in catch rates in some regions (10°S-30°S), especially for longline catch of adult albacore, with associated impacts on vessel profitability.
- SC14 also noted that the assessment results show that while the stock has exhibited a long-term decline the stock is not in an overfished state and overfishing is not taking place.

2.5 Tuna tagging

Large-scale tagging experiments are required to provide the level of information (fishery exploitation rates and population size) that is necessary to enable stock assessments of tropical tunas in the western and central Pacific Ocean. Tagging data have the potential to provide significant information of relevance to stock assessment, either by way of stand-alone analyses or, preferably, through their integration with other data directly in the stock assessment model. Tuna tagging has been a core activity of the Oceanic Fisheries Programme over the last 30 years, with tagging campaigns occurring in the 1970s, 1990s and, most recently, since 2006. This most recent campaign has now tagged and released 434,294 tuna in the equatorial western and central Pacific Ocean, including over 1,800 archival tag releases, with 62,575 reported recaptures (Figure 14). A summary of tag releases and recoveries is provided in Table 8.

3 Ecosystem and bycatch issues

3.1 Catch composition

The tuna fisheries of the WCPO principally target four main tuna species: skipjack, yellowfin, bigeye and albacore tuna. However, the fisheries also catch a range of other species in association with these. Some of the associated species (bycatch) are of commercial value (by-products), while many others are discarded. There are also incidents of the capture of species of ecological and/or social significance (protected species), including marine mammals, sea birds, sea turtles and some species of shark (e.g. whale sharks).

The information concerning the catch composition of the main tuna fisheries in the WCPO comes largely from the various observer programmes operating in the region. Overall, catch (in weight) from unassociated and associated purse seine sets are dominated by tuna species (99.7% and 98.1%, respectively), with anchored FAD sets having a lower bycatch rate (99.4% tuna) than drifting FADs. Historically, associated sets have accounted for the majority of bycatch of finfish and shark species, though there is some variation from year to year due to changes in the proportions of sets by association type (Peatman *et al.* 2018).

Species composition of the catch has also been estimated for four main longline fisheries operating in the WCPO: the western tropical Pacific (WTP) shallow-setting longline fishery; the WTP deep-setting longline fishery; the western South Pacific (WSP) and albacore fishery. While estimates are uncertain due to the low level of observer coverage, some general conclusions are possible. The main tuna species account for 53.4%, 76.9%, 70.7% and 42.9% of the total catch (by weight) of the shallow-set, deepset, albacore and shark target longline fisheries respectively (Figure 16). The WTP shallow-set fishery has a higher proportion of non-tuna species in the catch, principally shark and billfish species, while mahi mahi and opah (moonfish) represent a significant component of the WSP albacore longline catch. There are also considerable differences in the species composition of the billfish catch in the three longline fisheries as follows: the WTP shallow and WSP albacore fisheries catch a higher proportion of surface-orientated species than does the WTP deep-setting fishery. Silky sharks are the most common shark species in the shallow set and shark target longline fisheries, while blue sharks are the most common in the deep set and now non-operational target shark fisheries (Figure 16). Note, while the data for the shark fisheries are presented here, these fisheries have largely ended, with only few vessels targeting sharks in 2017. The catch in Figure 16 representing the shark target component is only 8% of the total catch from this figure, much of which comes from data prior to the termination of those fisheries.

3.2 Species of special interest

A range of conservation and management measures have been introduced by WCPFC to reduce impacts of fisheries on species of special interest, including whale sharks, silky and oceanic white tip sharks, sea turtles, whales and seabirds. Spatially and temporally disaggregated summaries of observer bycatch data are publicly available, including observed longline and purse seine effort and interaction rates for species of special interest . There are limited interactions between the purse seine fishery and protected species, such as whale sharks and manta rays (Figure 15). Historically, some vessels deliberately set around whale sharks associated with tuna schools, but this practice has been prohibited since 2014 in the WCPO. In a very small percentage of cases of free school sets a whale shark is encountered; in these instances the whale shark was not seen before the set was made. Observed interaction rates between the purse seine fishery and sea turtles are low ($<$ 1 interaction per 100 sets), and interactions with seabirds are very rare. Interactions with seabirds and marine mammals are very low in all four longline fisheries (although the probability of detecting rare events with low observer coverage means that the estimates of very low interaction rates are very uncertain). Catch of five species of marine turtles have been observed in the equatorial longline fishery, although the observed encounter rate was very low, and most of the turtles caught were alive at the time of release. The status of silky and oceanic whitetip sharks is of concern as assessments have shown that stocks are subject to overfishing and, in the case of oceanic whitetip, severely overfished. A WCPFC ban on the use of either shark lines or wire traces in longline sets is in place, which should reduce the catch of silky and oceanic whitetip sharks a small amount, but a ban on both would be more effective.

3.3 Catch of billfish and sharks

In addition to the main tuna species, annual catch estimates for the WCPO in 2017 are available for the main species of billfish (swordfish [18,824t], blue marlin [16,813t], striped marlin [3,057t] and black marlin [2,392t]). For all of these species current catch is around the average for the past decade. Catch of other associated species cannot be accurately quantified using logsheet data, but estimates should be possible in future when longline observer coverage increases (but see Peatman *et al.* (2018) for more details). Observer coverage is already sufficiently high to estimate catch of associated species for large-scale purse seiners operating in equatorial and tropic waters.

Over the past several years stock assessments have been undertaken for several billfish and shark species, in addition to the main tuna species. The SC recommendations to the Commission are broadly summarised as follows:

- Stabilise stock size or catch/no increase in fishing pressure

  - Southwest Pacific swordfish
  - Pacific-wide blue marlin
- Reduce catch and/or rebuild the stock and/or reduce effort
  - Pacific bluefin tuna
  - Southwest Pacific striped marlin
  - Western and central north Pacific striped marlin
  - Silky shark
  - Oceanic whitetip shark

3.4 Climate change

The SEAPODYM modelling framework was used to investigate how climate change could affect the distribution and abundance of skipjack, yellowfin, bigeye tuna and South Pacific albacore, at the Pacific basin scale, and within the EEZs of Pacific Island Countries (Senina *et al.* 2018). The analysis formed two parts, firstly, a model parameterization phase over the historical period (1980-2010) using an analysis of historic ocean conditions, and then projections of an ensemble of simulations to explore key sources of uncertainty in climate models. Second, five different atmospheric forcing datasets from Earth System models projected under the ("business as usual") IPCC RCP8.5 emissions scenario were used to drive physical-biogeochemical models through the 21^{st} Century. Additional scenarios were included to explore uncertainty associated with future primary production and dissolved oxygen concentration, as well as possible adaptation through phenotypic plasticity of these tuna species to warmer spawning grounds. The impact of ocean acidification was also included for yellowfin tuna based on results from laboratory experiments.

The historical simulations reflect key features of the ecology and behaviour of the four tuna species and match the total historical catch in terms of both weight and size frequency distributions. The projections show an eastern shift in the biomass of skipjack and yellowfin tuna over time, with a large and increasing uncertainty for the second half of the century, especially for skipjack tuna. The impact is weaker for bigeye tuna and albacore, which predict a wider and warmer range of favorable spawning habitat. For albacore, a strong sensitivity to sub-surface oxygen conditions resulted in a very large envelope of projections. Historical fishing pressure was estimated to have reduced the adult stocks of all four tuna species by 30-55% by the end of 2010. The effects of fishing on biomass strongly outweighed the decreases attributed to climate change in the short- to medium-term. Thus, fishing pressure is expected to be the dominant driver of tuna population status until the mid-century. The projected changes in abundance and redistribution of these tuna associated with climate change could have significant implications for the economic development of Pacific Island Countries, and the management of tuna resources, at basin scale. In particular, larger proportions of the catch of each species is increasingly expected to be made in international waters.

4 For further information [1]

4.1 Fishery

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[1] All WCPFC documents can be obtained by visiting the WCPFC website (`www.wcpfc.int`) and navigating to the meeting where the document was presented, e.g. WCPFC-SC13-GN-WP-1 can be found on the webpage of documents presented to the 13th session of the Scientific Committee (`https://www.wcpfc.int/meetings/sc13`).

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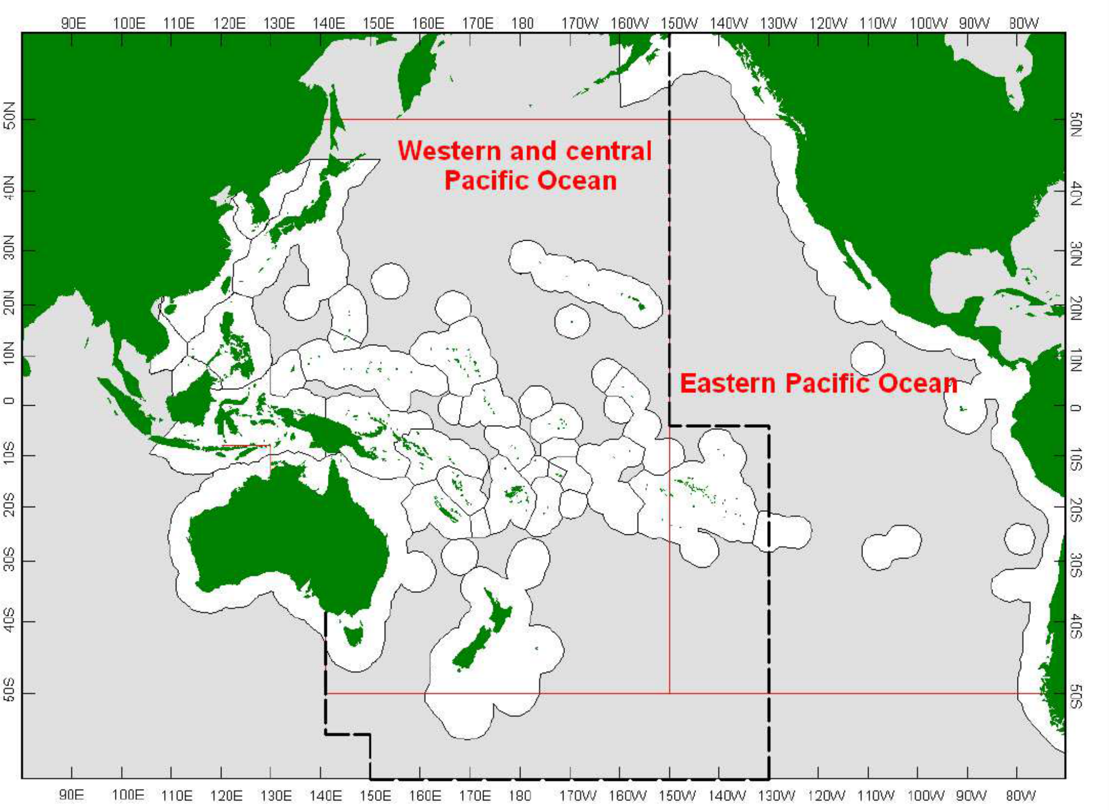
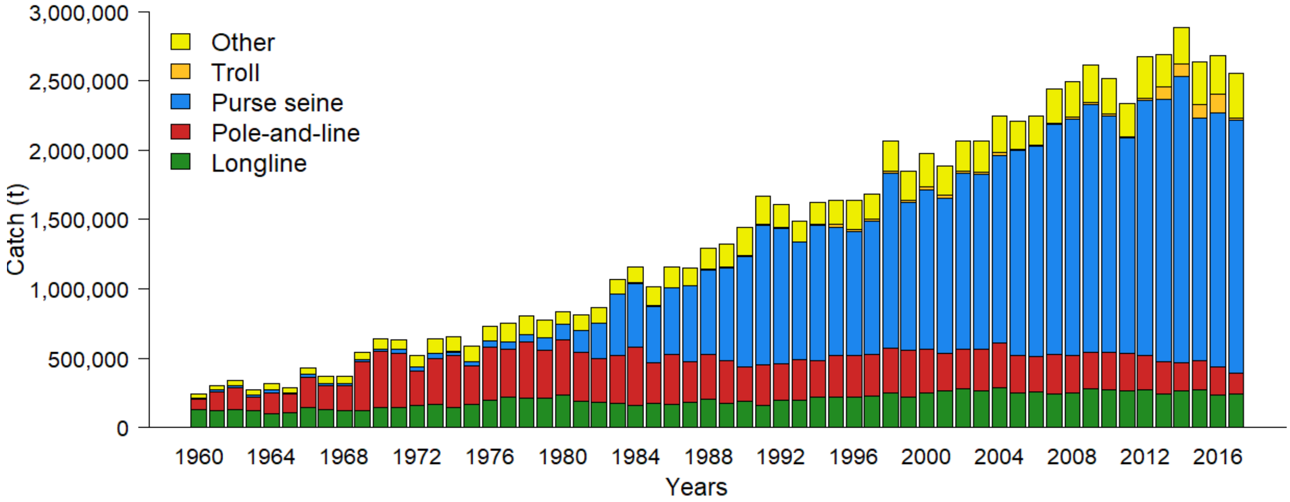


Figure 1: The western and central Pacific Ocean (WCPO), the eastern Pacific Ocean (EPO) and the WCPFC Convention Area boundary. Note: WCP-CA in dashed lines.



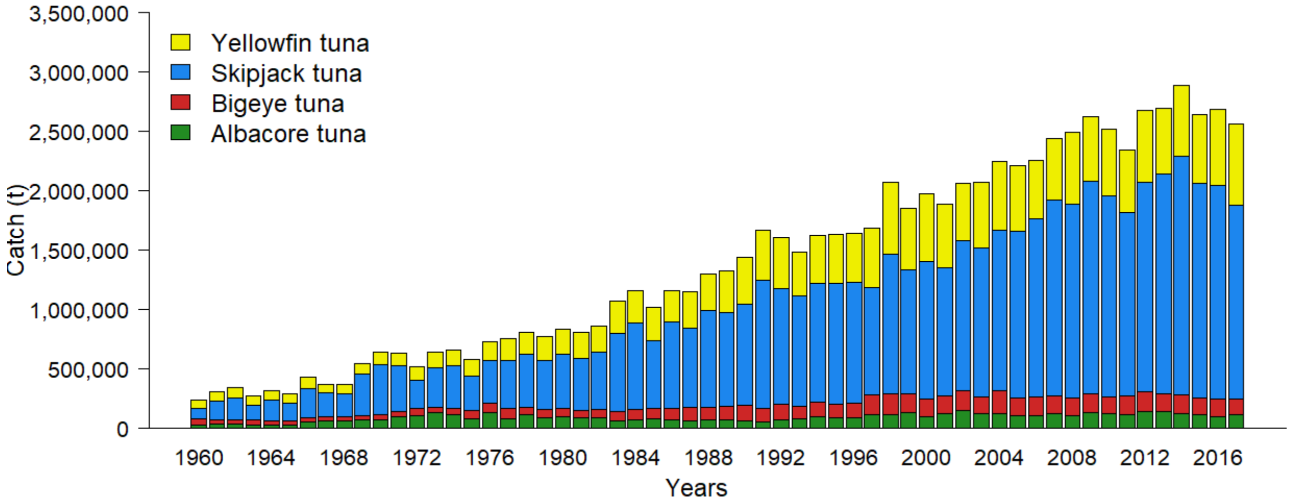


Figure 2: Catch (metric tonnes) by gear (top) and species (bottom) for the western and central Pacific region, 1960-2017. Note: data for 2017 are preliminary.

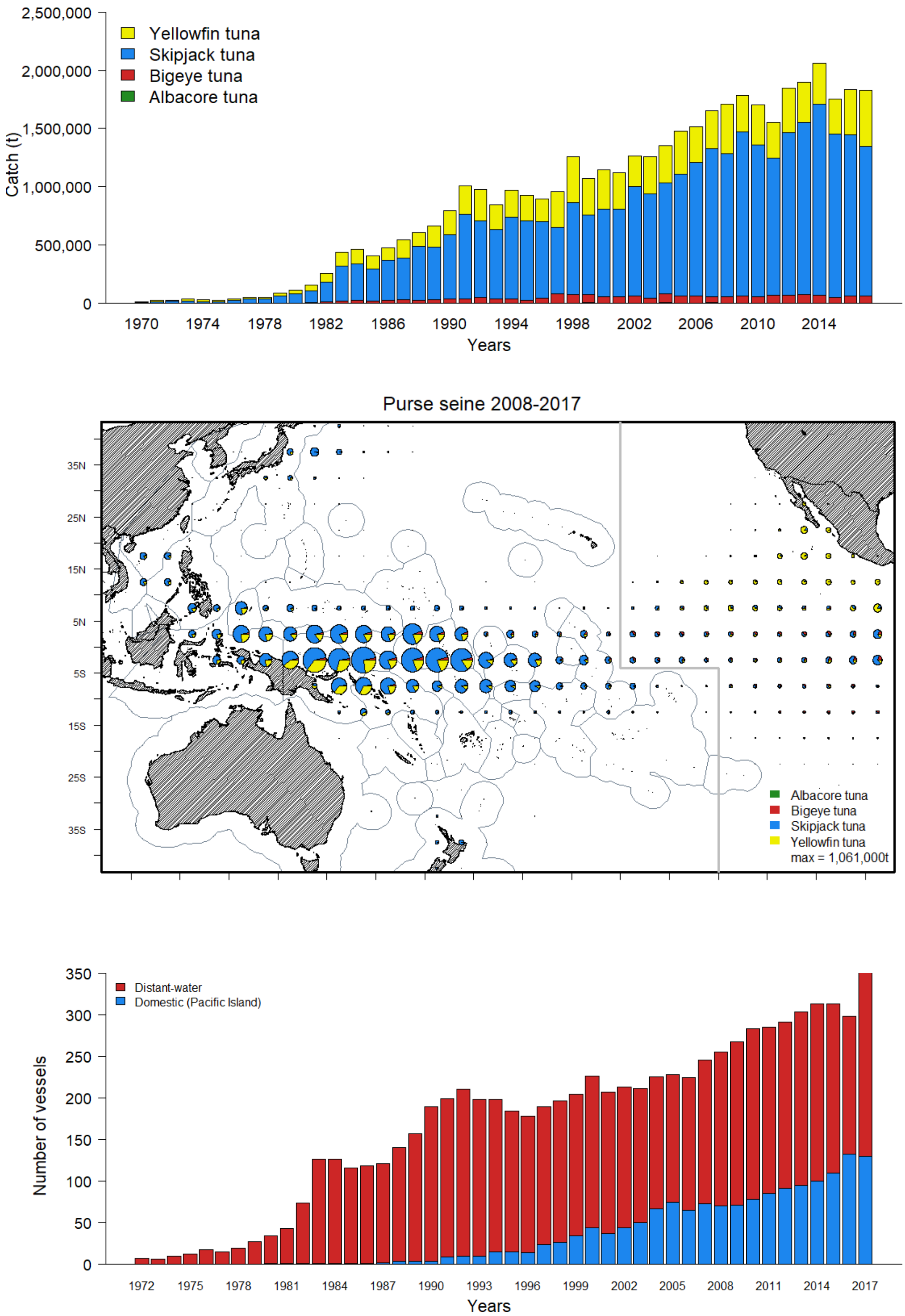


Figure 3: Time series of catch (t) (top), recent spatial distribution of catch (middle), and fleet sizes (bottom) for the purse seine fishery in the western and central Pacific Ocean (WCPO).

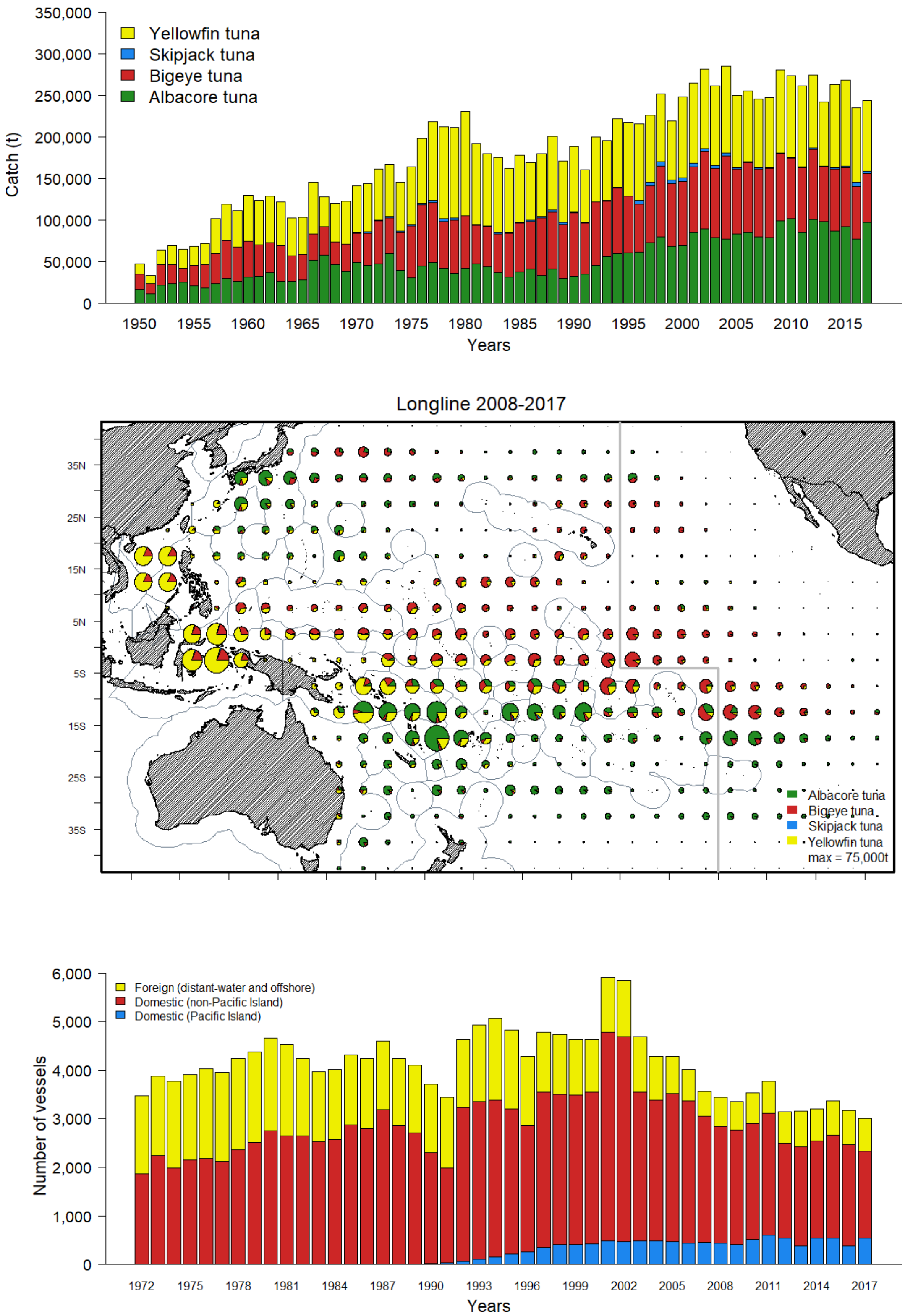


Figure 4: Time series of catch (t) (top), recent spatial distribution of catch (middle), and fleet sizes (bottom), for the longline fishery in the western and central Pacific Ocean (WCPO).

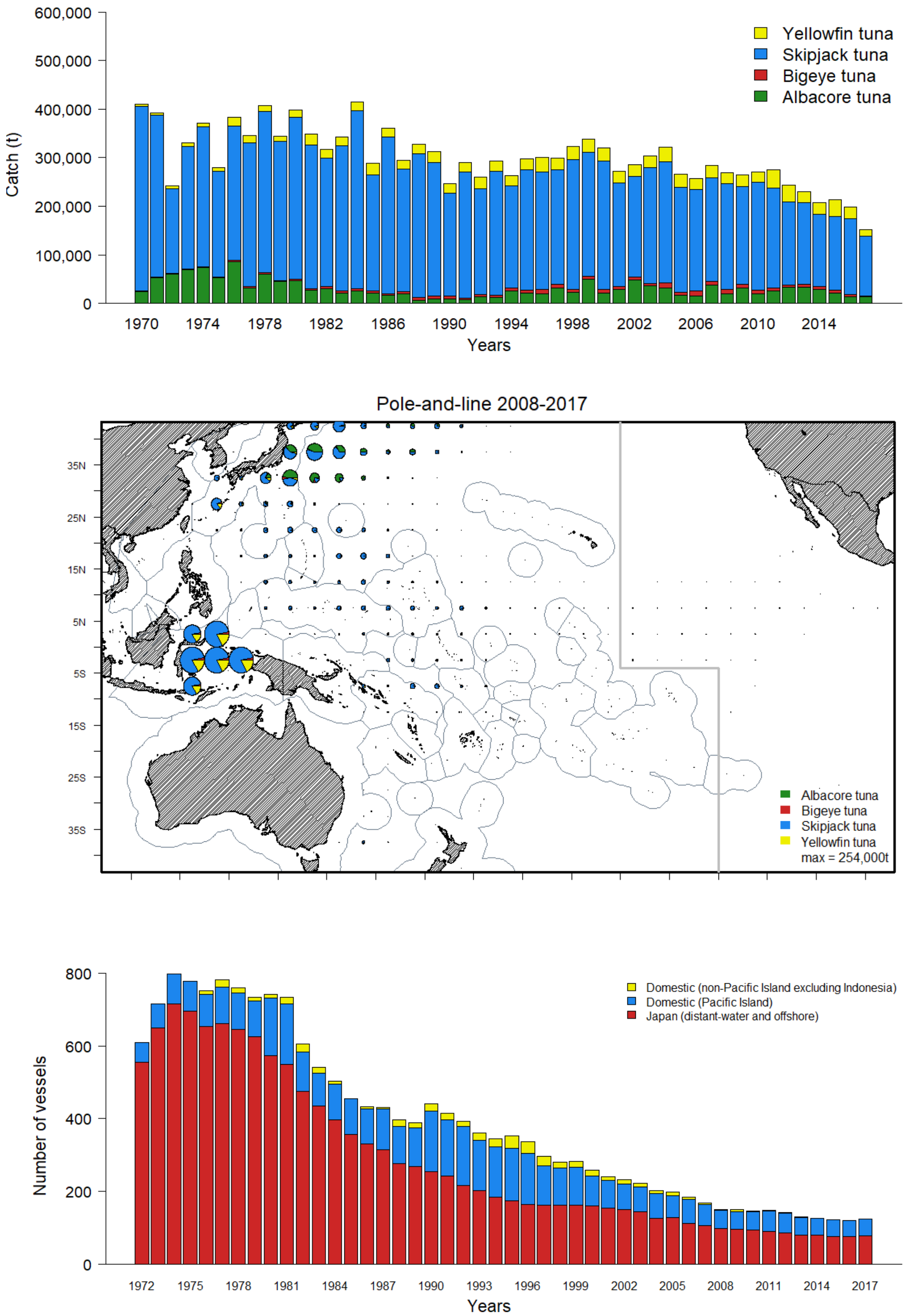


Figure 5: Time series of catch (t) (top), recent spatial distribution of catch (middle), and fleet sizes (bottom), for the pole-and-line fishery in the western and central Pacific Ocean (WCPO).

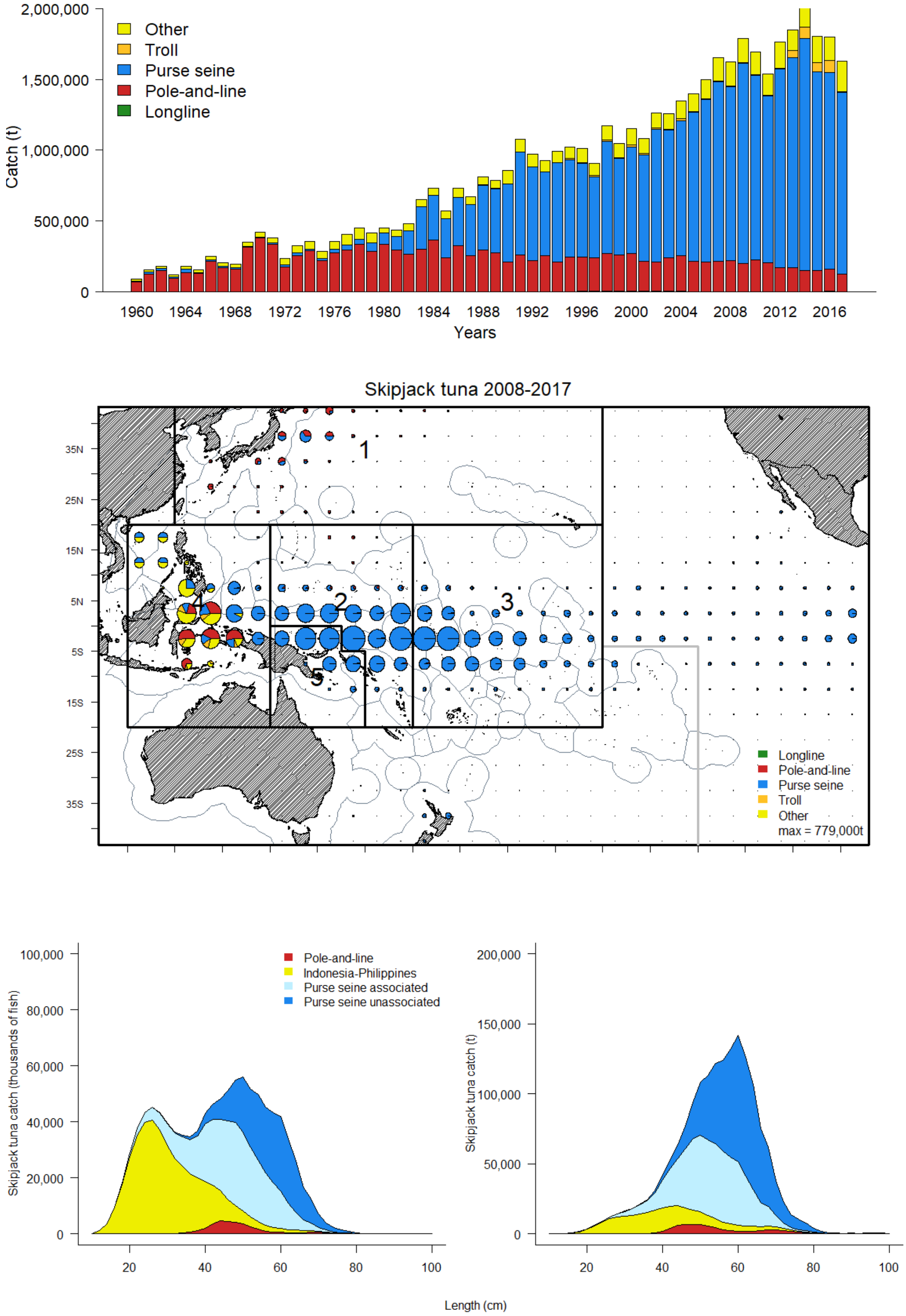


Figure 6: Time series (top), recent spatial distribution and assessment regions (middle), and size composition (average for last five years; bottom) of skipjack tuna catch (t) by gear for the western and central Pacific Ocean (WCPO).

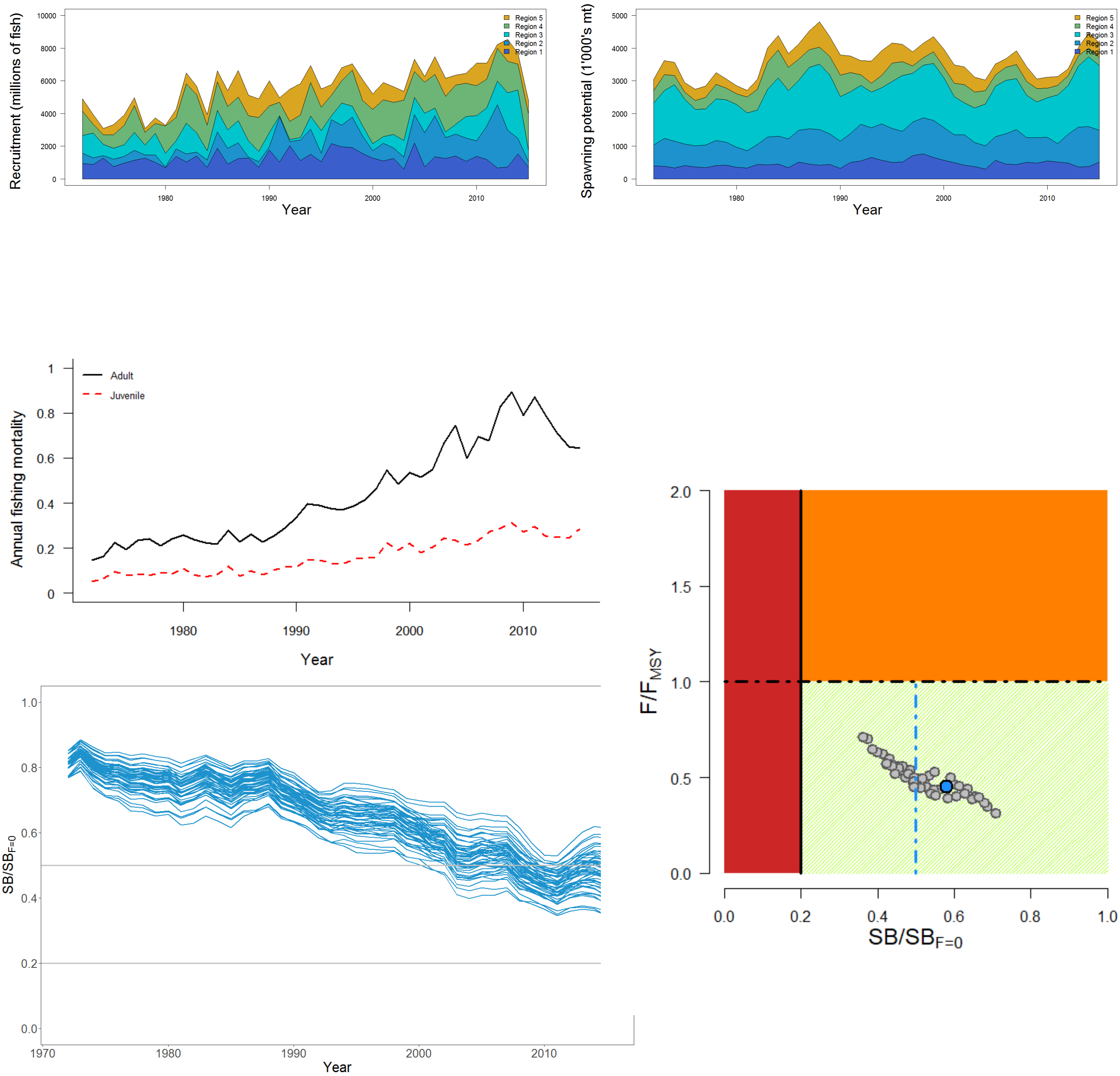


Figure 7: Estimated recruitment (top left), spawning biomass (top right), fishing mortality (middle left) from the diagnostic case; stock status displayed using a Majuro Plot, where the vertical dashed line represents the Target Reference Point, the blue point is the reference case run and the grey points indicate the runs in the sensitivity grid of 54 models (middle right) and estimated level of depletion across the grid (bottom left) from the 2016 skipjack tuna stock assessment.

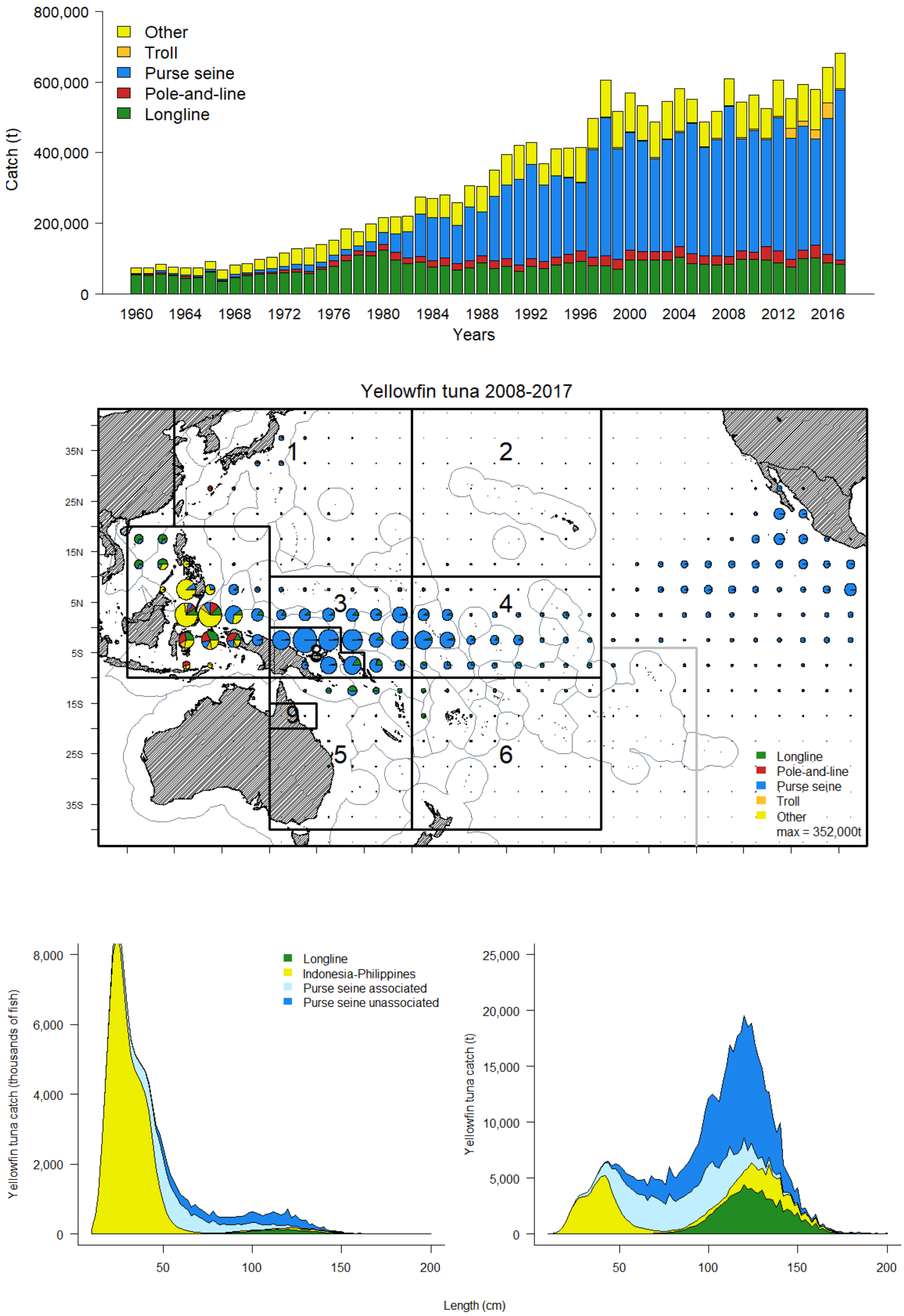


Figure 8: Time series (top), recent spatial distribution and assessment regions (middle), and size composition (average for last five years, bottom) of yellowfin tuna catch (t) by gear for the western and central Pacific Ocean (WCPO).

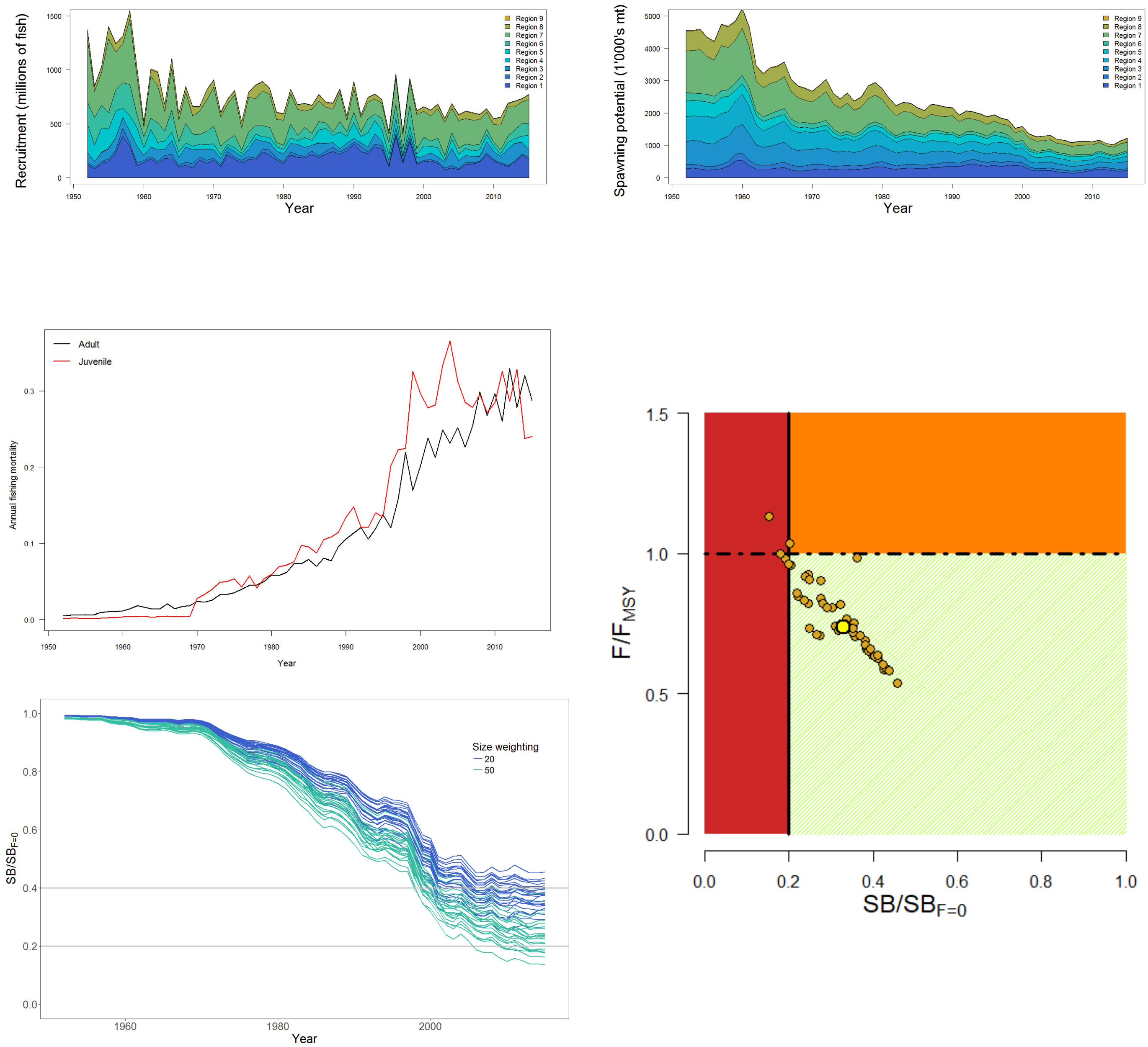


Figure 9: Estimated recruitment (top left), spawning biomass (top right), fishing mortality (middle left) from the diagnostic case; stock status displayed using the Majuro Plot (middle right) and estimated estimated level of depletion under two different size data weighting assumptions [20 and 50] (bottom), from the grid of 48 model runs used in the 2017 yellowfin tuna stock assessment.

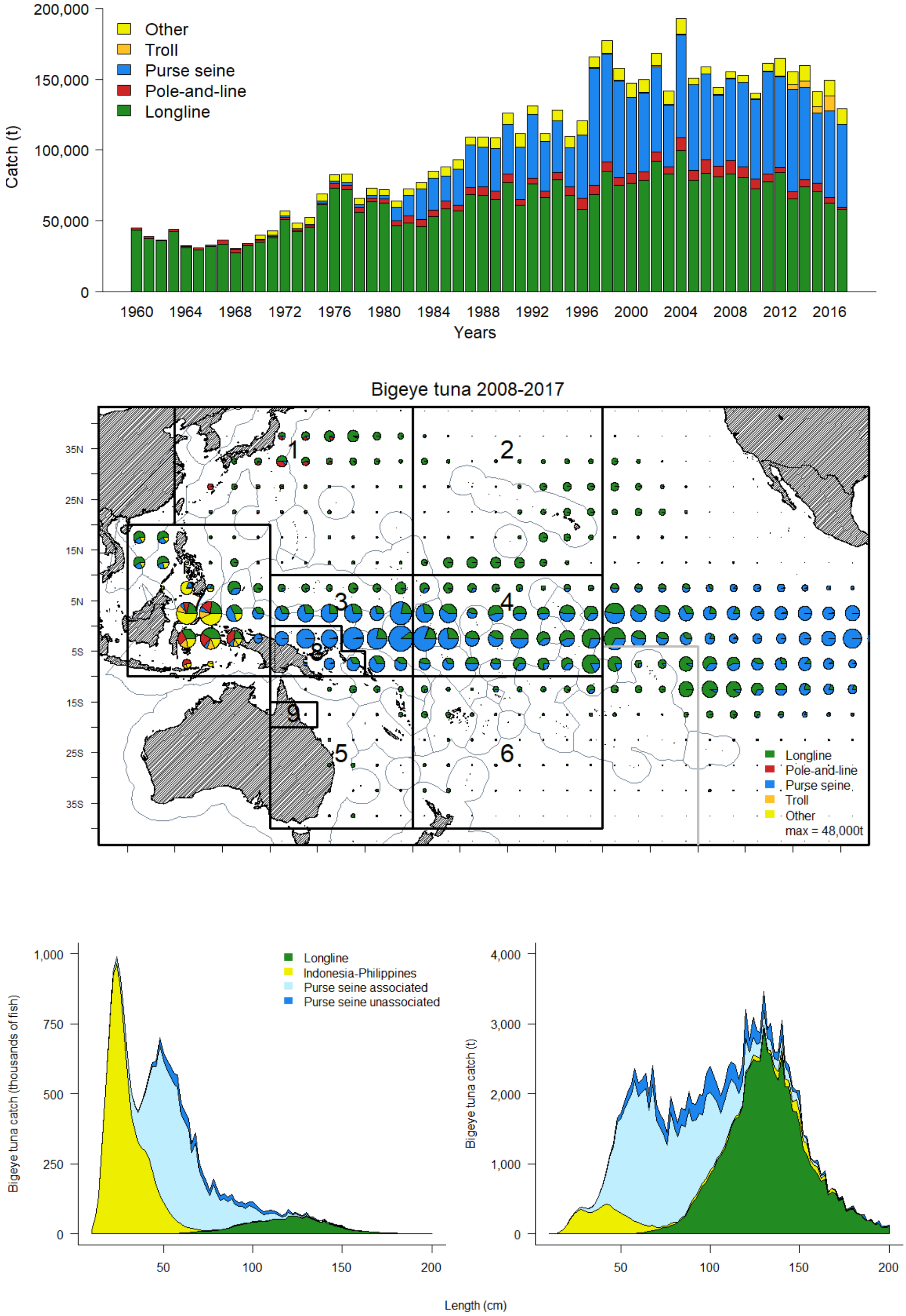


Figure 10: Time series (top), recent spatial distribution and assessment regions (middle), and size composition (average for last five years; bottom) of bigeye tuna catch (t) by gear for the western and central Pacific Ocean (WCPO).

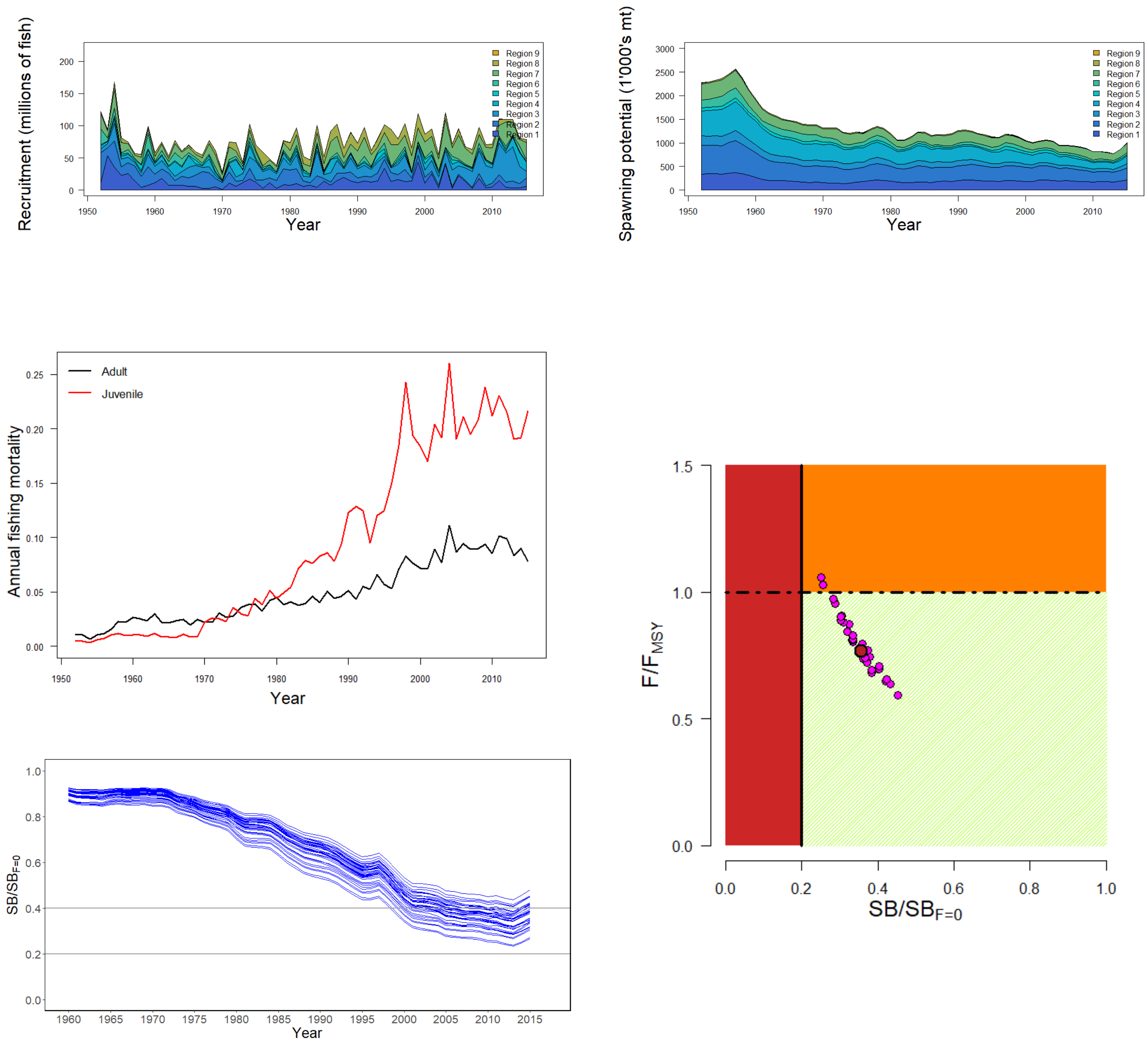


Figure 11: Estimated recruitment (top left), spawning biomass (top right), fishing mortality (middle left) from the reference case; stock status, displayed using the Majuro Plot (middle right), and estimated level of depletion under the ”new growth” assumptions (bottom left) from the grid of 36 model runs used in the 2018 bigeye tuna stock assessment.

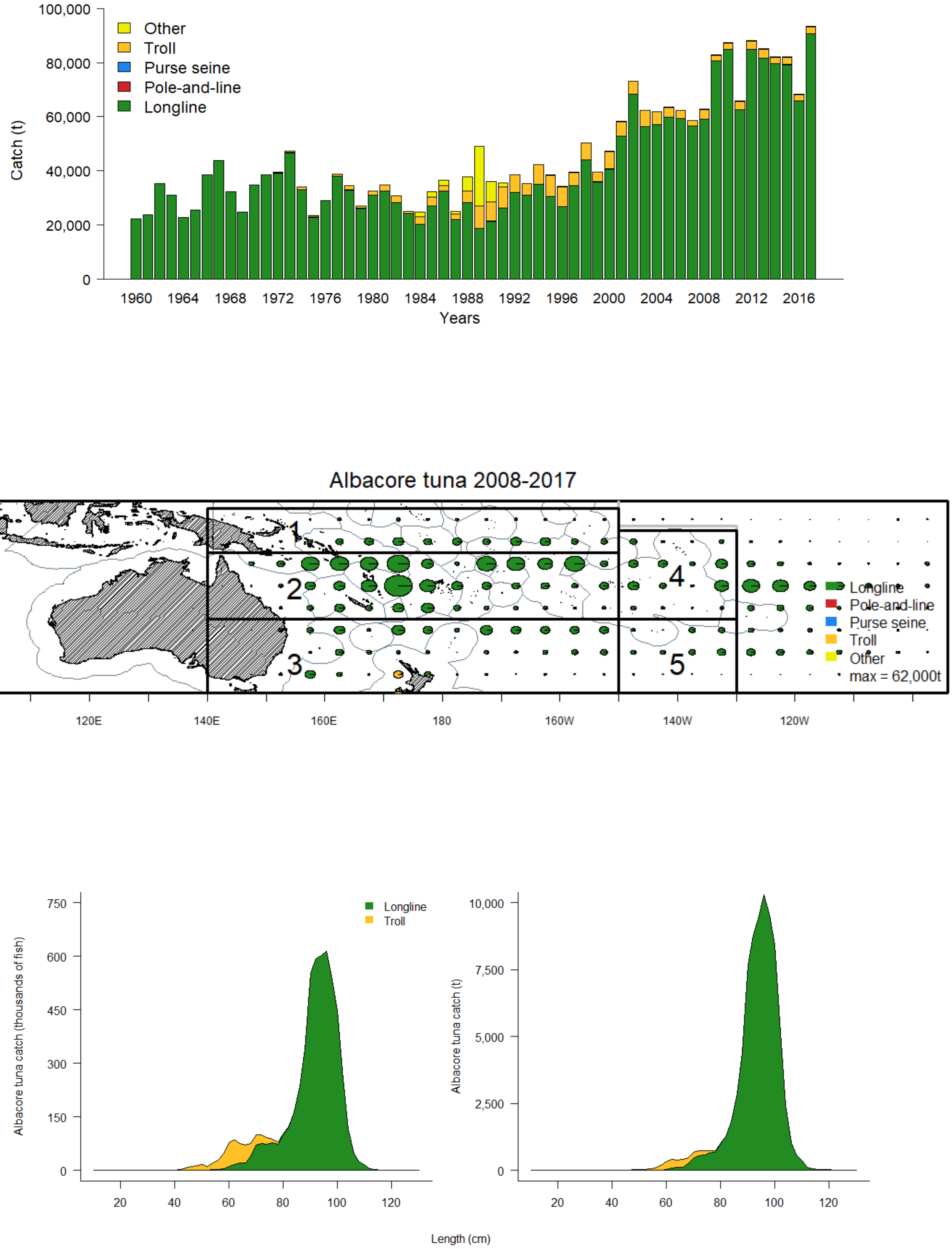


Figure 12: Time series (top), recent spatial distribution and assessment regions (middle), and size composition (average for last five years, bottom) of South Pacific albacore tuna catch (t) by gear for the western and central Pacific Ocean south of the Equator (WCPO).

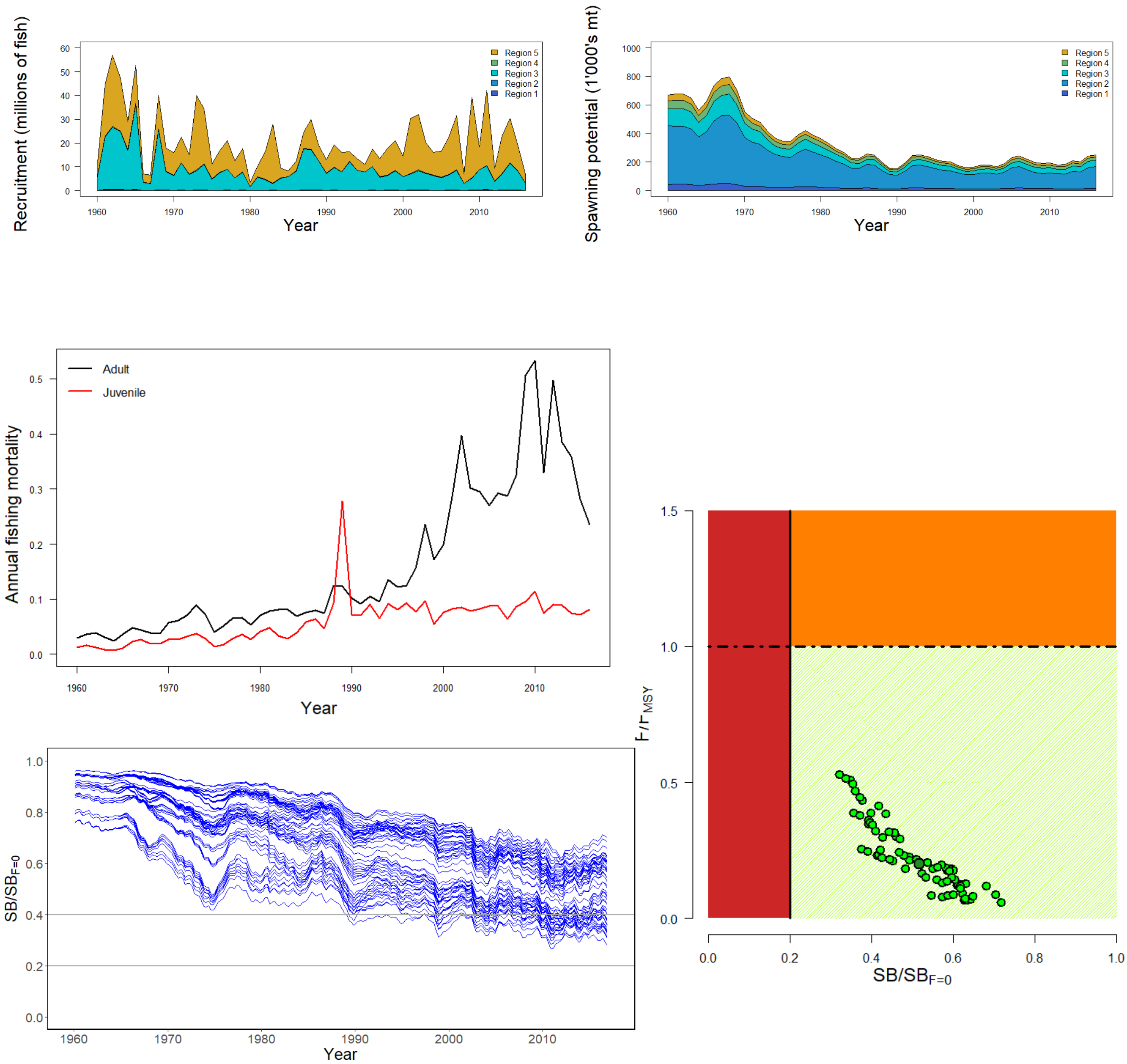


Figure 13: Estimated recruitment (top left), spawning biomass (top right), fishing mortality (middle left), from the reference case model and stock status, displayed using the Majuro Plot (middle right), and estimated level of depletion from the grid of 18 models used to describe the stock status.

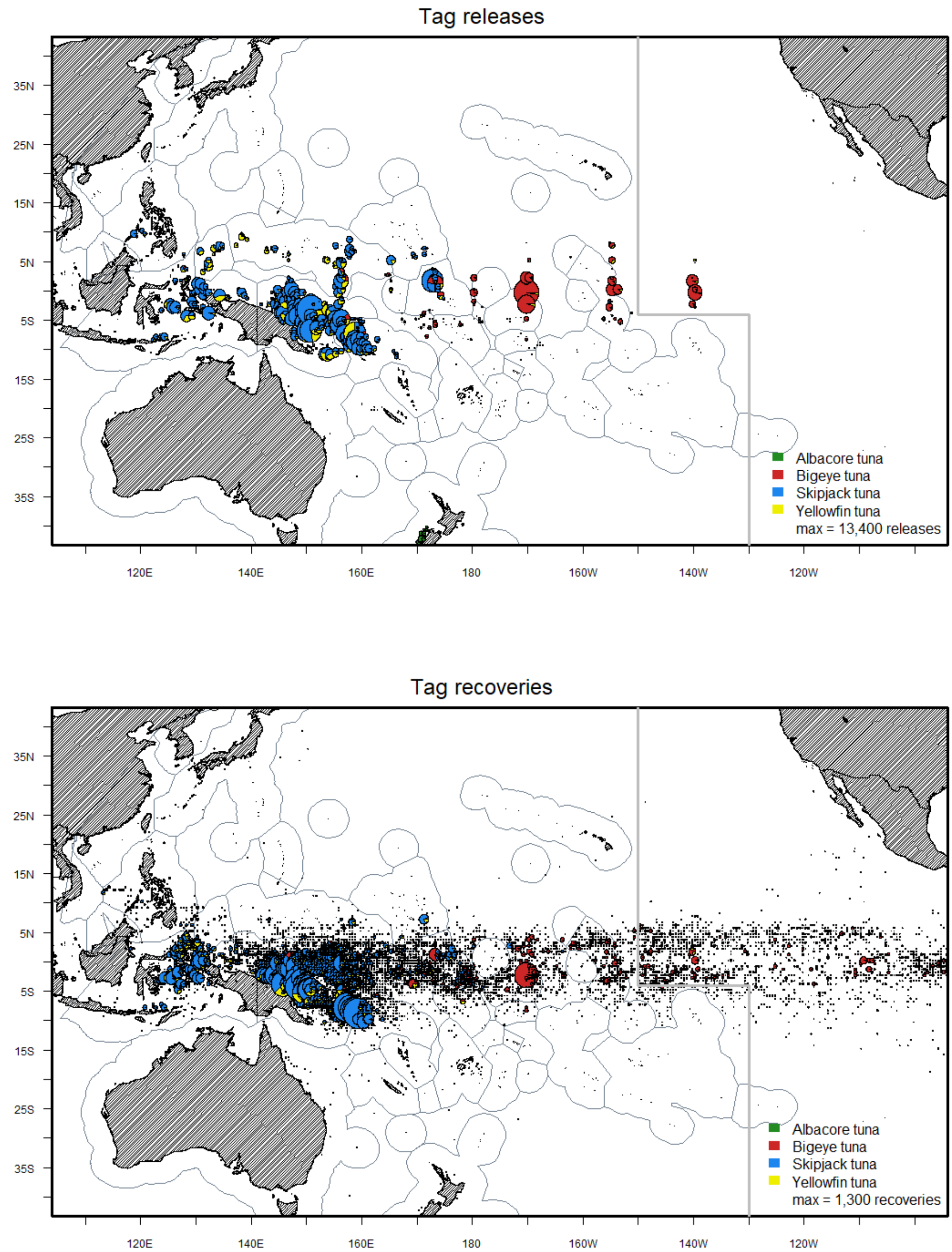


Figure 14: Tag releases (top) and recaptures (bottom) by species from the recent Pacific Tuna Tagging Programme (PTTP).

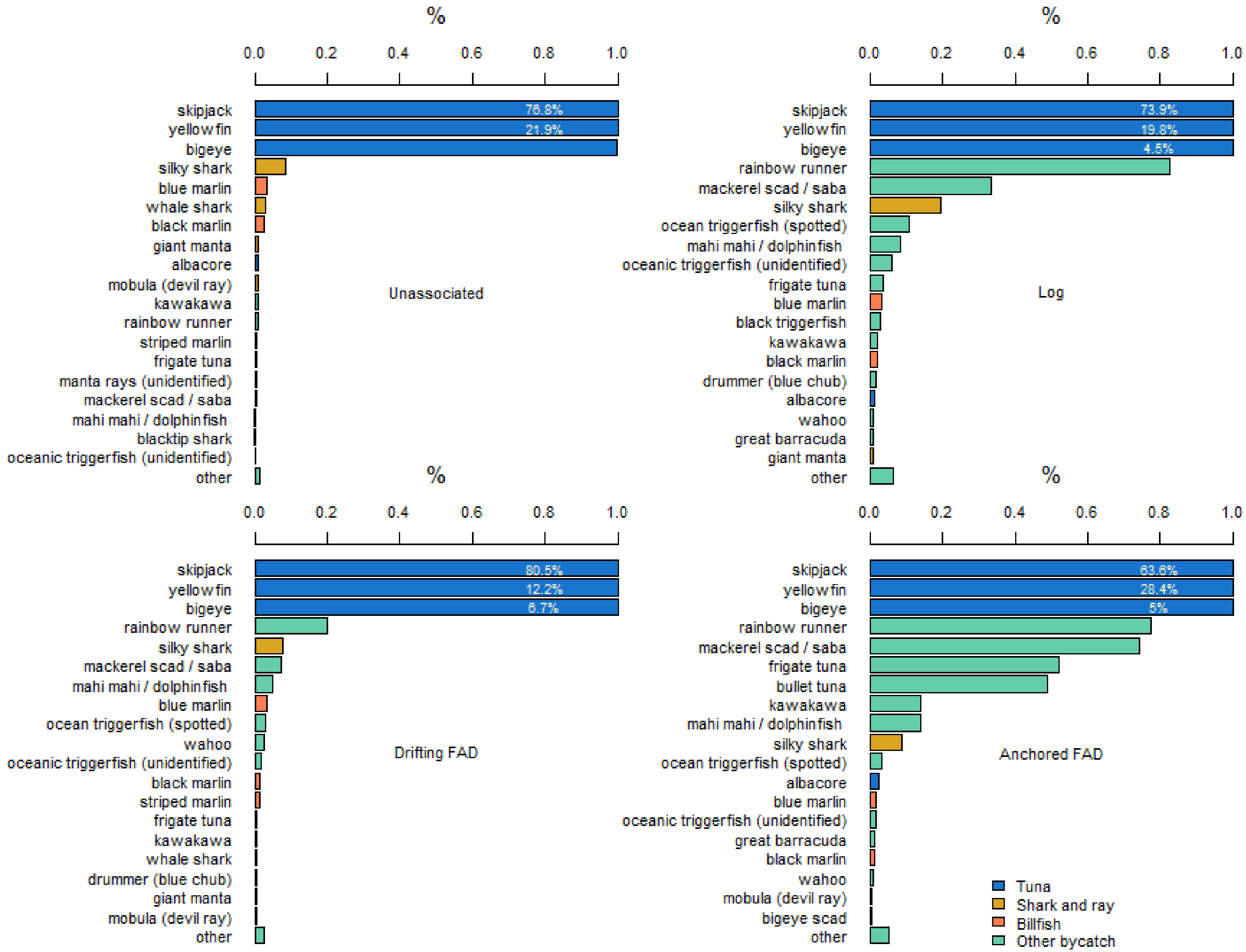


Figure 15: Catch composition of the various categories of purse seine fisheries operating in the WCPO based on observer data from the last five years' data. Note: the y-axis stops at 1% and bars exceeding 1% have the value displayed in the bar.

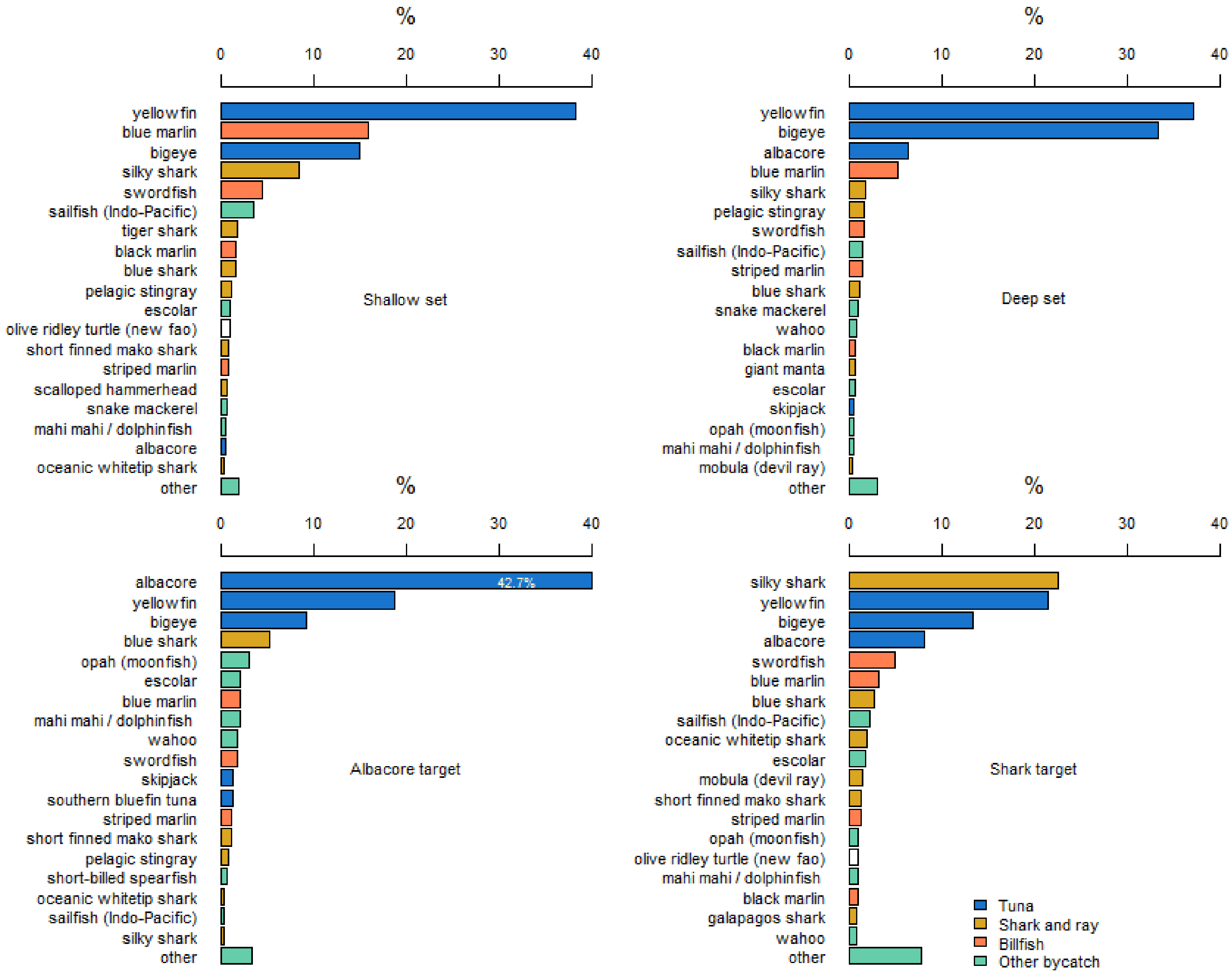


Figure 16: Catch composition of the various categories of longline fisheries operating in the WCPO based on observer data from the last five years' data.

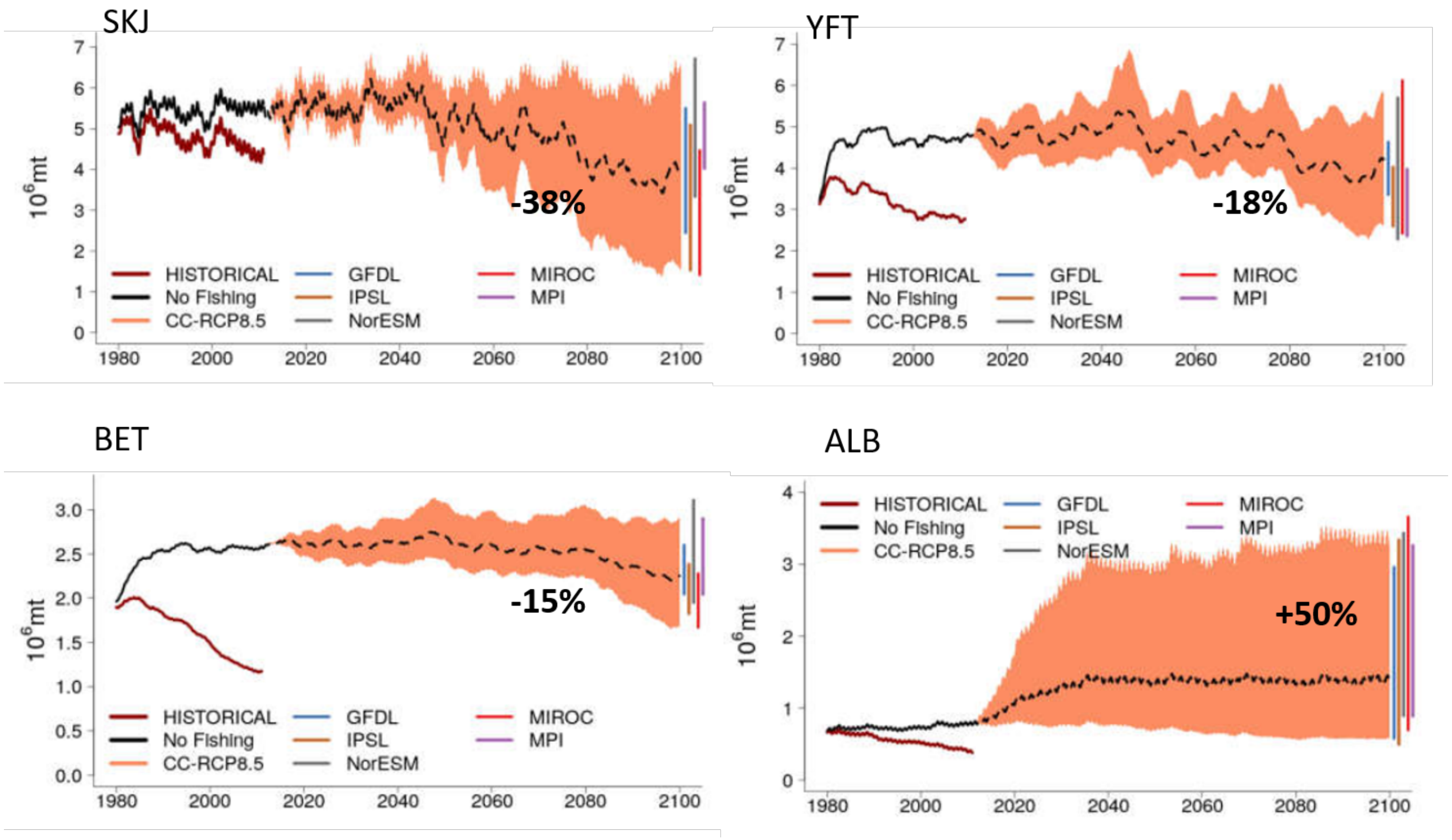


Figure 17: Envelope of predictions computed from simulation ensembles under IPCC RCP8.5 scenario for the western central Pacific Ocean. The change in total biomass is presented with the average (dotted line) and its envelope bounded by the 5% and 95% quantile values of the simulation ensembles. The percentage values represent the change in the mean biomass across runs in the 1990-2010 time window compared with 2090-2100. Modified from Senina *et al.*(2018).

Table 1: Catch (metric tonnes) by gear for the western and central Pacific region, 1960 to 2017. Note : data for 2017 are preliminary.

Year	Longline	Pole and line	Purse seine	Troll	Other	Total
1960	129,874	73,800	5,224	0	31,195	240,093
1961	123,330	132,070	14,540	0	34,536	304,476
1962	128,804	157,412	18,875	0	34,947	340,038
1963	122,263	98,628	11,934	0	36,795	269,620
1964	102,481	143,323	29,012	0	41,334	316,150
1965	103,955	134,621	8,621	0	41,727	288,924
1966	145,278	218,900	16,913	0	46,993	428,084
1967	128,047	174,774	14,508	5	52,006	369,340
1968	120,136	183,954	15,143	14	52,327	371,574
1969	122,806	354,784	9,483	0	57,703	544,776
1970	141,360	409,754	16,222	50	69,633	637,019
1971	143,625	392,914	24,511	0	68,925	629,975
1972	161,533	242,745	29,031	268	87,209	520,786
1973	166,399	330,841	36,269	484	103,281	637,274
1974	145,192	370,499	29,548	898	109,578	655,715
1975	164,049	279,663	27,685	646	111,669	583,712
1976	198,013	382,627	40,770	25	104,582	726,017
1977	218,413	345,257	53,491	621	136,322	754,104
1978	212,059	407,482	52,040	1,686	131,084	804,351
1979	211,221	344,799	90,102	814	124,684	771,620
1980	230,625	398,498	116,756	1,489	89,969	837,337
1981	191,732	348,917	158,559	2,118	107,884	809,210
1982	179,575	316,457	255,489	2,552	107,990	862,063
1983	175,498	342,287	442,152	949	109,378	1,070,264
1984	162,111	415,016	462,278	3,124	118,478	1,161,007
1985	177,722	287,892	409,535	3,468	136,812	1,015,429
1986	169,129	360,864	474,837	2,284	146,873	1,153,987
1987	179,966	294,879	543,979	2,350	131,849	1,153,023
1988	200,774	327,997	608,995	4,671	151,193	1,293,630
1989	170,876	311,981	664,659	8,687	165,164	1,321,367
1990	188,842	247,104	795,527	7,219	203,508	1,442,200
1991	160,889	290,006	1,006,763	8,004	203,129	1,668,791
1992	199,688	259,762	975,740	6,844	163,536	1,605,570
1993	195,377	293,014	846,115	4,612	145,262	1,484,380
1994	221,367	262,721	971,566	7,493	162,850	1,625,997
1995	217,417	298,301	927,490	23,585	168,062	1,634,855
1996	215,466	301,279	896,444	17,807	208,032	1,639,028
1997	226,375	298,666	959,215	18,732	178,199	1,681,187
1998	251,197	323,645	1,257,392	19,099	213,779	2,065,112
1999	219,024	338,480	1,068,961	13,476	211,900	1,851,841

Table 1: ***(continued)***

Year	Longline	Pole and line	Purse seine	Troll	Other	Total
2000	247,904	319,854	1,143,294	25,845	235,670	1,972,567
2001	264,291	272,483	1,118,920	17,329	211,934	1,884,957
2002	281,369	286,202	1,265,453	16,129	215,317	2,064,470
2003	261,346	303,905	1,258,225	19,875	223,218	2,066,569
2004	284,782	322,179	1,354,240	23,445	260,314	2,244,960
2005	250,167	266,735	1,479,329	13,293	195,972	2,205,496
2006	255,328	257,594	1,512,945	10,098	212,599	2,248,564
2007	245,129	284,661	1,655,499	9,249	244,044	2,438,582
2008	247,389	269,551	1,709,352	11,740	252,565	2,490,597
2009	280,197	264,350	1,785,791	9,898	277,286	2,617,522
2010	273,777	270,123	1,703,131	11,320	260,010	2,518,361
2011	261,423	275,070	1,550,491	11,973	239,331	2,338,288
2012	274,476	242,960	1,844,077	14,018	298,991	2,674,522
2013	242,065	229,560	1,897,360	84,098	238,445	2,691,528
2014	262,796	206,939	2,059,008	96,240	258,221	2,883,204
2015	267,938	214,144	1,752,754	92,968	311,123	2,638,927
2016	234,987	198,360	1,832,990	141,117	277,820	2,685,274
2017	243,276	151,232	1,825,444	10,972	326,687	2,557,611

Table 2: Catch (metric tonnes) by species for the four main tuna species taken in the western and central Pacific region, 1960 to 2017. Note : data for 2017 are preliminary.

Year	Albacore tuna	Bigeye tuna	Skipjack tuna	Yellowfin tuna	Total
1960	31,463	45,025	89,938	73,667	240,093
1961	32,922	39,380	156,736	75,438	304,476
1962	37,602	36,868	181,624	83,944	340,038
1963	26,815	44,346	122,703	75,756	269,620
1964	26,687	32,391	182,918	74,154	316,150
1965	28,735	31,333	155,221	73,635	288,924
1966	52,284	33,187	249,514	93,099	428,084
1967	58,822	36,749	204,837	68,932	369,340
1968	64,213	30,426	195,027	81,908	371,574
1969	72,106	34,358	351,038	87,274	544,776
1970	74,350	40,094	423,416	99,159	637,019
1971	100,737	43,220	380,891	105,127	629,975
1972	109,655	57,142	237,804	116,185	520,786
1973	131,149	48,854	328,718	128,553	637,274
1974	115,162	52,765	356,360	131,428	655,715
1975	84,651	69,280	288,708	141,073	583,712
1976	132,947	82,730	357,624	152,716	726,017
1977	83,171	83,293	404,033	183,607	754,104
1978	111,161	66,177	450,528	176,485	804,351
1979	86,007	73,205	414,178	198,230	771,620
1980	95,156	72,169	452,495	217,517	837,337
1981	88,095	64,043	437,902	219,170	809,210
1982	89,496	72,548	479,672	220,347	862,063
1983	65,988	77,285	651,702	275,289	1,070,264
1984	74,540	84,994	731,096	270,377	1,161,007
1985	77,060	87,998	570,624	279,747	1,015,429
1986	71,757	93,009	730,058	259,163	1,153,987
1987	63,645	109,311	673,306	306,761	1,153,023
1988	67,948	109,019	812,803	303,860	1,293,630
1989	73,533	108,632	787,713	351,489	1,321,367
1990	63,872	126,404	857,072	394,852	1,442,200
1991	58,322	111,513	1,077,401	421,555	1,668,791
1992	74,452	131,284	971,559	428,275	1,605,570
1993	77,496	111,952	926,621	368,311	1,484,380
1994	96,461	128,347	990,463	410,726	1,625,997
1995	91,750	109,947	1,020,888	412,270	1,634,855
1996	91,140	120,844	1,011,978	415,066	1,639,028
1997	112,900	165,739	906,514	496,034	1,681,187
1998	112,465	177,286	1,171,291	604,070	2,065,112
1999	131,066	157,882	1,046,141	516,752	1,851,841

Table 2: *(continued)*

Year	Albacore tuna	Bigeye tuna	Skipjack tuna	Yellowfin tuna	Total
2000	101,171	147,422	1,154,538	569,436	1,972,567
2001	121,561	149,743	1,080,010	533,643	1,884,957
2002	147,793	168,502	1,260,536	487,639	2,064,470
2003	122,949	141,820	1,256,139	545,661	2,066,569
2004	122,343	192,564	1,348,243	581,810	2,244,960
2005	105,135	150,920	1,397,584	551,857	2,205,496
2006	104,986	158,858	1,497,594	487,126	2,248,564
2007	126,701	144,189	1,650,702	516,990	2,438,582
2008	104,966	155,014	1,620,614	610,003	2,490,597
2009	135,476	152,987	1,785,371	543,688	2,617,522
2010	124,898	140,199	1,690,373	562,891	2,518,361
2011	115,766	161,204	1,536,151	525,167	2,338,288
2012	143,215	164,887	1,760,949	605,471	2,674,522
2013	137,770	155,120	1,846,182	552,456	2,691,528
2014	121,705	159,791	2,008,929	592,779	2,883,204
2015	118,147	141,344	1,800,419	579,017	2,638,927
2016	98,642	149,362	1,797,002	640,268	2,685,274
2017	119,023	129,173	1,627,971	681,444	2,557,611

Table 3: Biological reference points from the latest stock assessments for South Pacific albacore, bigeye, skipjack, and yellowfin tunas. All biomasses are in metric tonnes (t). SB_{recent} is the average spawning biomass over the last 3 years for albacore and skipjack and 4 yeras for bigeye and yellowfin; $SB_{F=0}$ is the average spawning potential predicted to occur in the absence of fishing; MSY is the maximum sustainable yield based on recent patterns of fishing; F_{recent}/F_{MSY} is the ratio of recent fishing mortality to that which will support the MSY; $SB_{recent}/SB_{F=0}$ Spawning potential in the latest time period relative to that predicted to occur in the absence of fishing. Note: for bigeye and yellowfin tuna the values referenced are the median of the grid, and for all the recent period will vary depending on the assessment.

	Albacore tuna	Bigeye tuna	Skipjack tuna	Yellowfin tuna
SB_{recent}	240,569	665,441	4,188,258	1,994,655
$SB_{F=0}$	462,633	1,858,775	7,221,135	2,368,557
MSY	98,080	159,020	1,891,600	586,400
F_{recent}/F_{MSY}	0.2	0.77	0.45	0.72
$SB_{recent}/SB_{F=0}$	0.52	0.36	0.58	0.38

Table 4: Skipjack tuna catch (metric tonnes) by gear type for the western and central Pacific region, 1960 to 2017. Note : data for 2017 are preliminary.

Year	Longline	Pole and line	Purse seine	Troll	Other	Total
1960	0	70,428	3,728	0	15,782	89,938
1961	0	127,011	11,693	0	18,032	156,736
1962	4	152,387	11,674	0	17,559	181,624
1963	0	94,757	9,592	0	18,354	122,703
1964	5	137,106	25,006	0	20,801	182,918
1965	11	129,933	4,657	0	20,620	155,221
1966	52	215,600	10,949	0	22,913	249,514
1967	124	168,846	10,937	0	24,930	204,837
1968	83	162,379	7,636	0	24,929	195,027
1969	130	315,795	5,043	0	30,070	351,038
1970	1,608	379,074	7,519	0	35,215	423,416
1971	1,475	333,284	13,703	0	32,429	380,891
1972	1,544	172,827	18,065	0	45,368	237,804
1973	1,861	253,217	19,205	0	54,435	328,718
1974	2,124	289,202	11,012	0	54,022	356,360
1975	1,919	218,271	13,499	0	55,019	288,708
1976	2,096	276,582	22,839	0	56,107	357,624
1977	3,127	294,641	35,025	0	71,240	404,033
1978	3,233	331,401	34,665	0	81,229	450,528
1979	2,179	285,859	59,998	0	66,142	414,178
1980	632	333,597	79,970	12	38,284	452,495
1981	756	296,065	96,840	17	44,224	437,902
1982	972	264,726	165,872	64	48,038	479,672
1983	2,144	298,928	300,970	154	49,506	651,702
1984	870	366,811	315,007	284	48,124	731,096
1985	1,108	238,932	276,678	146	53,760	570,624
1986	1,439	322,665	340,989	219	64,746	730,058
1987	2,329	252,142	360,133	168	58,534	673,306
1988	1,937	295,325	456,964	299	58,278	812,803
1989	2,507	275,088	451,437	244	58,437	787,713
1990	363	211,573	550,377	176	94,583	857,072
1991	885	259,778	725,013	148	91,577	1,077,401
1992	432	218,765	661,305	168	90,889	971,559
1993	573	255,152	592,839	175	77,882	926,621
1994	379	209,636	703,256	228	76,964	990,463
1995	598	247,744	681,905	12,298	78,343	1,020,888
1996	3,935	242,486	659,808	6,514	99,235	1,011,978
1997	4,070	236,999	569,967	9,218	86,260	906,514
1998	5,030	266,772	789,487	8,316	101,686	1,171,291
1999	4,208	255,330	680,365	5,660	100,578	1,046,141

Table 4: *(continued)*

Year	Longline	Pole and line	Purse seine	Troll	Other	Total
2000	4,559	264,407	754,994	15,005	115,573	1,154,538
2001	5,059	212,668	750,332	7,536	104,415	1,080,010
2002	3,450	207,488	937,991	6,796	104,811	1,260,536
2003	3,824	238,179	897,656	9,721	106,759	1,256,139
2004	4,051	249,936	951,774	15,118	127,364	1,348,243
2005	1,084	216,715	1,049,714	6,302	123,769	1,397,584
2006	1,528	208,731	1,145,930	3,987	137,418	1,497,594
2007	1,175	213,010	1,270,729	3,598	162,190	1,650,702
2008	803	218,570	1,226,906	4,572	169,763	1,620,614
2009	1,220	201,323	1,408,514	4,252	170,062	1,785,371
2010	1,191	223,409	1,302,265	4,705	158,803	1,690,373
2011	1,124	206,843	1,174,327	4,214	149,643	1,536,151
2012	2,004	170,538	1,400,218	6,235	181,954	1,760,949
2013	1,254	169,025	1,481,038	49,031	145,834	1,846,182
2014	1,874	148,684	1,639,791	76,509	142,071	2,008,929
2015	1,794	151,344	1,400,995	61,397	184,889	1,800,419
2016	5,514	156,559	1,383,165	85,461	166,303	1,797,002
2017	2,551	123,132	1,283,336	5,074	213,878	1,627,971

Table 5: Yellowfin tuna catch (metric tonnes) by gear type for the western and central Pacific region, 1960 to 2017. Note : data for 2017 are preliminary.

Year	Longline	Pole and line	Purse seine	Troll	Other	Total
1960	55,020	1,872	1,438	0	15,337	73,667
1961	53,166	3,259	2,777	0	16,236	75,438
1962	55,547	4,225	6,975	0	17,197	83,944
1963	53,185	2,071	2,277	0	18,223	75,756
1964	45,247	5,074	3,647	0	20,186	74,154
1965	45,493	3,434	3,752	0	20,956	73,635
1966	61,654	2,192	5,844	0	23,409	93,099
1967	36,083	3,125	3,421	0	26,303	68,932
1968	46,070	2,706	7,047	0	26,085	81,908
1969	51,627	5,166	3,869	0	26,612	87,274
1970	55,806	4,606	7,814	0	30,933	99,159
1971	57,766	5,248	9,219	0	32,894	105,127
1972	61,175	7,465	10,039	0	37,506	116,185
1973	62,291	7,458	14,976	0	43,828	128,553
1974	58,116	6,582	17,289	0	49,441	131,428
1975	69,462	7,801	12,781	0	51,029	141,073
1976	77,570	17,186	15,194	0	42,766	152,716
1977	94,414	15,257	15,866	0	58,070	183,607
1978	110,202	12,767	14,115	0	39,401	176,485
1979	108,910	11,638	28,117	0	49,565	198,230
1980	125,113	15,142	33,827	9	43,426	217,517
1981	97,114	22,044	52,020	16	47,976	219,170
1982	86,149	17,123	74,221	54	42,800	220,347
1983	90,259	17,184	119,639	51	48,156	275,289
1984	76,988	17,633	121,477	67	54,212	270,377
1985	79,973	22,717	113,659	69	63,329	279,747
1986	68,999	17,970	106,765	62	65,367	259,163
1987	75,407	19,044	152,316	48	59,946	306,761
1988	88,855	20,566	122,785	76	71,578	303,860
1989	73,306	22,133	180,563	73	75,414	351,489
1990	79,300	20,769	207,867	68	86,848	394,852
1991	63,512	19,182	241,894	51	96,916	421,555
1992	77,739	23,043	265,269	98	62,126	428,275
1993	72,055	20,486	215,176	141	60,453	368,311
1994	82,184	21,378	230,186	101	76,877	410,726
1995	88,306	23,209	217,224	2,570	80,961	412,270
1996	91,887	30,551	191,561	2,636	98,431	415,066
1997	81,065	22,845	305,531	2,838	83,755	496,034
1998	81,077	27,506	390,068	2,806	102,613	604,070
1999	71,023	26,787	313,720	3,162	102,060	516,752

Table 5: *(continued)*

Year	Longline	Pole and line	Purse seine	Troll	Other	Total
2000	96,851	26,957	332,620	3,343	109,665	569,436
2001	95,540	24,443	311,886	3,716	98,058	533,643
2002	95,644	24,133	263,735	3,172	100,955	487,639
2003	95,712	24,304	316,274	3,101	106,270	545,661
2004	104,059	30,640	322,759	2,706	121,646	581,810
2005	87,417	27,007	368,058	2,508	66,867	551,857
2006	84,994	23,653	306,264	2,607	69,608	487,126
2007	82,434	26,570	328,833	2,854	76,299	516,990
2008	84,182	22,705	423,788	2,903	76,425	610,003
2009	99,357	23,918	316,012	3,027	101,374	543,688
2010	98,263	20,112	344,195	3,611	96,710	562,891
2011	97,446	36,838	303,552	3,802	83,529	525,167
2012	87,666	34,705	375,776	3,935	103,389	605,471
2013	77,204	21,924	342,133	28,091	83,104	552,456
2014	99,707	24,082	351,689	12,906	104,395	592,779
2015	103,025	35,793	300,810	24,505	114,884	579,017
2016	89,248	23,396	385,007	42,903	99,714	640,268
2017	84,790	12,219	480,129	3,081	101,225	681,444

Table 6: Bigeye tuna catch (metric tonnes) by gear type for the western and central Pacific region, 1960 to 2017. Note : data for 2017 are preliminary.

Year	Longline	Pole and line	Purse seine	Troll	Other	Total
1960	43,467	1,500	58	0	0	45,025
1961	37,517	1,800	63	0	0	39,380
1962	35,895	800	173	0	0	36,868
1963	42,540	1,800	6	0	0	44,346
1964	30,989	1,143	231	0	28	32,391
1965	29,848	1,254	201	0	30	31,333
1966	31,984	1,108	9	0	86	33,187
1967	33,632	2,803	61	0	253	36,749
1968	27,757	2,272	193	0	204	30,426
1969	32,571	1,675	50	0	62	34,358
1970	34,965	1,589	572	0	2,968	40,094
1971	38,359	931	687	0	3,243	43,220
1972	51,040	1,762	650	0	3,690	57,142
1973	42,412	1,258	735	0	4,449	48,854
1974	45,653	1,039	1,086	0	4,987	52,765
1975	61,488	1,334	1,246	0	5,212	69,280
1976	73,325	3,423	1,628	0	4,354	82,730
1977	72,083	3,325	1,931	0	5,954	83,293
1978	56,364	3,337	2,145	0	4,331	66,177
1979	63,837	2,540	1,862	0	4,966	73,205
1980	62,537	2,916	2,630	0	4,086	72,169
1981	46,590	3,382	9,447	0	4,624	64,043
1982	48,578	4,993	14,835	0	4,142	72,548
1983	46,311	5,077	21,193	0	4,704	77,285
1984	52,976	4,557	22,414	0	5,047	84,994
1985	58,629	5,529	17,665	0	6,175	87,998
1986	56,989	4,133	25,541	0	6,346	93,009
1987	68,832	4,602	30,325	0	5,552	109,311
1988	68,288	5,890	28,038	0	6,803	109,019
1989	64,916	6,131	30,138	0	7,447	108,632
1990	77,009	5,985	35,288	0	8,122	126,404
1991	61,033	3,929	37,204	0	9,347	111,513
1992	75,966	4,055	45,062	0	6,201	131,284
1993	66,566	4,505	35,211	0	5,670	111,952
1994	79,175	5,251	36,098	0	7,823	128,347
1995	68,125	6,228	27,184	145	8,265	109,947
1996	58,054	7,940	44,494	432	9,924	120,844
1997	68,597	6,563	82,649	412	7,518	165,739
1998	85,048	6,405	76,283	507	9,043	177,286
1999	74,959	5,856	68,004	316	8,747	157,882

Table 6: *(continued)*

Year	Longline	Pole and line	Purse seine	Troll	Other	Total
2000	76,912	6,838	53,272	397	10,003	147,422
2001	78,670	5,905	55,728	408	9,032	149,743
2002	92,381	6,109	60,424	713	8,875	168,502
2003	83,016	5,296	43,668	142	9,698	141,820
2004	99,705	9,238	72,507	232	10,882	192,564
2005	78,597	6,851	60,707	220	4,545	150,920
2006	83,560	9,781	60,387	157	4,973	158,858
2007	81,350	7,296	50,255	187	5,101	144,189
2008	83,365	9,204	57,833	212	4,400	155,014
2009	80,492	7,916	59,188	175	5,216	152,987
2010	72,507	7,027	56,341	275	4,049	140,199
2011	77,566	5,655	72,132	251	5,600	161,204
2012	83,971	3,934	63,890	273	12,819	164,887
2013	65,637	5,009	72,201	3,446	8,827	155,120
2014	74,235	4,714	65,519	4,222	11,101	159,791
2015	70,798	5,687	49,877	4,265	10,717	141,344
2016	62,714	3,930	61,129	10,437	11,152	149,362
2017	58,332	1,411	58,289	198	10,943	129,173

Table 7: Albacore tuna catch (metric tonnes) by gear type for the western and central Pacific region south of the Equator, 1960 to 2017. Note : data for 2017 are preliminary.

Year	Longline	Pole and line	Purse seine	Troll	Other	Total
1960	22,248	45	0	0	0	22,293
1961	23,742	0	0	0	0	23,742
1962	35,219	0	0	0	0	35,219
1963	31,095	16	0	0	0	31,111
1964	22,824	0	0	0	0	22,824
1965	25,455	0	0	0	0	25,455
1966	38,661	0	0	0	0	38,661
1967	43,952	0	0	5	0	43,957
1968	32,368	0	0	14	0	32,382
1969	24,805	0	0	0	0	24,805
1970	34,775	100	0	50	0	34,925
1971	38,530	100	0	0	0	38,630
1972	39,131	122	0	268	0	39,521
1973	46,705	141	0	484	0	47,330
1974	33,039	112	0	898	0	34,049
1975	22,849	105	0	646	0	23,600
1976	28,957	100	0	25	0	29,082
1977	38,019	100	0	621	0	38,740
1978	32,890	100	0	1,686	0	34,676
1979	26,162	100	0	814	0	27,076
1980	30,972	101	0	1,468	0	32,541
1981	32,694	0	0	2,085	5	34,784
1982	28,347	1	0	2,434	6	30,788
1983	24,309	0	0	744	39	25,092
1984	20,340	2	0	2,773	1,589	24,704
1985	27,138	0	0	3,253	1,937	32,328
1986	32,641	0	0	2,003	1,946	36,590
1987	21,979	9	0	2,134	930	25,052
1988	28,288	0	0	4,296	5,283	37,867
1989	18,738	0	0	8,370	21,968	49,076
1990	21,304	245	0	6,975	7,538	36,062
1991	26,292	14	0	7,805	1,489	35,600
1992	32,014	11	0	6,578	65	38,668
1993	30,998	74	0	4,296	70	35,438
1994	34,998	67	0	7,164	89	42,318
1995	30,508	139	0	7,716	104	38,467
1996	26,763	30	0	7,410	156	34,359
1997	34,657	21	0	4,679	133	39,490
1998	43,970	36	0	6,280	85	50,371
1999	35,955	138	0	3,447	74	39,614

Table 7: ***(continued)***

Year	Longline	Pole and line	Purse seine	Troll	Other	Total
2000	40,642	102	0	6,455	139	47,338
2001	52,855	37	0	5,253	199	58,344
2002	68,411	18	0	4,661	150	73,240
2003	56,351	12	0	5,984	130	62,477
2004	57,024	110	0	4,614	123	61,871
2005	59,897	29	0	3,503	137	63,566
2006	59,343	29	0	2,884	188	62,444
2007	56,500	17	0	2,014	60	58,591
2008	59,066	12	0	3,502	160	62,740
2009	80,638	21	0	2,031	211	82,901
2010	84,949	14	0	2,139	190	87,292
2011	62,494	30	0	3,189	233	65,946
2012	84,896	41	0	2,962	248	88,147
2013	81,523	26	0	3,226	248	85,023
2014	79,545	26	0	2,403	248	82,222
2015	79,245	26	0	2,581	248	82,100
2016	65,883	26	0	2,097	367	68,373
2017	90,664	28	0	2,416	212	93,320

Table 8: Total of bigeye, skipjack, and yellowfin tuna tagged during the three major tropical tuna tagging projects in the western and central Pacific region. Note: Separate EEZ results are provided for any region with more than 10,000 releases in any single programme; SSAP = Skipjack Survey and Assessment Programme (1977-1981); RTTP = Regional Tuna Tagging Programme (1989-1992); PTTP = Pacific Tuna Tagging Programme (2006-2017).

	PTTP		**RTTP**		**SSAP**	
EEZ	**Releases**	**Recoveries**	**Releases**	**Recoveries**	**Releases**	**Recoveries**
FJ		9	5,197	528	28,980	2,659
FM	25,038	2,676	11,711	1,779	8,791	330
ID	40,416	6,616	13,740	2,653		37
IW	17,487	7,310				
KI	40,594	4,981	14,754	851	5,212	449
NZ	2863	9		2	15,020	1,000
PG	217,034	30,519	44,502	3,677	9,079	1,077
PF				1	29,693	128
PW	7,304	262	7,495	142	8,663	114
SB	78,163	8,481	15,226	2,372	7,870	597
Other	5,395	1,712	39,042	6,925	48,976	1,077
TOTAL	434,294	62,575	151,667	18,930	162,284	7,468

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