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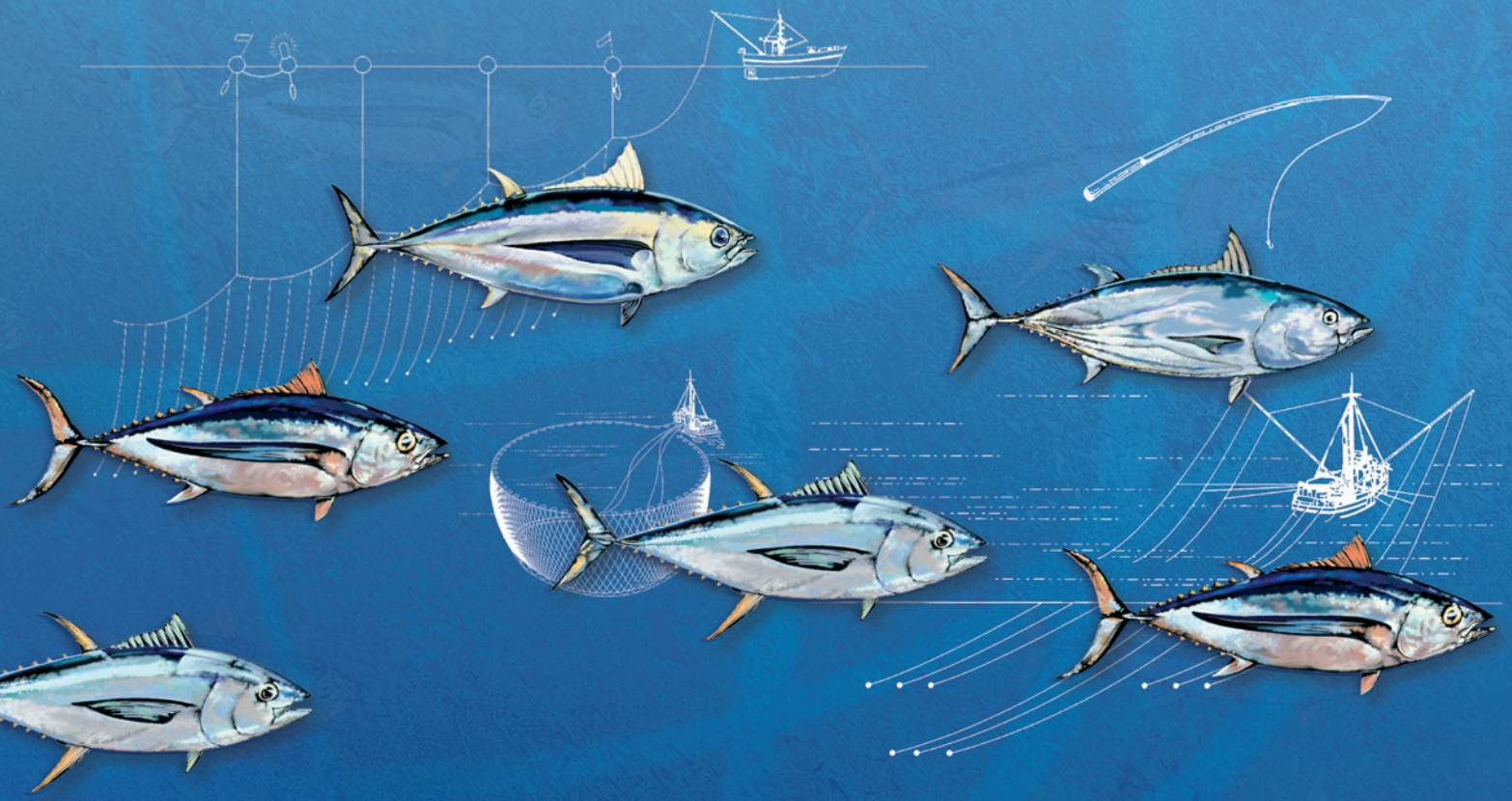
THE WESTERN AND CENTRAL PACIFIC TUNA FISHERY:

2012 OVERVIEW AND STATUS OF STOCKS

Shelton Harley, Peter Williams, Simon Nicol, and John Hampton



Oceanic Fisheries Programme

Tuna Fisheries Assessment Report N °13

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Contents

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 focuses on the main tuna stocks targeted by the fishery — skipjack tuna (*Katsuwonus pelamis*), yellowfin tuna (*Thunnus albacares*), bigeye tuna (*T. obesus*), and South Pacific albacore tuna (*T. alalunga*).

The report is in three main parts: the first section provides an overview of the fishery, with emphasis on developments during 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 and other associated and dependent species. 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.

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1 The western and central Pacific tuna fishery

The tuna fishery 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), is a diverse fishery 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 of Pacific states as well as 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 are greatest for 2011 (including both the gear totals and the break down by species) and much more minor before this. The 2012 catch estimate from Indonesia uses a different method and is considerably higher than the estimates for earlier years. This has yet to be verified, might be expected to change, and has an impact on some perceived changes in catch from 2011 for yellowfin and bigeye tuna.

There are now two years of catch data which have not yet been included in the stock assessments, so comparisons between recent catches and estimated sustainable yields require caution.

Annual total catches 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. Over the past seven years, there has been an upward trend in total tuna catch, primarily due to increases in purse-seine fishery catches (Figure 2 and Table 1). The provisional total WCP–CA tuna catch for 2012 was estimated at **2,588,011 tonnes (t)**, a recovery from the drop experienced in 2011. This was 259,811 t higher than the 2011 catch (2,328,200 t) and only 15,635 t lower than the record catch in 2009 (2,603,646 t). In 2012, the purse-seine fishery accounted for an estimated 1,799,097 t (70% of the total catch, and the highest catch ever for this fishery), with pole-and-line taking an estimated 214,981 t (8% and the lowest catch in over 40 years), the longline fishery an estimated 263,194 t (10%), and the remainder (12%) taken by troll gear and a variety of artisanal gear, mostly in eastern Indonesia and the Philippines. The WCP–CA tuna catch for 2012 represented 81% of the total Pacific Ocean catch and 58% of the global tuna catch (the provisional estimate for 2012 is 4,456,605 t).

The 2012 WCP–CA catch of skipjack (**1,647,936 t** — 64% of the total catch) was a recovery from the low point in 2011 which had reflected the low catch rates from the purse-seine fishery in the second half of 2011 (Table 2). The WCP–CA yellowfin catch for 2012 (**646,165 t** — 25%) is clearly the highest on record, but is particularly sensitive to the 2012 Indonesia catch estimate. The WCP–CA bigeye catch for 2012 (**161,561 t** — 6%) but is also particularly sensitive to the 2012 Indonesia catch estimate. The 2012 WCP–CA albacore catch (**132,349 t** — 5%) was the third highest on record, with longline catches from the South Pacific stock increasing again with increased fishing effort.

The 2012 purse-seine catch of **1,799,097 t** was a record catch for this fishery (Figure 3 and Table 1). The 2012 purse-seine skipjack catch (1,339,502 t — 81% of the total skipjack catch) was a 15% increase from the low in 2011 and the second highest on record. The 2012 purse-seine catch of yellowfin tuna (390,921 t) was the second highest on record after 2008. The provisional purse-seine catch estimate for bigeye tuna for 2012 (68,353 t) was slightly lower than 2011 and 42% of the total 2011 bigeye catch. It is important to note that the purse-seine species composition for 2012 will be revised once all observer data for 2012 have been received and processed.

The 2012 longline catch of **263,194 t** was around 5% lower than the highest on record (2009 – 279,012 t) (Figure 4 and Table 1). The provisional bigeye catch (77,284 t) for 2012 was the second lowest since 2001 (after 2010). The yellowfin catch for 2012 (85,147 t) represented a 10% decline from the 2011 high catch.

In 2011 the overall pole-and-line catches were subject to significant revision due to the new catch estimates from Indonesia. The 2012 pole-and-line catch of **214,981 t** was the lowest catch in over 40 years and was primarily driven by a drop in skipjack catches of over 50,000 t (Figure 5 and Table 1 and 4). Skipjack tends to account for the majority of the catch (~70–80% in recent years, but typically more than 85% of the total catch in tropical areas), and albacore (8–20% in recent years) is taken by the Japanese coastal and offshore fleets in the temperate waters of the northern Pacific Ocean. Yellowfin tuna (5–10%) and a small component of bigeye tuna (1–6%) make up the remainder of the catch. The Japanese distant-water and offshore fleets and the Indonesian fleet account for most of the WCP–CA pole-and-line catch.

The 2012 troll albacore catch in the South Pacific of 2,925 t was 8% smaller than the 2011 catch, but well above the two low catch years of 2009 and 2010. Since 2008 only New Zealand (averaging 2,500 t per year) and the United States (averaging 260 t per year) have had vessels operating in the troll fishery.

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. The three tropical tunas were last assessed in 2011 while south Pacific albacore was last assessed in 2012, therefore much of the information below is unchanged from recent years.

2.1 Skipjack tuna

The 2012 WCP–CA skipjack catch of **1,647,936 t** was a recovery from the low of 2011 (Figure 6 and Table 4). As has been the case in recent years, the main determinant in the overall catch of skipjack is catch taken in the purse-seine fishery (1,339,502 t in 2012 — 81%). The next highest proportion of the catch was 'unclassified' gear in the domestic fisheries of Indonesia, the Philippines and Japan (153,250 t — 9%) slightly ahead of the catch taken by pole-and-line gear (149,220 t — 9%). The longline and troll fisheries accounted for much less than 1% of the total catch.

The majority of the skipjack catch is taken in equatorial areas, and most of the remainder is taken in the seasonal home-water fishery of Japan. The domestic fisheries in Indonesia (purse-seine, pole-and-line and unclassified gear) and the Philippines (e.g. ring-net and purse-seine) account for the majority of the skipjack catch in the western equatorial portion of the WCP–CA.

The dominant 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 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 schools are larger than those taken in associated schools.

2.1.1 Stock assessment

The most recent assessment of skipjack in the WCPO was conducted in 2011 and included data from 1972 to 2010.

While estimates of fishing mortality for skipjack have increased over time, current fishing mortality rates for skipjack tuna are estimated to be about one-third the level of fishing mortality associated with maximum sustainable yield (F_{MSY}). Therefore, overfishing is not occurring (i.e. $F_{CURRENT} < F_{MSY}$) (Figure 7). Estimated recruitment shows an upward trend over time, but estimated biomass is declining over time to about 60% of the level predicted in the absence of fishing. Nevertheless, recent spawning biomass levels are estimated to be well above the SB_{MSY} level.

Based on these results, the WCPFC Scientific Committee noted that if recent fishing patterns continue, catch rate levels are likely to decline and catch should decrease as stock levels are fished down to MSY levels. Due to the rapid change of the fishing mortality and biomass indicators relative to MSY in recent years, increases of fishing effort should be monitored. The commission should consider developing limits on fishing for skipjack to limit the declines in catch rate associated with further declines in biomass.

2.2 Yellowfin tuna

The WCPC-CA yellowfin catch in 2012 of **646,165 t** represents a 24% increase over 2011 catches. This increase is partly, but not entirely, due to the 2012 catch estimate from Indonesia. Purse-seine catches also increased 26% from 2011 to 390,921 t which is the second highest on record and 60% of the total catch (Figure 8 and Table 5). The remainder of the yellowfin tuna catch comes from the pole-and-line fishery (33,935 t and 5%) and the domestic Indonesian and Philippines 'other' gear (131,959 t and 20%). In recent years, the yellowfin longline catch has ranged from 80,000 t to 96,000 t, which is well below catches taken in the late 1970s to early 1980s (90,000–120,000 t). The purse-seine catch of yellowfin tuna is typically around four times the longline catch.

As with skipjack, the great majority of the yellowfin catch is taken in equatorial areas by large purse-seine vessels, and a variety of gear in the Indonesian and Philippine fisheries. The domestic surface fisheries of the Philippines and Indonesia take large numbers of small yellowfin in the range of 20–50 cm. In the purse-seine fishery, smaller yellowfin are caught in log and FAD sets than in unassociated sets. A major portion of the purse-seine catch by weight is adult (> 100 cm) yellowfin tuna, to the extent that the purse-seine catch (by weight) of adult yellowfin tuna is usually higher than the longline catch, which was the case in 2008, when exceptional catches of large yellowfin in the size range 120–130 cm were experienced in the purse-seine fishery.

2.2.1 Stock assessment

The most recent assessment of yellowfin tuna in the WCPO was conducted in 2011 and included data from 1952 to 2010.

Fishing mortality has increased in recent years, but is still estimated to be below F_{MSY}, indicating that overfishing is not occurring (Figure 9). Both biomass and recruitment have declined gradually over the duration of the fishery, but spawning biomass levels are estimated to still be above SB_{MSY}, so the stock is not considered to be in an overfished state. This optimism at the stock level must be tempered by the patterns observed at the subregional level within the stock assessment. Patterns of exploitation and fishery impacts are not the same across the entire model region, with much higher fishery impacts estimated for Region 3, western equatorial Pacific. This region, from which ~81% of catches are taken, is at least fully exploited, with no potential for increased catches. The WCPFC Scientific Committee reiterated earlier advice that there be no increase in fishing mortality in the western equatorial Pacific.

2.3 Bigeye tuna

The WCP–CA 2012 bigeye tuna catch was **161,561 t**, which was 2,000 t higher than the 2011 catch level. Increases in other catch (up 7,000 t to 12,360 t) more than offset small declines in longline, pole-and-line, and purse-seine catches. Longline bigeye catches have ranged between 73,053 t and 96,445 t since 2000, with the 2012 longline catch (77,284 t) slightly below the average (Figure 10 and Table 6). Purse-seine bigeye catches have ranged between 45,390 t and 70,929 t since 2000, with the 2012 longline catch (68,353 t) well above the average, but representing a small decrease from the 2011 catch. The WCP–CA pole-and-line fishery of 3,253 t was the lowest in almost 20 years, but the catch in other fisheries was a record high of 12,360 t based on the 2012 estimate from Indonesia.

The majority of the WCP–CA catch is taken in equatorial areas, both by 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). 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 20–50 cm range. The longline fishery clearly accounts for most of the catch (by weight) of large bigeye in the WCP–CA. This is in contrast to large yellowfin tuna, which (in addition to the longline gear) are also taken in significant amounts from unassociated (free-swimming) 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 ~130 cm fork length (range 80–160 cm FL).

2.3.1 Stock assessment

The most recent assessment of bigeye tuna in the WCPO was conducted in 2011 and included data from 1952 to 2010.

Fishing mortality is estimated to have increased through time, particularly in recent years, and current levels are far in excess of F_{MSY} level ($F_{CURRENT} > F_{MSY}$). Therefore, overfishing is occurring (Figure 11). The biomass of spawners is estimated to have declined over the duration of the fishery and is now approaching SB_{MSY}, and there is a possibility that bigeye tuna is already in an overfished state. The model estimates that recent catches have been sustained by higher-than-average levels of recruitment, which have also maintained biomass above the SB_{MSY} level.

The WCPFC Scientific Committee recommended a reduction of at least 32% in fishing mortality from the average levels for 2006–2009 to return the fishing mortality rate to F_{MSY}. It was considered too early to quantitatively conclude whether the WCPFC Conservation and Management Measure (CMM2008-01) has reduced fishing mortality for bigeye tuna to the levels stated in the objective of the measure. Data for 2009 and 2010 have been incorporated into the stock assessments, but the data for these years are incomplete and estimates of fishing mortality in the final year of the model (2010) are particularly uncertain.

2.4 South Pacific albacore tuna

The South Pacific albacore catch in 2012 (**87,429 t**) was back to around the 2010 record after the 18% drop in 2011 (Figure 12 and Table 7). Longline fishing has accounted for most of the catch of this stock (> 75% in the 1990s, but > 90% in recent years). The troll catch, covering a season spanning November to April, has generally been in the range of 3,000–8,000 t, although it has averaged around 2,700 t over the past five years.

The longline catch is widely distributed in the South Pacific, but with catches concentrated in the western part of the Pacific. Much of the increase in catches is attributed to catches taken by Chinese-Taipei and Chinese vessels fishing north of 20°S. The Pacific Island domestic longline fleet catch is restricted to latitudes 10°–25°S. Troll catches are distributed in New Zealand's coastal waters, mainly off the South Island, and along the sub-tropical convergence zone (STCZ). Less than 20% of the overall South Pacific albacore catch is usually taken east of 150°W.

The longline fishery takes adult albacore, mostly in the narrow size range 90–105 cm, and the troll fishery takes juvenile fish in the range 45–80 cm. Juvenile albacore also appear in the longline catch from time to time.

2.4.1 Stock assessment

The most recent stock assessment for South Pacific albacore tuna was undertaken in 2012 and was based on data from 1960 to 2011. For this assessment a single model run (a reference case) was chosen to show trends in stock size, but the Scientific Committee reached conclusions regarding stock status, sustainable yields, and subsequent management advice based on the median outcomes from a large number of model runs.

The assessment indicates that fishing mortality on adult fish has increased considerably over the past decade, but that overall estimates of fishing mortality are well below $F_{MSY.}$ Therefore, overfishing is not occurring (Figure 13). Spawning biomass levels remain well above SB_{MSY}, so the stock is not in an overfished state. Nevertheless, the current level of longline catch is estimated to be having a considerably higher impact on the portion of the stock vulnerable to the longline fishery. The assessment indicates that the current level of impact is about 70% for fish of the sizes taken in the northern longline fisheries, having increased sharply in recent years.

Given the recent expansion of the fishery and recent declines in exploitable biomass available to longline fisheries, and given the importance of maintaining catch rates, the WCPFC Scientific Committee recommended that longline fishing mortality be reduced if the Commission wishes to maintain economically viable catch rates.

3 Ecosystem considerations

The Convention on the Conservation and Management of Highly Migratory Fish Stocks in the Western and Central Pacific Ocean has identified ecosystem issues as an important element of the principles for conservation and management of the tuna resource in the WCP–CA. This section of the report provides a brief summary of the information available from the WCP–CA tuna fishery concerning associated and dependent species, including information on the species composition of the catch from the tuna fisheries and an assessment of the impact of the fishery on these species. It is important to note that most of these species have received limited attention to date and, consequently, it is possible to provide an assessment of the impact of the fishery for a few species only. The section also includes a summary review of recent and current research that is being undertaken to learn more about the relationship between the main tuna species and the pelagic ecosystem.

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 are of commercial value (by-products), while many others are of no value and are discarded. There are also incidents of the capture of species of ecological and/or social significance ('protected species'), including marine mammals, 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, catches from unassociated and associated purse-seine sets are dominated by tuna species (99.6% and 98.4%, respectively), and there has been limited interaction with protected species (Figure 14). Most of the observed interactions involved unidentified species of marine mammals, and few mortalities have been recorded.

Species composition of the catch has also been estimated for three main longline fisheries operating in the WCPO: the western tropical Pacific (WTP) shallow-setting longline fishery, the WTP deep-setting longline fishery, and the western South Pacific (WSP) 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 44%, 71% and 69% of the total catch (by weight) of the three fisheries respectively (Figure 14). Blue

shark was in the top four-ranked species in the catch composition of all three fisheries. The WTP shallow fishery has a higher proportion of non-tuna species in the catch, principally shark and billfish species, while opah (moonfish) represents 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 fisheries while, overall, the WTP shallow and WSP albacore fisheries catch a higher proportion of surface-orientated species than does the WTP deep-setting fishery.

Interactions with seabirds and marine mammals were very low in all three longline fisheries. Catches of five species of marine turtles were 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.

3.2 Impact of catches

In addition to the main tuna species, annual catch estimates for the WCPO in 2012 are available for the main species of billfish (swordfish [20,127 t], blue marlin [17,558 t], striped marlin [4,686 t] and black marlin [2,050 t]). For the three marlin species the 2012 catches represent declines from 2010 and 2011 catch levels, while for swordfish they represent a small increase. Catches of other associated species cannot be accurately quantified using logsheet data, but estimates should be possible as longline observer coverage increases – purse-seine observer coverage is already sufficiently high to estimate catches of associated species.

In 2012 and 2013, stock assessments were undertaken for several other species taken in WCPO tuna fisheries. The conclusions of the assessments are provided below:

- Southwest Pacific striped marlin: The southwest Pacific striped marlin assessment results indicate that the stock is fully exploited, and is not experiencing overfishing but may be overfished. The WCPFC Scientific Committee noted that recent catches are close to MSY, recent fishing mortality is slightly below F_{MSY}, and recent spawning biomass is slightly below SB_{MSY}. The recent catch increase is driven in part by increases in catch in the northern part of the stock area that is not subject to the current CMM for this stock.
- North Pacific striped marlin: The stock is overfished and experiencing overfishing. Reducing fishing mortality would likely increase spawning stock biomass and may improve the chances of higher recruitment.
- Oceanic whitetip shark: Despite the data limitations going into the assessment and the wide range of uncertainties considered, all of the accepted model runs indicate that the WCPO oceanic whitetip shark stock is currently overfished and overfishing is occurring relative to commonly used MSY-based reference points and depletion-based reference points. Management measures to reduce fishing mortality and to rebuild spawning biomass have been agreed to under CMM 2011-04, but mitigation to avoid capture is recommended. Given the bycatch nature of most of the fishery impacts, mitigation measures provide the best opportunity to improve the status of the WCPO oceanic whitetip shark stock.
- Southwest Pacific swordfish: The assessment was highly sensitive to growth assumptions. Two different growth models, one from Australia (GA) and the other from Hawaii (GH), were included in alternative model runs. The Scientific Committee could not decide which of these two assumptions was more reliable. Assessment runs using the GA growth data indicated that overfishing is occurring but that the stock is not in an overfished state. Assessment runs using the GH growth data indicate that no overfishing is occurring and that the stock is not in an overfished state. The Scientific Committee recommended that given the current uncertainty in the assessment the Commission should adopt a precautionary approach when considering future management arrangements. Specifically it recommended that there be no increase in fishing mortality over current (2007–2010) levels.

- Silky shark: Silky shark is a low productivity species, and estimated fishing mortality has increased to levels far in excess of F_{MSY} and estimated spawning biomass has declined to levels below SB_{MSY} for the majority of the model runs undertaken. The Scientific Committee concluded that overfishing is occurring and that it is highly likely that the stock is in an overfished state. The greatest impact on the stock is attributed to bycatch from the longline fishery in the tropical and subtropical areas, but there are also significant impacts from the associated purse-seine fishery which catches predominantly juvenile sharks. The Commission should consider measures directed at bycatch mitigation as well as measures directed at targeted catch, such as from shark lines, to improve the status of the silky shark population

In 2014, a revised stock assessment is planned for blue shark in the northern hemisphere (to address concerns raised about the 2013 assessment) in addition to the three tropical tuna assessments.

3.3 Tuna tagging

Large-scale tagging experiments are required to provide the level of information (fishery exploitation rates and population size) necessary for stock assessments of tropical tunas in the western and central Pacific Ocean. Tagging data have the potential to provide much information of relevance to stock assessment, either by way of stand-alone analyses or, preferably, through integration with other data directly in the stock assessment model. Tuna tagging has been a core activity of the Oceanic Fisheries Programme for 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 over 390,000 tuna in the equatorial western and central Pacific Ocean with over 65,000 reported recaptures (Figure 15). A summary of tag releases and recoveries is provided in Table 8.

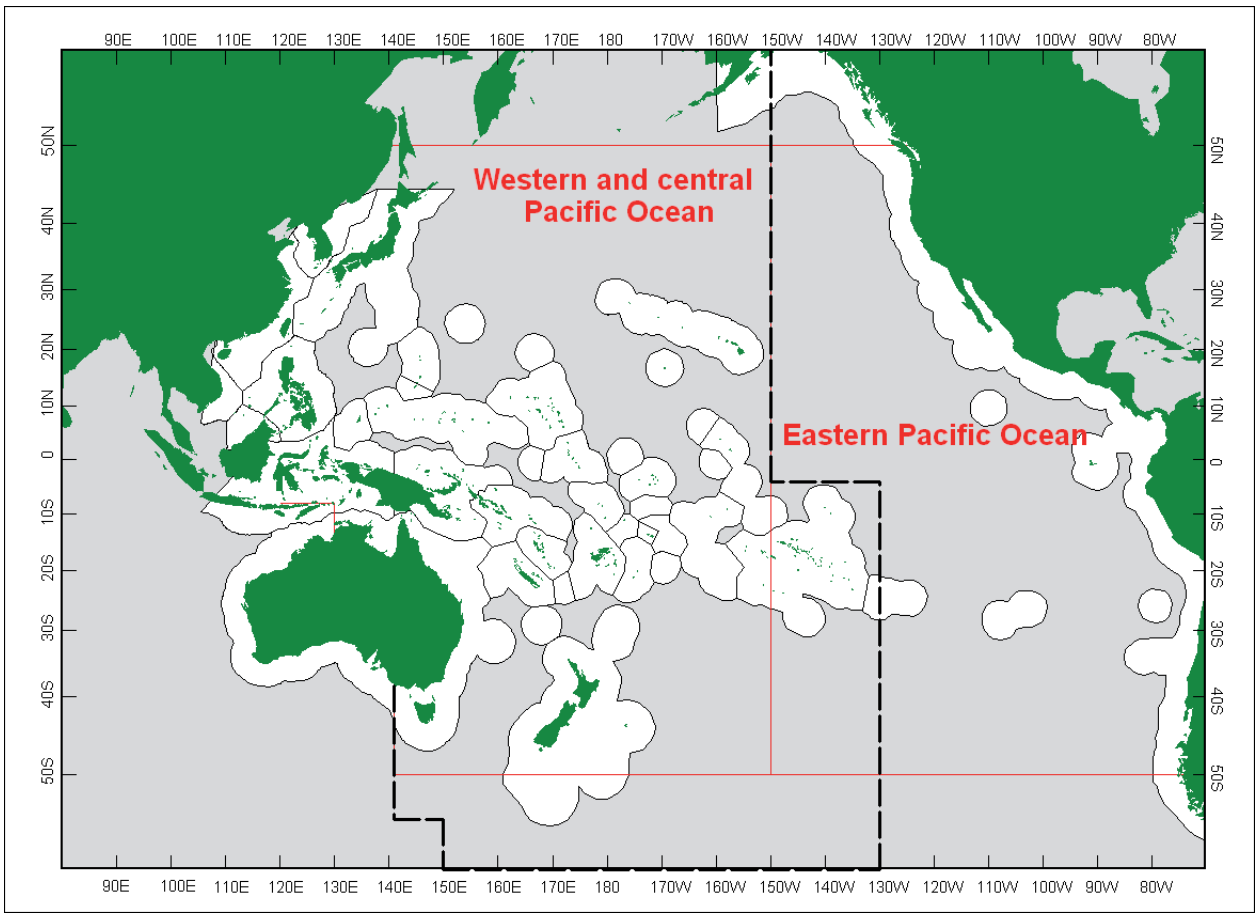

Figure 1: The western and central Pacific Ocean (WCPO), the eastern Pacific Ocean (EPO) and the WCPFC Convention Area boundary (WCP–CA in dashed lines).

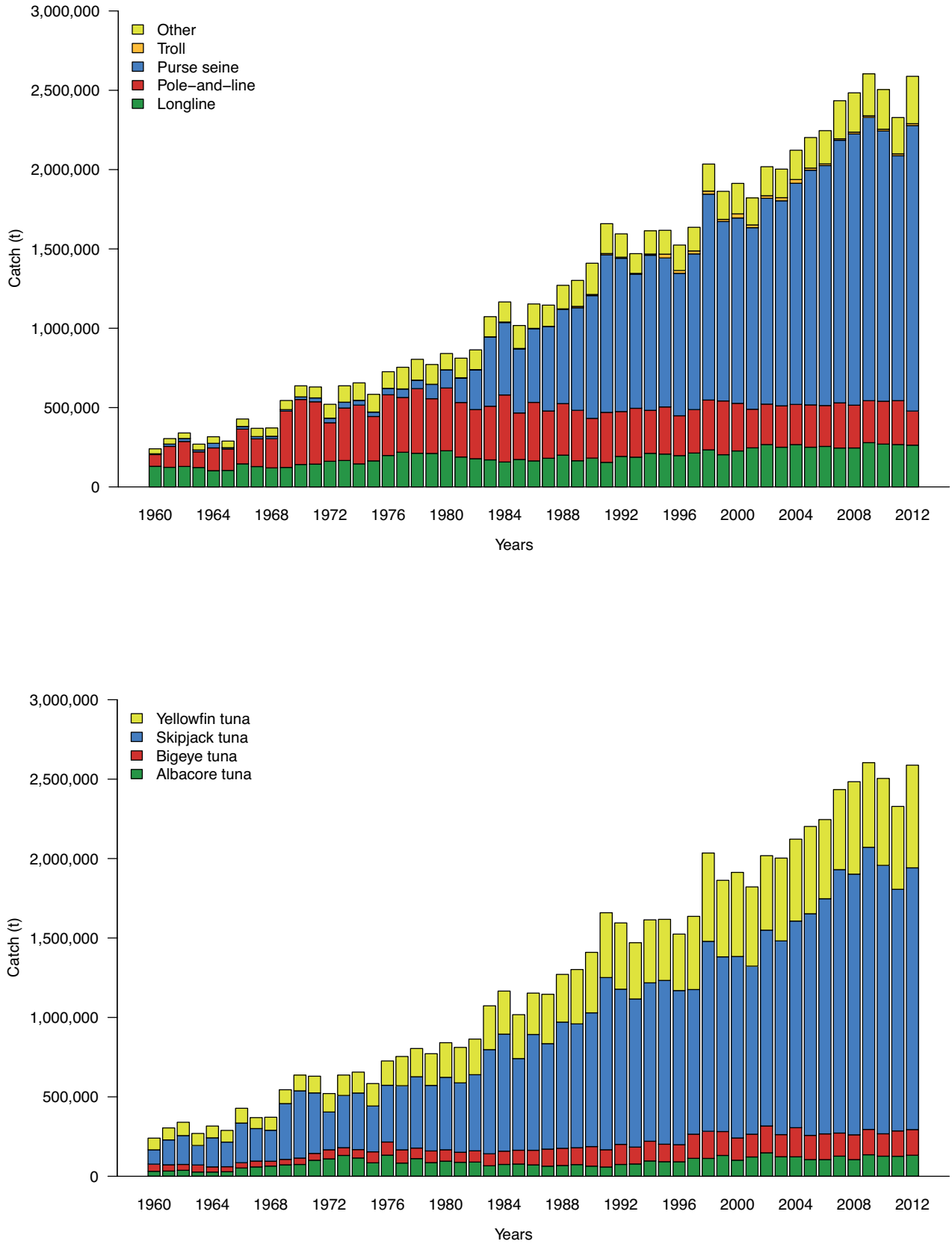

Figure 2: Catch (metric tonnes) by gear (top) and species (bottom) for the western and central Pacific region, 1960–2012. Note: data for 2012 are preliminary.

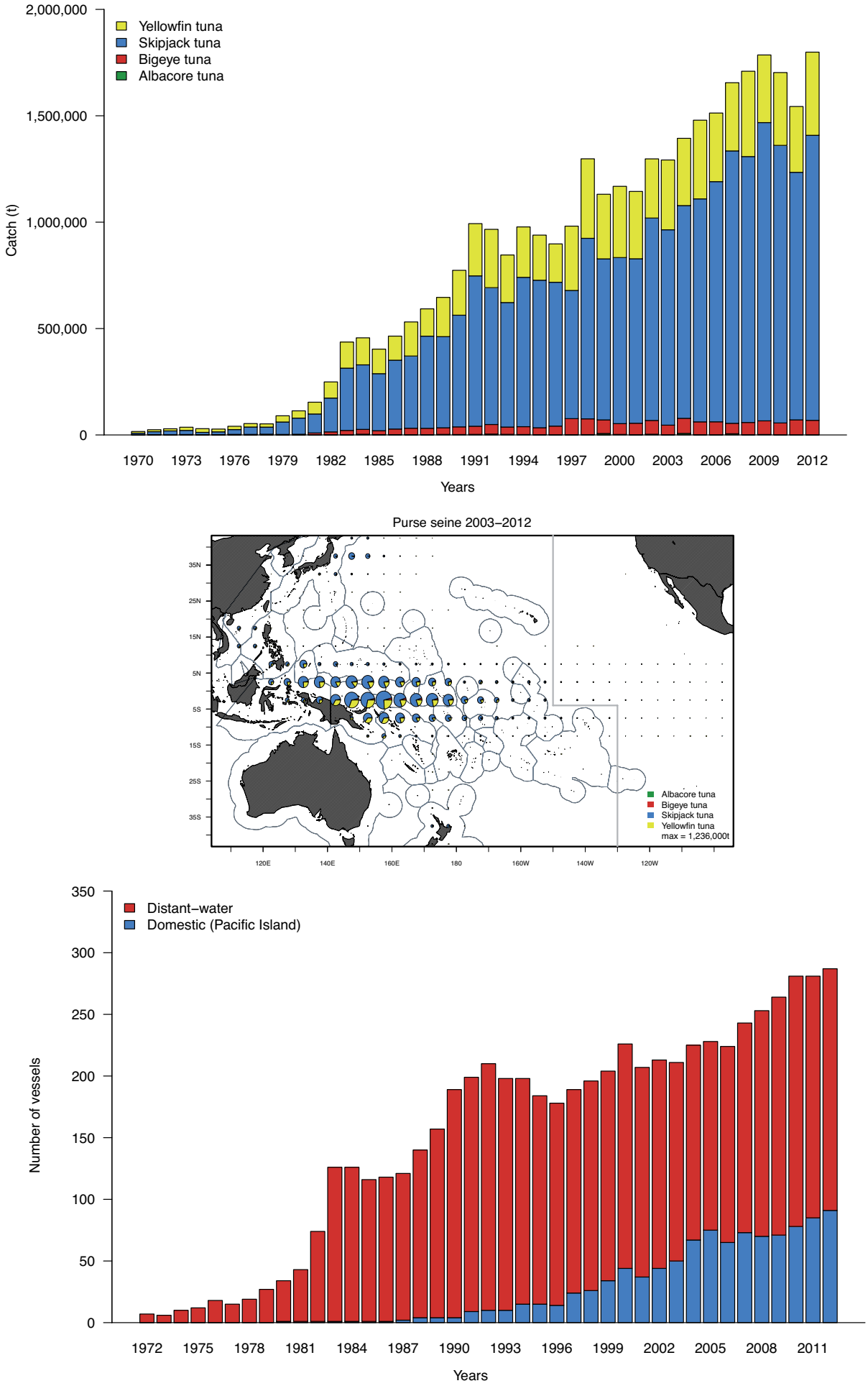

Figure 3: Time series of catch (t) (top), recent spatial distribution of catches (middle), and fleet sizes (bottom) for the purse-seine fishery in the western and central Pacific Ocean (WCPO).

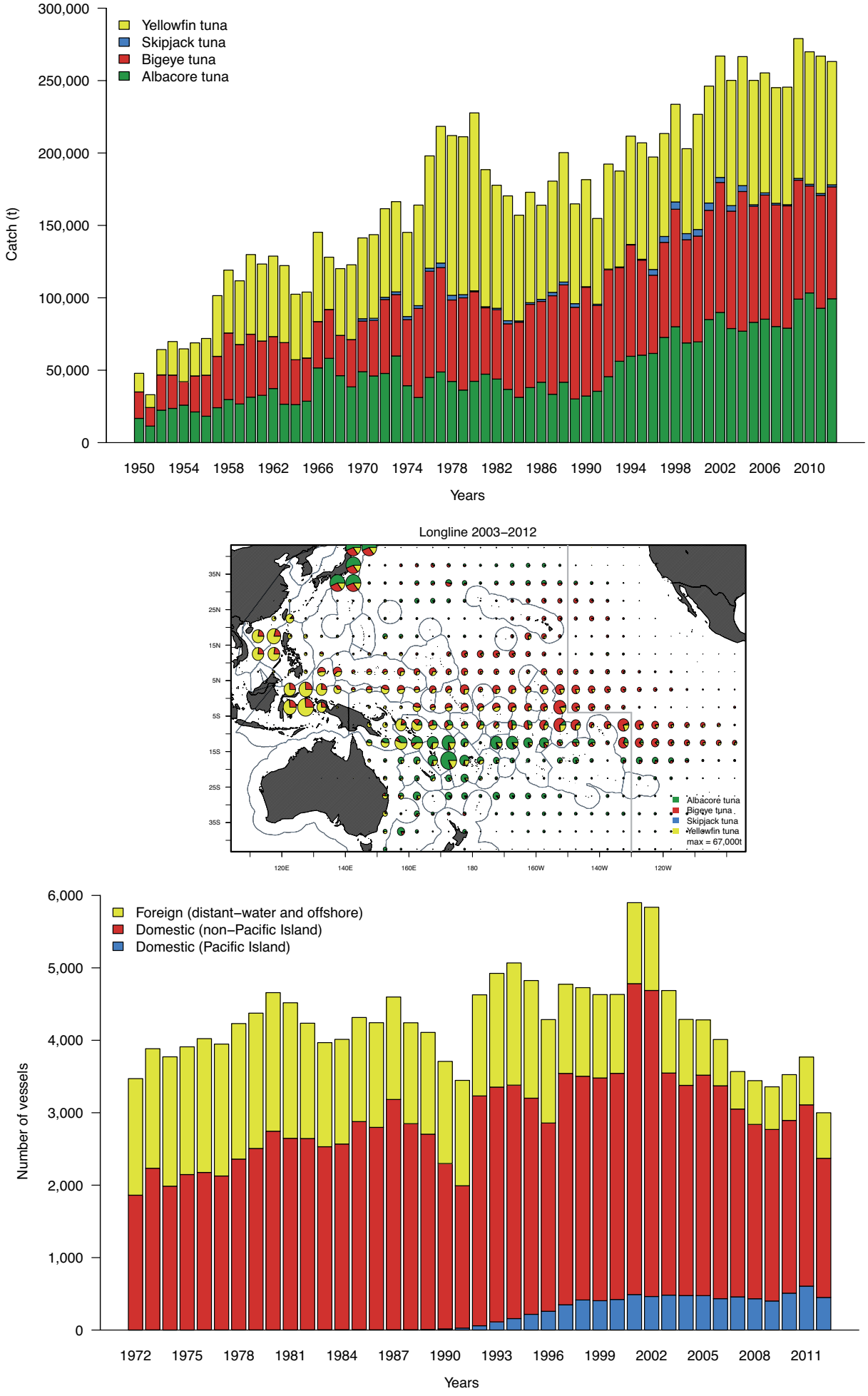

Figure 4: Time series of catch (t) (top), recent spatial distribution of catches (middle), and fleet sizes (bottom), for the longline fishery in the western and central Pacific Ocean (WCPO).

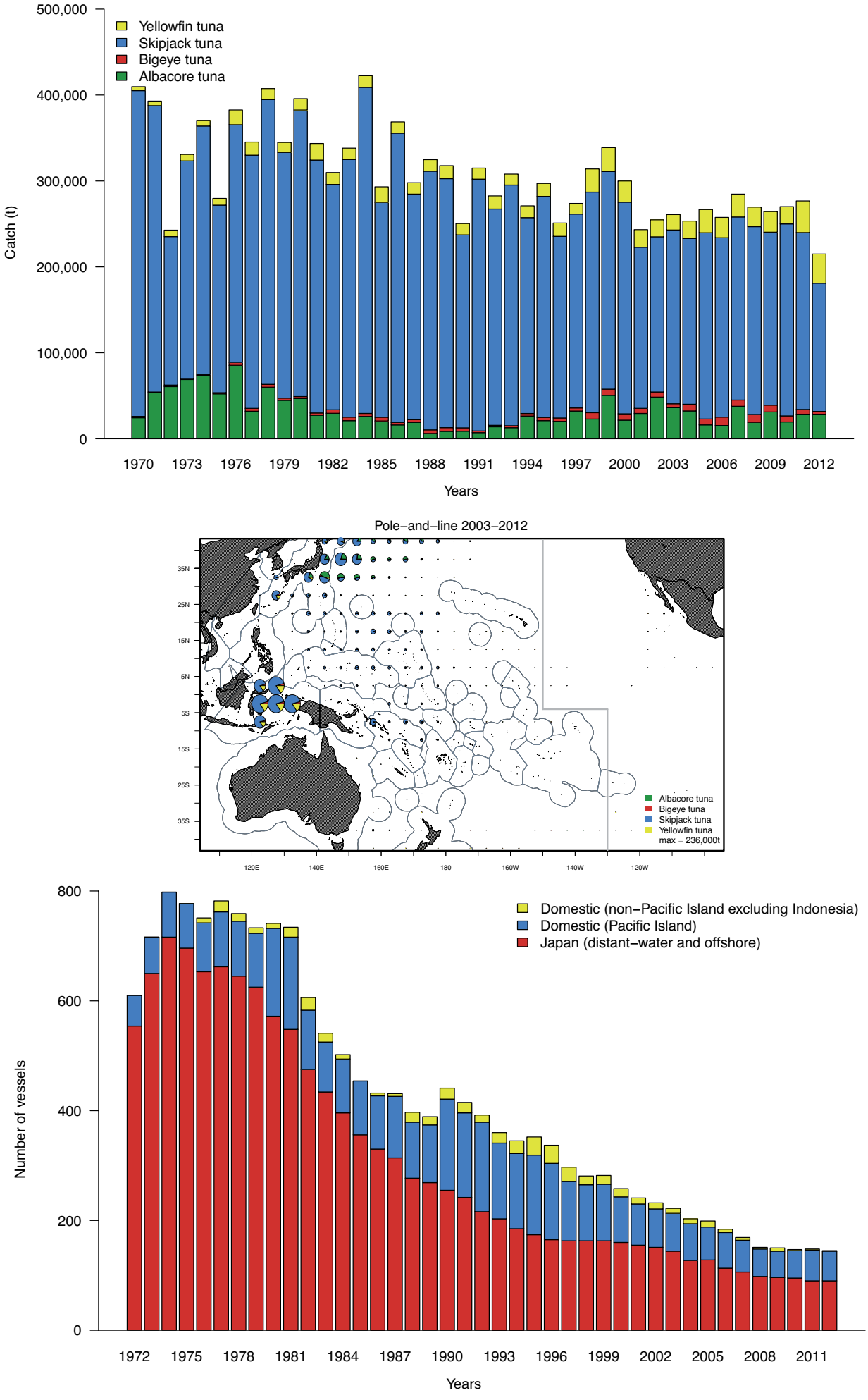

Figure 5: Time series of catch (t) (top), recent spatial distribution of catches (middle), and fleet sizes (bottom), for the pole-and-line fishery in the western and central Pacific Ocean (WCPO).

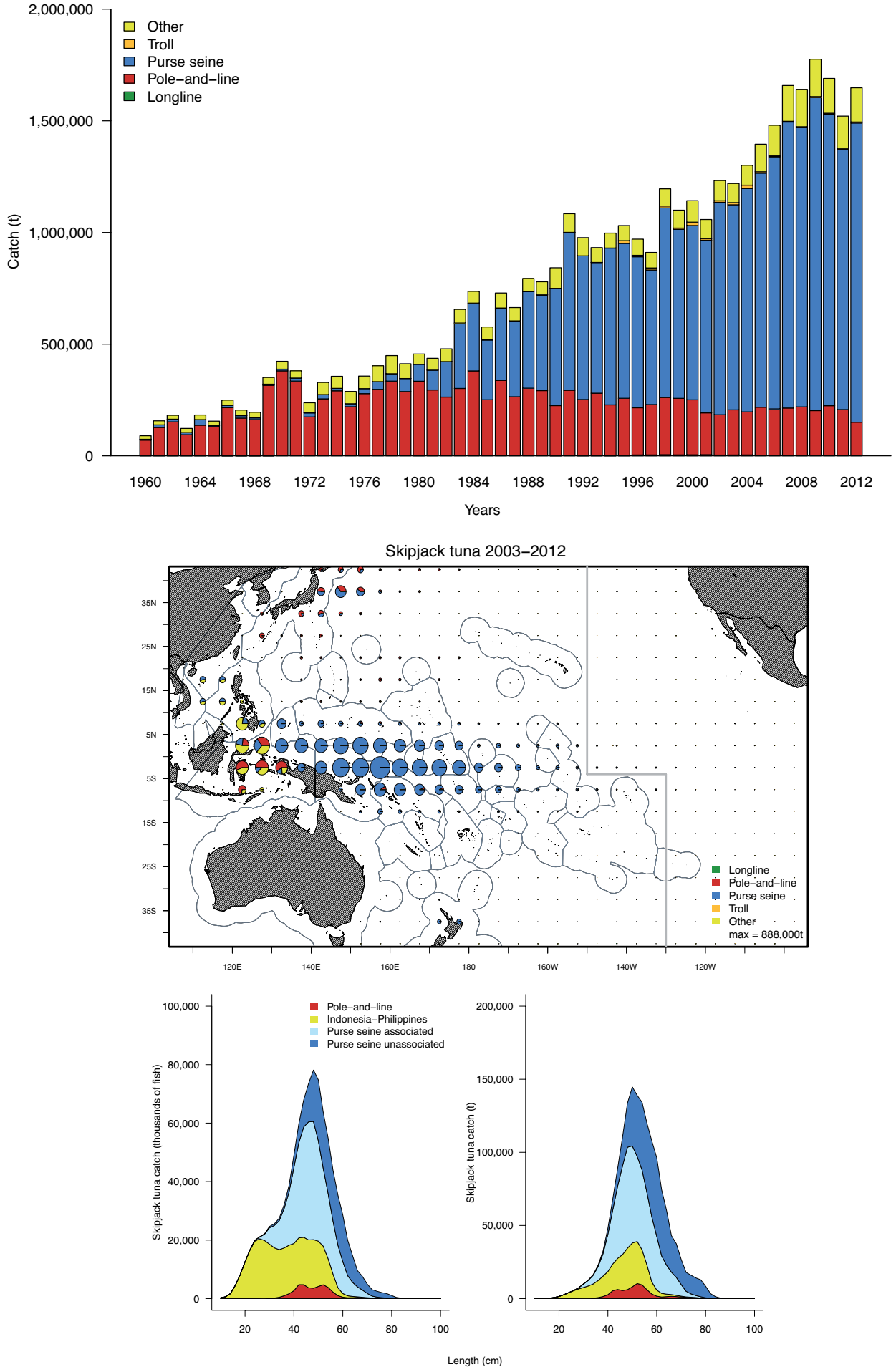

Figure 6: Time series (top), recent spatial distribution (middle), and size composition (average for last five years; bottom) of skipjack tuna catches (t) by gear for the western and central Pacific Ocean (WCPO).

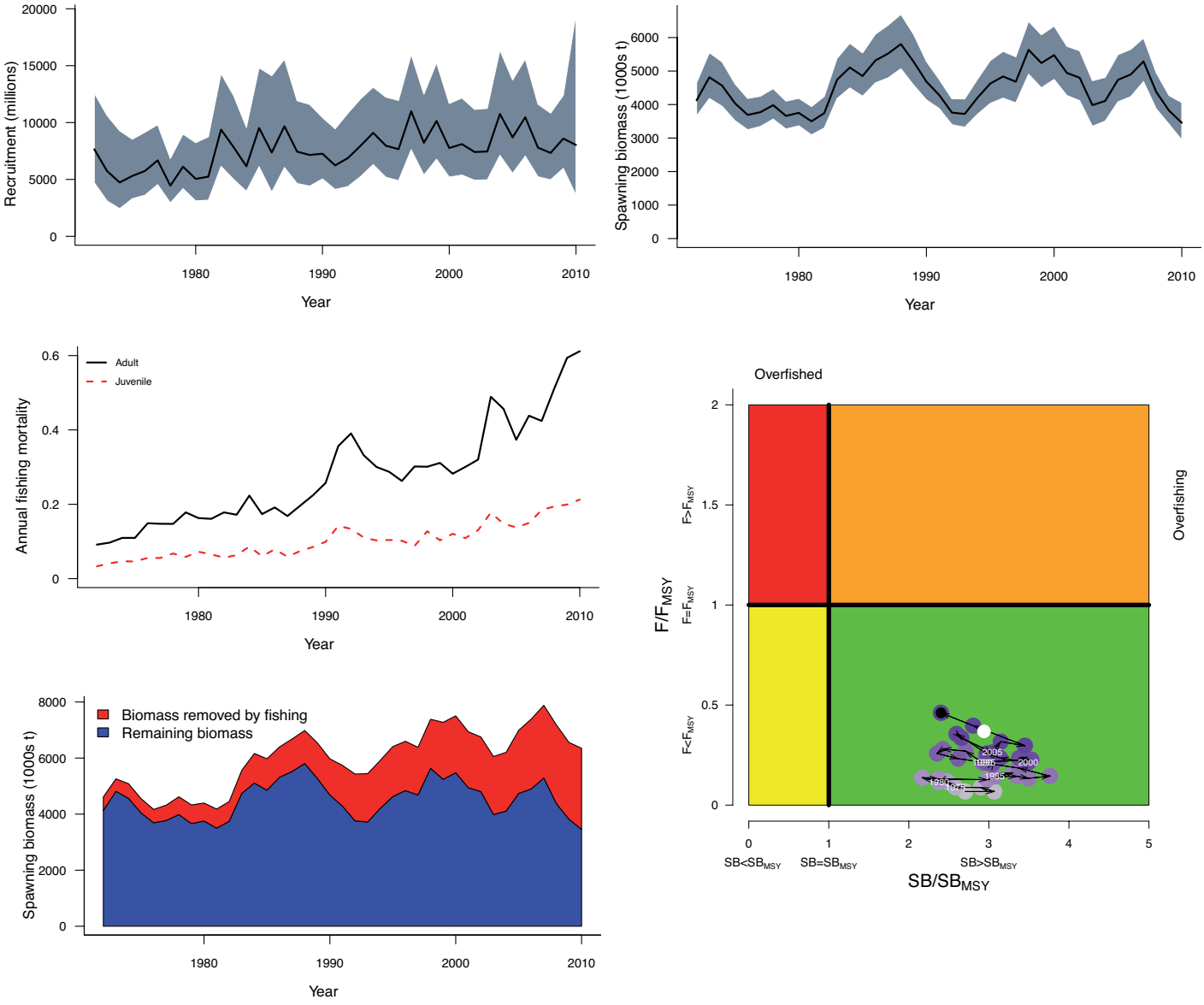

Figure 7: Estimated recruitment (top left), spawning biomass (top right), fishing mortality (middle left), stock status (middle right) and estimated spawning biomass with [blue] and without [red] fishing (bottom left) from the 2011 skipjack tuna stock assessment.

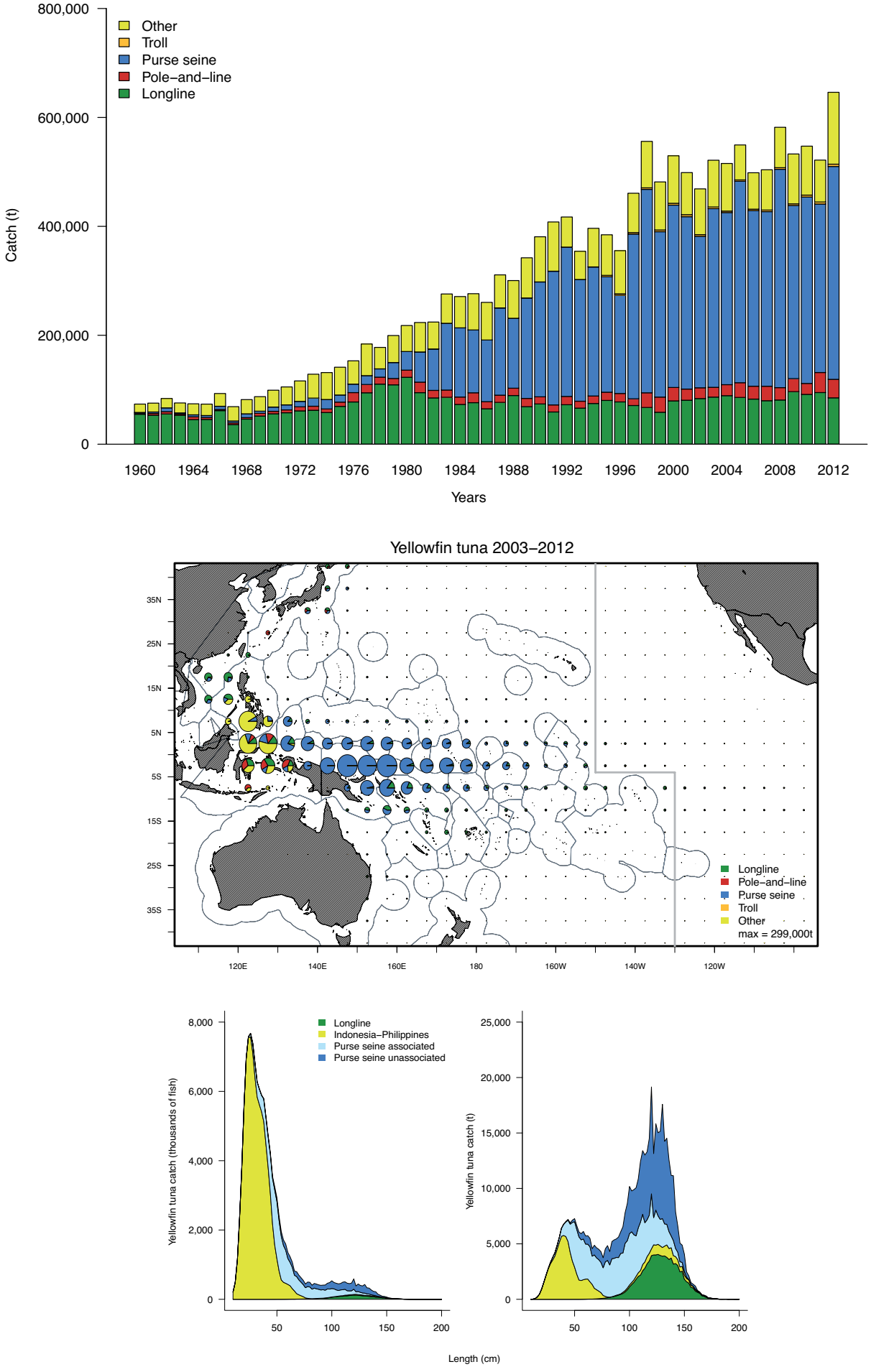

Figure 8: Time series (top), recent spatial distribution (middle), and size composition (average for last five years; bottom) of yellowfin tuna catches (t) by gear for the western and central Pacific Ocean (WCPO).

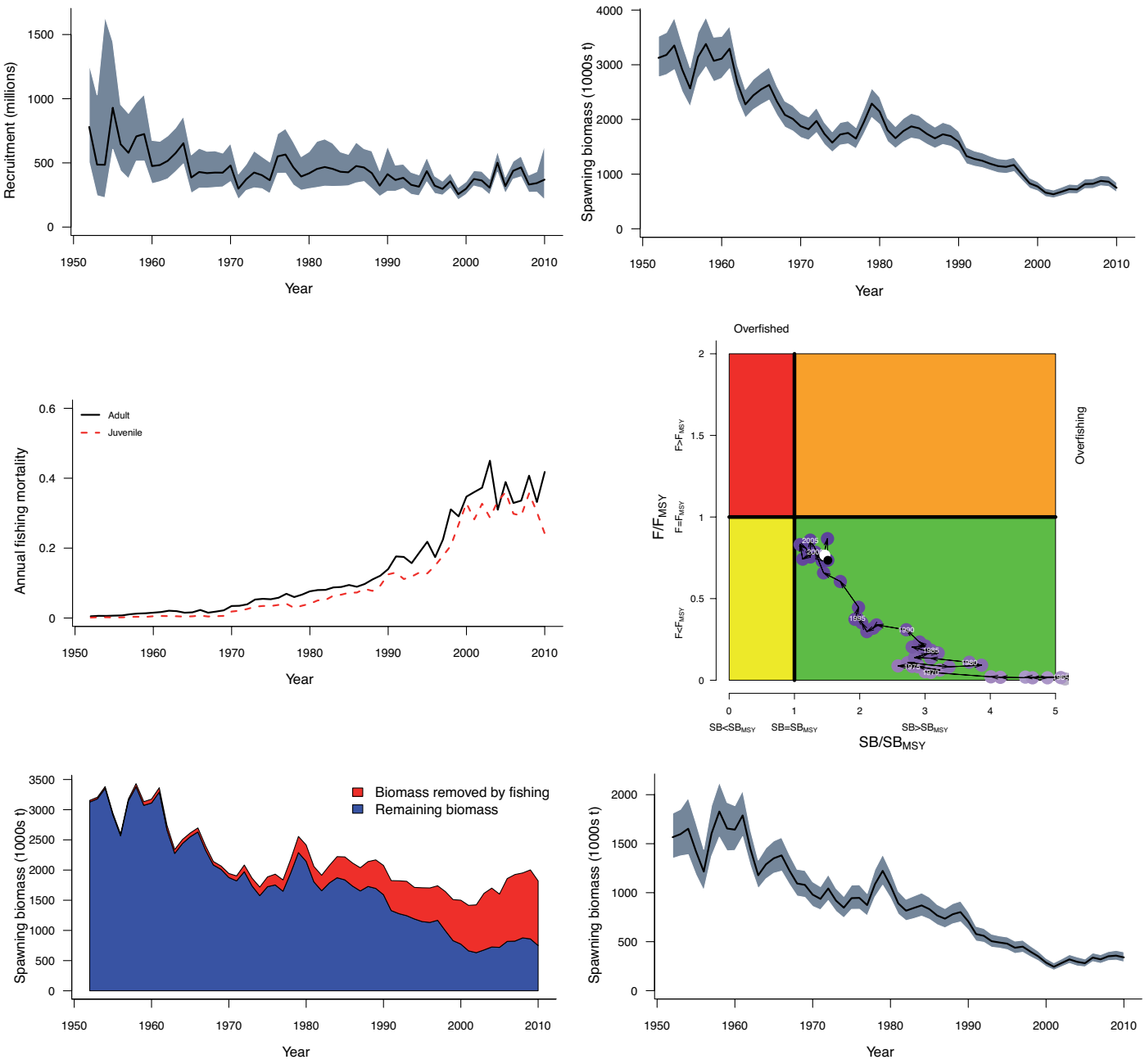

Figure 9: Estimated recruitment (top left), spawning biomass (top right), fishing mortality (middle left), stock status (middle right), estimated spawning biomass with [blue] and without [red] fishing (bottom left), and spawning biomass for the western equatorial region (bottom right) from the 2011 yellowfin tuna stock assessment.

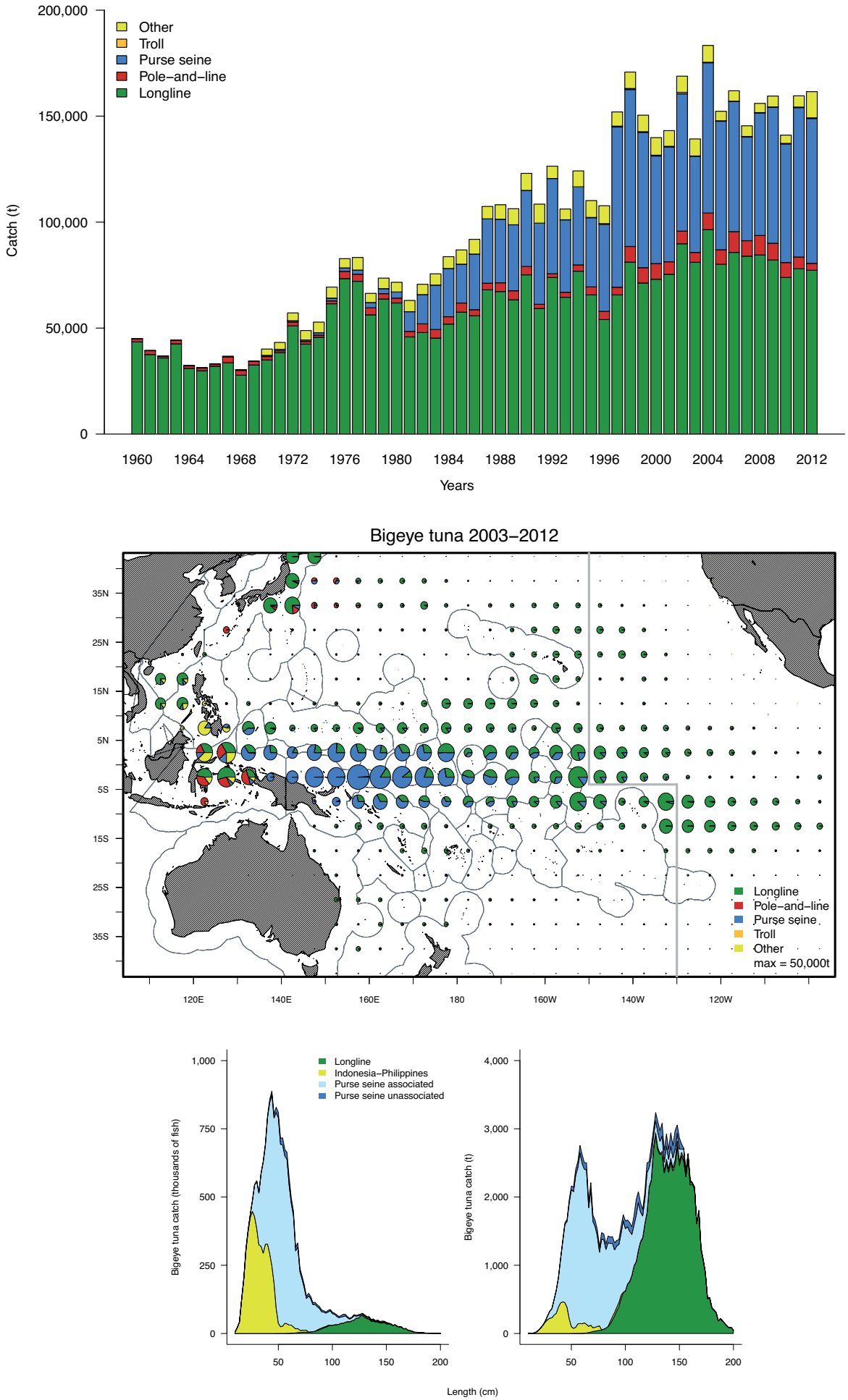

Figure 10: Time series (top), recent spatial distribution (middle), and size composition (average for last five years; bottom) of bigeye tuna catches (t) by gear for the western and central Pacific Ocean (WCPO).

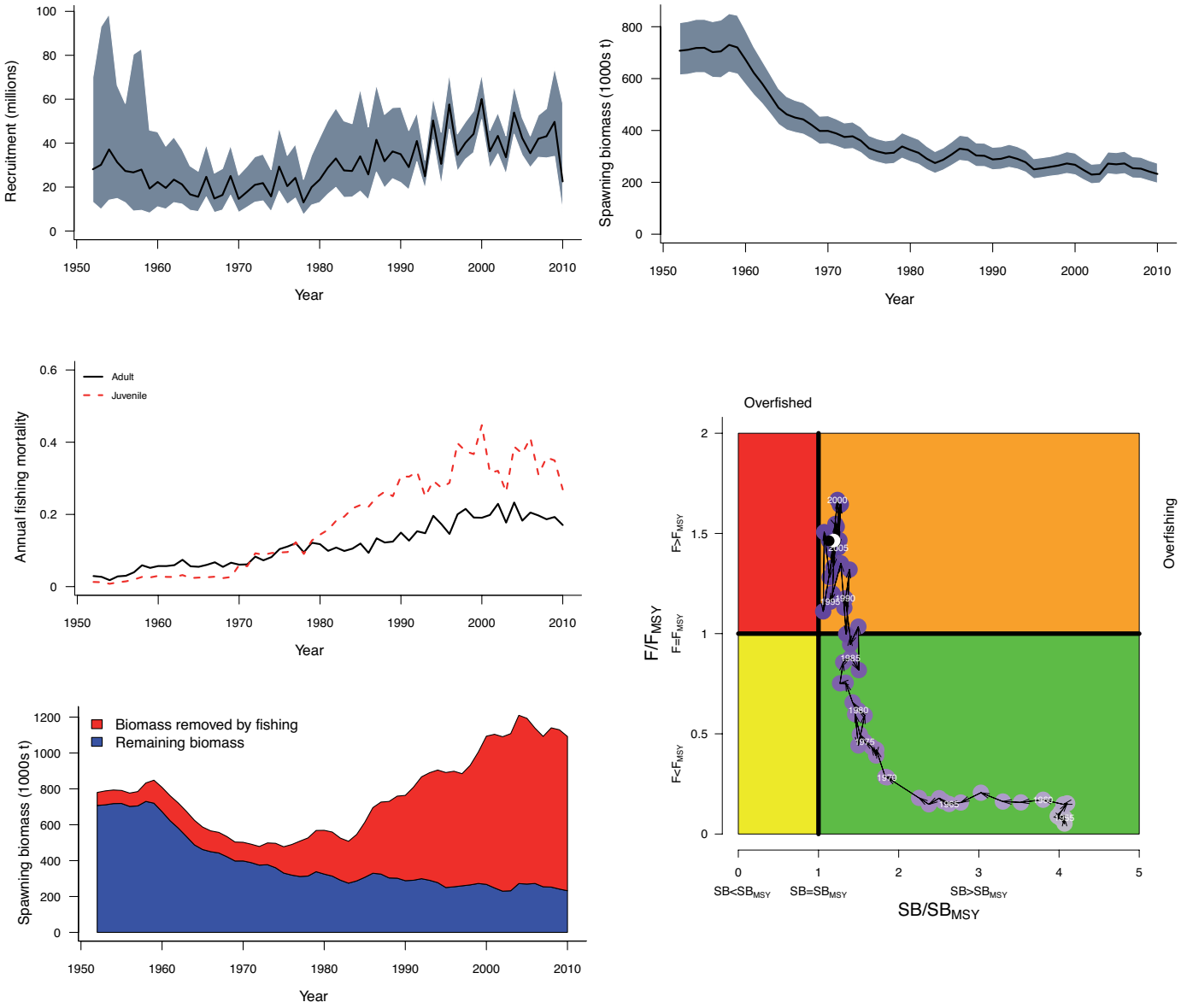

Figure 11: Estimated recruitment (top left), spawning biomass (top right), fishing mortality (middle left), stock status (middle right), and estimated spawning biomass with [blue] and without [red] fishing (bottom left) from the 2011 bigeye tuna stock assessment.

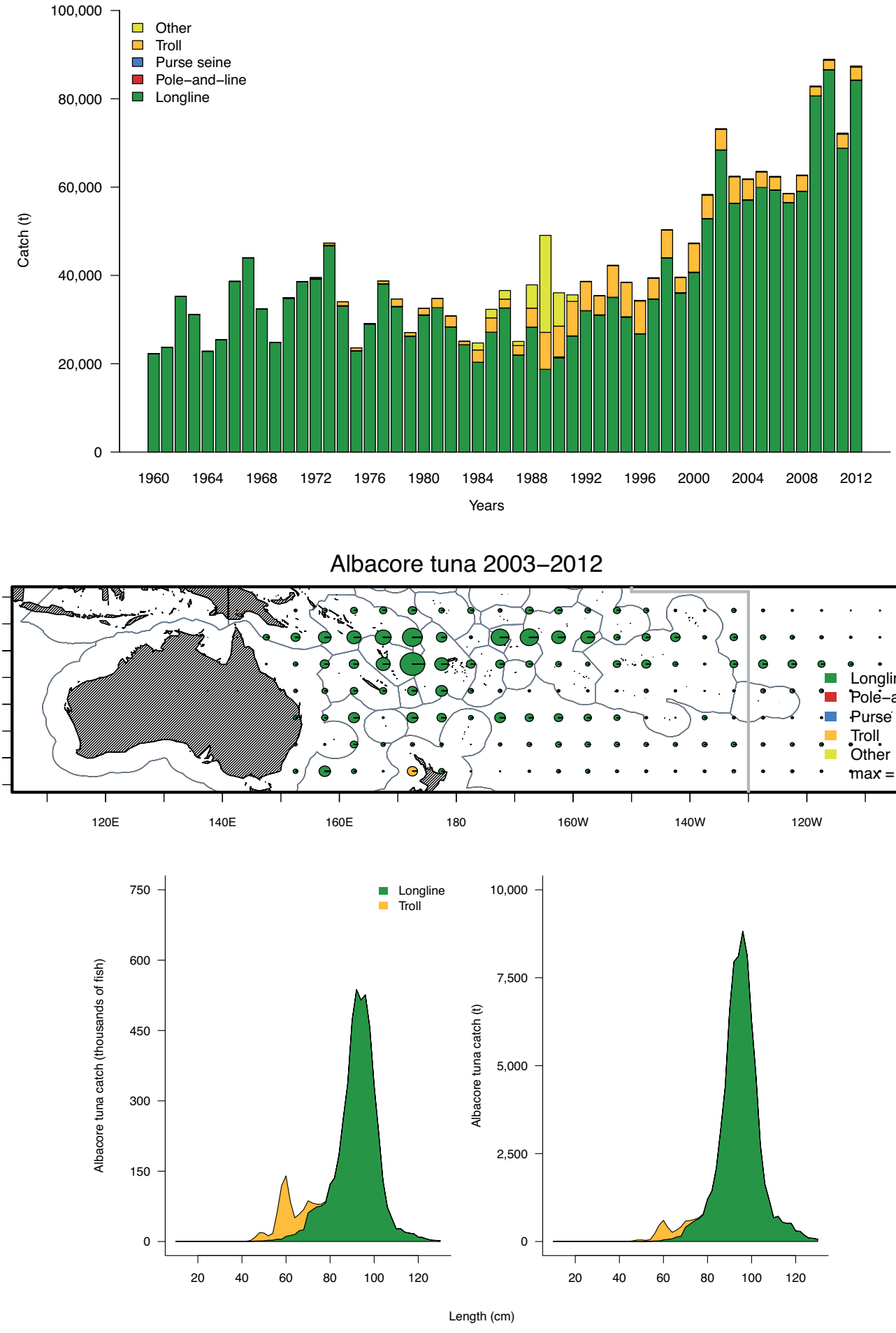

Figure 12: Time series (top), recent spatial distribution (middle), and size composition (average for last five years; bottom) of South Pacific albacore tuna catches (t) by gear for the western and central Pacific Ocean (WCPO).

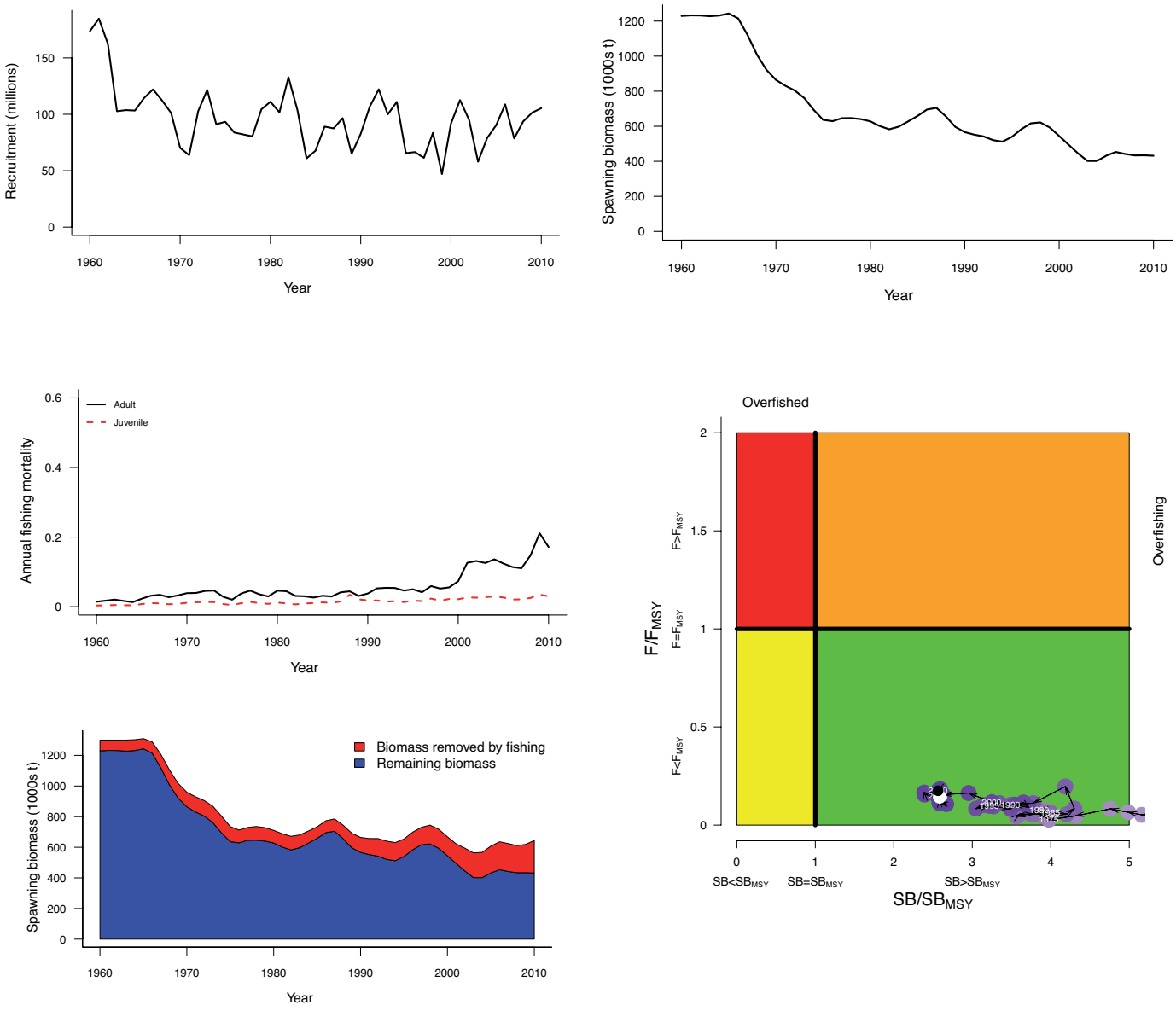

Figure 13: Estimated recruitment (top left), spawning biomass (top right), fishing mortality (middle left), stock status (middle right), and estimated spawning biomass with [blue] and without [red] fishing (bottom left) from the 2012 South Pacific albacore tuna stock assessment.

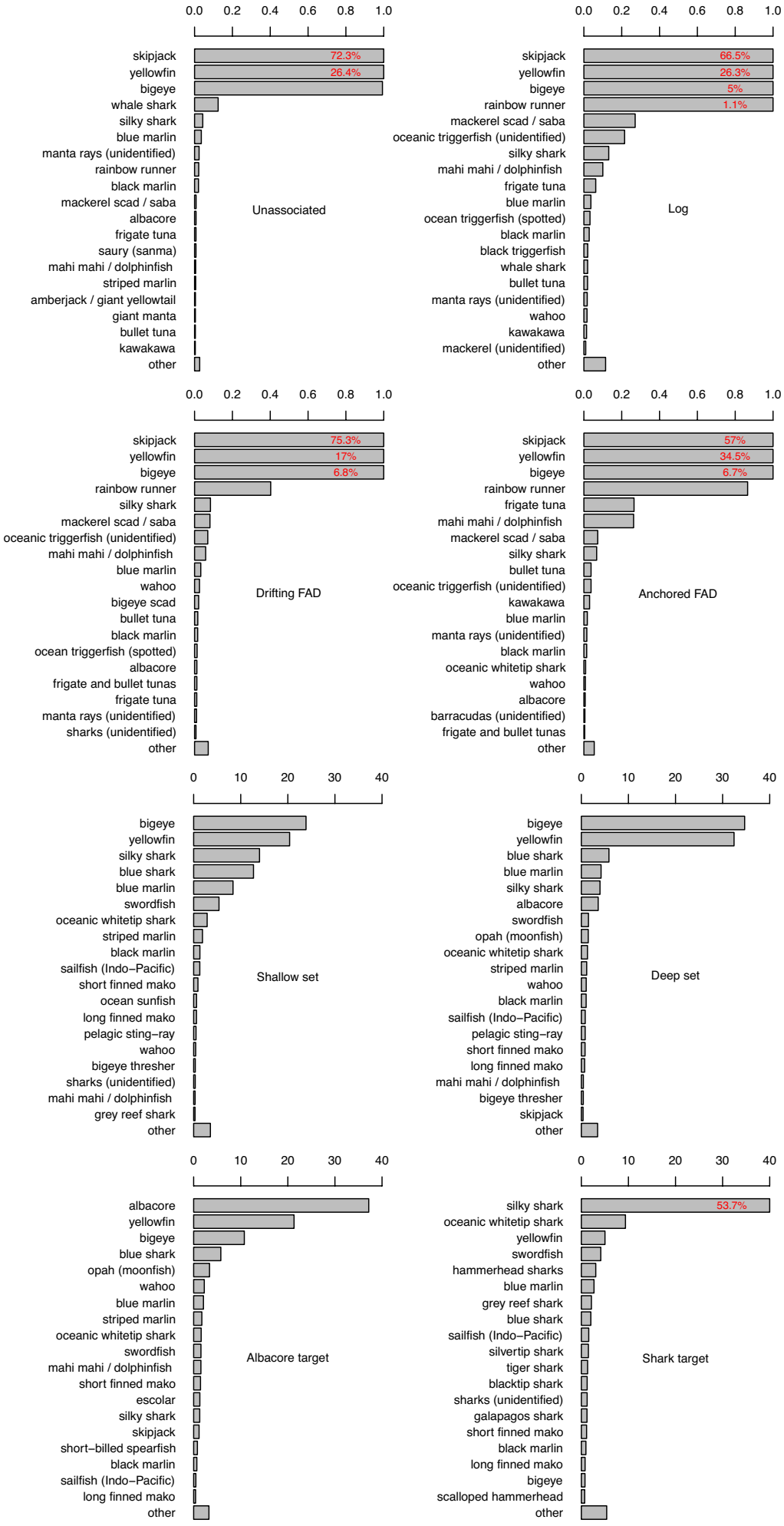

Figure 14: Catch composition of the various categories of purse-seine (top) and longline (bottom) fisheries operating in the WCPO based on observer data based on the last ten years data

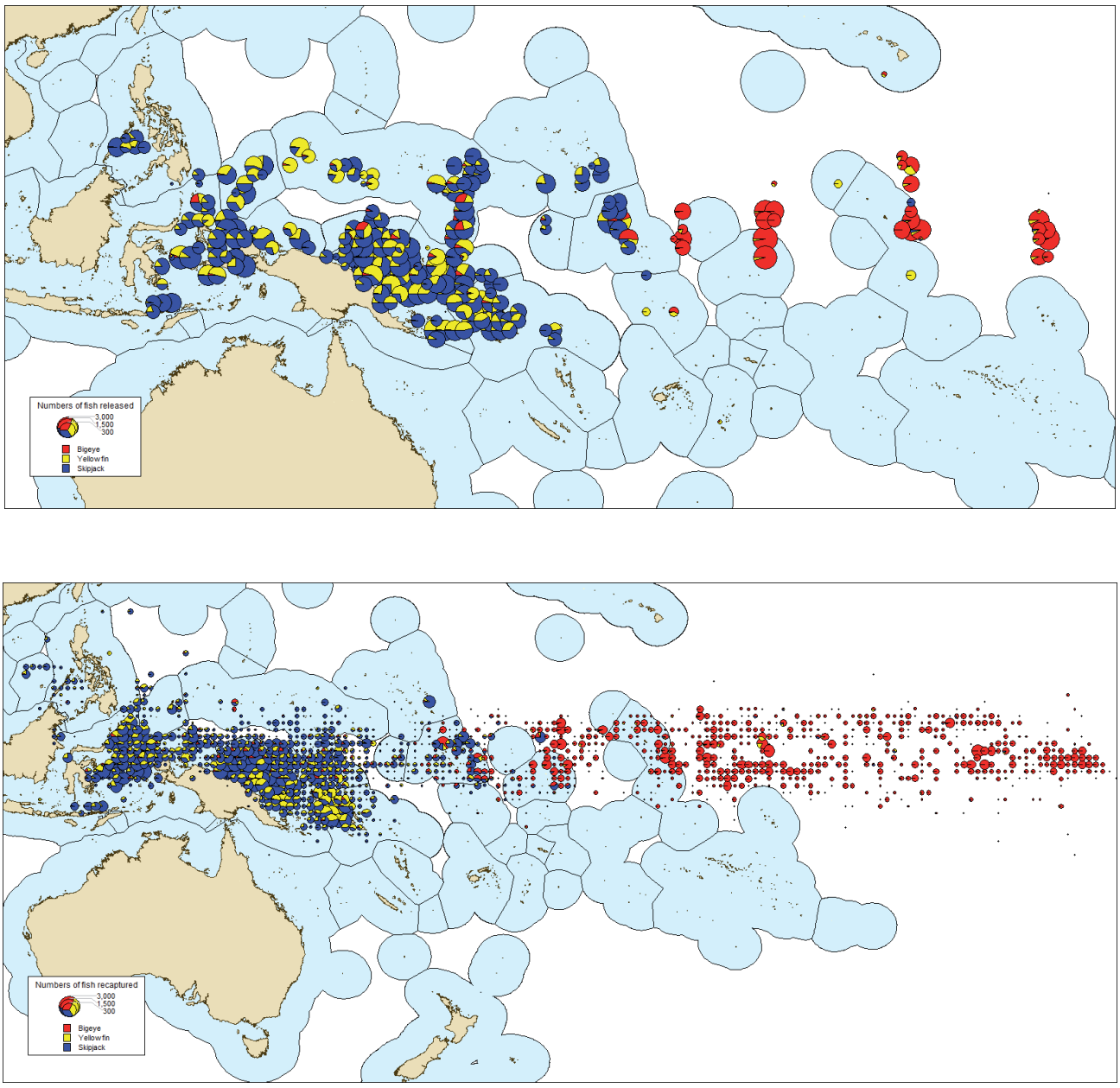

Figure 15: Tag releases (top) and recaptures (bottom) by species from the recent Pacific Tuna Tagging Programme (PTTP).

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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-SC6-GN-WP-1 can be found on the webpage of documents presented to the 6th session of the Scientific Committee. (http://www.wcpfc.int/meetings/2010/6th-regular-session-scientific-committee)

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Table 1: Catch (metric tonnes) by gear for the western and central Pacific region, 1960–2012. Note: data for 2012 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	29,030	268	87,209	520,785
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	53,492	621	136,322	754,105
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	227,707	395,746	113,265	1,489	102,645	840,852
1981	188,516	343,584	153,906	2,118	123,315	811,439
1982	177,765	309,802	249,234	2,552	124,409	863,762
1983	170,385	338,181	436,508	949	127,088	1,073,111
1984	157,072	422,512	456,466	3,124	126,690	1,165,864
1985	172,886	293,206	403,252	3,468	144,604	1,017,416
1986	163,964	368,730	464,460	2,284	153,694	1,153,132
1987	180,581	297,935	531,142	2,350	133,813	1,145,821
1988	200,281	324,805	592,610	4,671	148,481	1,270,848
1989	164,878	317,802	646,441	8,687	163,829	1,301,637
1990	181,591	250,390	773,732	7,219	196,934	1,409,866
1991	154,805	314,979	993,151	8,004	188,156	1,659,095
1992	192,364	282,598	966,313	6,844	146,840	1,594,959
1993	187,553	307,966	845,647	4,612	124,526	1,470,304
1994	211,638	271,071	977,649	7,493	146,462	1,614,313
1995	207,042	297,106	939,173	23,585	150,516	1,617,422
1996	197,234	251,053	897,906	17,807	160,522	1,524,522
1997	213,450	273,844	981,358	18,732	148,946	1,636,330
1998	233,645	313,968	1,297,727	19,099	170,528	2,034,967
1999	202,973	338,832	1,131,139	13,476	176,635	1,863,055
2000	226,730	299,976	1,168,429	25,845	192,174	1,913,154
2001	246,221	243,337	1,144,442	17,329	170,328	1,821,657
2002	266,963	254,785	1,297,473	16,129	182,838	2,018,188
2003	250,160	260,875	1,292,289	19,875	179,895	2,003,094
2004	266,581	253,342	1,393,992	23,445	184,771	2,122,131
2005	250,167	266,735	1,479,329	13,293	192,651	2,202,175
2006	255,328	257,594	1,512,944	10,098	209,591	2,245,555
2007	245,129	284,661	1,655,501	9,249	239,652	2,434,192
2008	245,509	269,551	1,709,351	11,740	247,724	2,483,875
2009	279,012	264,350	1,785,823	9,894	264,567	2,603,646
2010	269,885	270,123	1,703,138	11,320	250,081	2,504,547
2011	266,913	276,765	1,543,651	11,966	228,905	2,328,200
2012	263,194	214,981	1,799,097	12,421	298,318	2,588,011

Table 2: Catch (metric tonnes) by species for the four main tuna species taken in the western and central Pacific region, 1960–2012. Note: data for 2012 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	204,840	68,929	369,340
1968	64,213	30,426	195,031	81,904	371,574
1969	72,106	34,361	351,031	87,278	544,776
1970	74,350	40,102	423,398	99,169	637,019
1971	100,737	43,233	380,853	105,152	629,975
1972	109,655	57,156	237,764	116,210	520,785
1973	131,149	48,855	328,748	128,522	637,274
1974	115,162	52,808	356,200	131,545	655,715
1975	84,651	69,360	288,310	141,391	583,712
1976	132,947	82,752	357,207	153,111	726,017
1977	83,171	83,315	403,610	184,009	754,105
1978	111,161	66,386	449,032	177,772	804,351
1979	86,007	73,581	412,486	199,546	771,620
1980	95,156	71,614	456,150	217,932	840,852
1981	88,095	63,039	436,845	223,460	811,439
1982	89,496	70,671	479,289	224,306	863,762
1983	65,988	75,607	655,661	275,855	1,073,111
1984	74,540	83,708	736,467	271,149	1,165,864
1985	77,060	86,879	577,090	276,387	1,017,416
1986	71,757	91,875	729,102	260,398	1,153,132
1987	63,645	107,390	663,864	310,922	1,145,821
1988	67,948	108,195	794,201	300,504	1,270,848
1989	73,533	106,328	779,484	342,292	1,301,637
1990	63,872	123,006	842,097	380,891	1,409,866
1991	58,322	108,483	1,084,192	408,098	1,659,095
1992	74,452	126,401	976,914	417,192	1,594,959
1993	77,496	106,179	932,393	354,236	1,470,304
1994	96,461	124,159	997,280	396,413	1,614,313
1995	91,750	110,158	1,030,960	384,554	1,617,422
1996	91,140	107,733	970,256	355,393	1,524,522
1997	112,900	151,993	910,613	460,824	1,636,330
1998	112,465	170,815	1,195,621	556,066	2,034,967
1999	131,066	150,460	1,099,932	481,597	1,863,055
2000	101,171	139,861	1,142,491	529,631	1,913,154
2001	121,561	143,171	1,058,209	498,716	1,821,657
2002	147,793	168,869	1,232,665	468,861	2,018,188
2003	122,949	139,243	1,219,482	521,420	2,003,094
2004	122,343	183,355	1,300,944	515,489	2,122,131
2005	105,135	152,301	1,395,238	549,501	2,202,175
2006	104,986	161,980	1,480,137	498,452	2,245,555
2007	126,701	145,458	1,658,141	503,892	2,434,192
2008	104,966	156,016	1,640,945	581,948	2,483,875
2009	135,476	159,473	1,775,790	532,907	2,603,646
2010	126,446	141,052	1,689,772	547,277	2,504,547
2011	125,903	159,597	1,521,035	521,665	2,328,200
2012	132,349	161,561	1,647,936	646,165	2,588,011

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). B_0 is the average estimated unfished biomass; B_{CURR} is the average biomass over the last 3-4 years; MSY is the maximum sustainable yield based on recent patterns of fishing; F_{CURR}/F_{MSY} is the ratio of recent fishing mortality to that which will support the MSY; and SB_{CURR}/SB_{MSY} is the ratio of recent spawning biomass to that which will support the MSY.

	S. Pacific albacore	Bigeye	Skipjack	Yellowfin
B_0	1,131,000	1,432,000	6,147,000	3,740,000
B_{CURR}	1,028,983	623,121	5,018,049	1,881,625
MSY	99,085	76,760	1,503,600	538,800
$F_{CURR/}F_{MSY}$	0.21	1.46	0.37	0.77
SB_{CURR}/SB_{MSY}	2.56	1.19	2.94	1.47

Table 4: Skipjack tuna catch (metric tonnes) by gear type for the western and central Pacific region, 1960–2012. Note: data for 2012 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	10,940	0	24,930	204,840
1968	83	162,379	7,640	0	24,929	195,031
1969	130	315,795	5,036	0	30,070	351,031
1970	1,608	379,074	7,501	0	35,215	423,398
1971	1,475	333,284	13,665	0	32,429	380,853
1972	1,544	172,827	18,025	0	45,368	237,764
1973	1,861	253,217	19,235	0	54,435	328,748
1974	2,124	289,202	10,852	0	54,022	356,200
1975	1,919	218,271	13,101	0	55,019	288,310
1976	2,096	276,582	22,422	0	56,107	357,207
1977	3,127	294,641	34,602	0	71,240	403,610
1978	3,233	331,401	33,169	0	81,229	449,032
1979	2,179	285,859	58,306	0	66,142	412,486
1980	632	333,457	75,891	12	46,158	456,150
1981	756	294,292	88,888	17	52,892	436,845
1982	1,015	262,244	158,865	64	57,101	479,289
1983	2,144	299,762	292,666	154	60,935	655,661
1984	870	379,474	303,307	284	52,532	736,467
1985	1,108	250,010	268,112	146	57,714	577,090
1986	1,439	336,695	323,490	219	67,259	729,102
1987	2,329	262,467	339,367	168	59,533	663,864
1988	1,937	301,031	433,086	299	57,848	794,201
1989	2,507	289,706	428,387	244	58,640	779,484
1990	363	224,592	524,912	176	92,054	842,097
1991	885	292,950	706,684	148	83,525	1,084,192
1992	432	251,717	643,146	168	81,451	976,914
1993	573	280,066	585,145	175	66,434	932,393
1994	379	227,921	701,847	228	66,905	997,280
1995	598	257,147	693,334	12,298	67,583	1,030,960
1996	3,935	211,408	676,011	6,514	72,388	970,256
1997	4,070	225,612	602,378	9,218	69,335	910,613
1998	5,030	256,691	848,560	8,316	77,024	1,195,621
1999	4,208	253,244	756,754	5,660	80,066	1,099,932
2000	4,559	246,300	780,419	15,005	96,208	1,142,491
2001	5,059	187,490	772,891	7,536	85,233	1,058,209
2002	3,450	180,618	951,308	6,796	90,493	1,232,665
2003	3,824	202,154	918,185	9,721	85,598	1,219,482
2004	4,051	192,948	999,835	15,118	88,992	1,300,944
2005	1,084	216,715	1,047,975	6,302	123,162	1,395,238
2006	1,528	208,731	1,128,704	3,987	137,187	1,480,137
2007	1,175	213,010	1,280,162	3,598	160,196	1,658,141
2008	817	218,570	1,249,751	4,572	167,235	1,640,945
2009	1,225	201,323	1,401,719	4,251	167,272	1,775,790
2010	1,181	223,409	1,304,613	4,705	155,864	1,689,772
2011	1,296	205,869	1,163,464	4,209	146,197	1,521,035
2012	1,428	149,220	1,339,502	4,536	153,250	1,647,936

Table 5: Yellowfin tuna catch (metric tonnes) by gear type for the western and central Pacific region, 1960–2012. Note: data for 2012 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	3,418	0	26,303	68,929
1968	46,070	2,706	7,043	0	26,085	81,904
1969	51,627	5,166	3,873	0	26,612	87,278
1970	55,806	4,606	7,824	0	30,933	99,169
1971	57,766	5,248	9,244	0	32,894	105,152
1972	61,175	7,465	10,064	0	37,506	116,210
1973	62,291	7,458	14,945	0	43,828	128,522
1974	58,116	6,582	17,406	0	49,441	131,545
1975	69,462	7,801	13,099	0	51,029	141,391
1976	77,570	17,186	15,589	0	42,766	153,111
1977	94,414	15,257	16,268	0	58,070	184,009
1978	110,329	12,767	15,275	0	39,401	177,772
1979	109,043	11,638	29,300	0	49,565	199,546
1980	122,875	13,168	34,131	9	47,749	217,932
1981	94,665	19,270	55,444	16	54,065	223,460
1982	84,988	13,835	76,006	54	49,423	224,306
1983	86,187	13,266	122,530	51	53,821	275,855
1984	73,036	13,558	127,018	67	57,470	271,149
1985	76,265	18,156	115,280	69	66,617	276,387
1986	65,019	13,074	113,171	62	69,072	260,398
1987	76,812	13,243	160,208	48	60,611	310,922
1988	89,400	13,433	128,334	76	69,261	300,504
1989	68,908	15,169	184,391	73	73,751	342,292
1990	73,917	13,103	210,915	68	82,888	380,891
1991	59,224	12,921	245,525	51	90,377	408,098
1992	72,508	15,225	274,113	98	55,248	417,192
1993	66,244	12,698	223,385	141	51,768	354,236
1994	74,779	13,743	236,941	101	70,849	396,413
1995	80,407	15,063	212,013	2,570	74,501	384,554
1996	77,682	15,479	180,350	2,636	79,246	355,393
1997	71,081	12,362	302,309	2,838	72,234	460,824
1998	67,450	26,935	373,564	2,806	85,311	556,066
1999	58,645	27,869	303,669	3,162	88,252	481,597
2000	79,536	24,658	334,828	3,343	87,266	529,631
2001	80,752	20,479	316,507	3,716	77,262	498,716
2002	83,828	19,743	278,073	3,172	84,045	468,861
2003	86,499	17,955	328,087	3,101	85,778	521,420
2004	89,118	20,206	316,028	2,706	87,431	515,489
2005	85,904	27,007	369,876	2,508	64,206	549,501
2006	82,835	23,653	322,471	2,607	66,886	498,452
2007	79,853	26,570	320,666	2,854	73,949	503,892
2008	81,180	22,705	400,980	2,903	74,180	581,948
2009	96,551	23,918	317,870	3,024	91,544	532,907
2010	91,458	20,112	342,236	3,611	89,860	547,277
2011	94,857	36,794	309,342	3,800	76,872	521,665
2012	85,147	33,935	390,921	4,203	131,959	646,165

Table 6: Bigeye tuna catch (metric tonnes) by gear type for the western and central Pacific region, 1960–2012. Note: data for 2012 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	53	0	62	34,361
1970	34,965	1,589	580	0	2,968	40,102
1971	38,359	931	700	0	3,243	43,233
1972	51,040	1,762	664	0	3,690	57,156
1973	42,412	1,258	736	0	4,449	48,855
1974	45,653	1,039	1,129	0	4,987	52,808
1975	61,488	1,334	1,326	0	5,212	69,360
1976	73,325	3,423	1,650	0	4,354	82,752
1977	72,083	3,325	1,953	0	5,954	83,315
1978	56,237	3,337	2,481	0	4,331	66,386
1979	63,704	2,540	2,371	0	4,966	73,581
1980	61,857	2,278	2,914	0	4,565	71,614
1981	45,823	2,596	9,322	0	5,298	63,039
1982	47,886	4,108	13,802	0	4,875	70,671
1983	45,270	4,055	20,962	0	5,320	75,607
1984	51,889	3,465	22,761	0	5,593	83,708
1985	57,501	4,326	18,327	0	6,725	86,879
1986	55,804	2,865	26,257	0	6,949	91,875
1987	68,042	3,134	30,362	0	5,852	107,390
1988	67,250	4,125	29,982	0	6,838	108,195
1989	63,316	4,298	31,142	0	7,572	106,328
1990	75,141	3,918	35,910	0	8,037	123,006
1991	59,237	1,991	38,290	0	8,965	108,483
1992	73,873	1,757	44,950	0	5,821	126,401
1993	64,553	2,331	34,228	0	5,067	106,179
1994	76,851	2,951	36,835	0	7,522	124,159
1995	65,649	3,776	32,649	145	7,939	110,158
1996	54,027	3,864	40,964	432	8,446	107,733
1997	65,656	3,611	75,603	412	6,711	151,993
1998	81,123	7,380	74,049	507	7,756	170,815
1999	71,286	7,212	63,844	316	7,802	150,460
2000	73,053	7,366	50,774	397	8,271	139,861
2001	75,388	5,901	54,070	408	7,404	143,171
2002	89,791	5,952	64,789	713	7,624	168,869
2003	81,043	4,640	45,390	142	8,028	139,243
2004	96,445	7,823	70,929	232	7,926	183,355
2005	80,110	6,851	60,628	220	4,492	152,301
2006	85,719	9,781	61,405	157	4,918	161,980
2007	83,931	7,296	48,991	187	5,053	145,458
2008	84,473	9,204	57,795	212	4,332	156,016
2009	82,108	7,916	64,157	175	5,117	159,473
2010	73,882	7,027	55,959	275	3,909	141,052
2011	77,964	5,540	70,524	251	5,318	159,597
2012	77,284	3,253	68,353	311	12,360	161,561

Table 7: Albacore tuna catch (metric tonnes) by gear type for the south Pacific Ocean, 1960–2012. Note: data for 2012 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
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	86,599	14	0	2,139	190	88,942
2011	68,782	30	0	3,189	233	72,234
2012	84,215	41	0	2,925	248	87,429

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. 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); and PTTP – Pacific Tuna Tagging Programme (2006–present).

	PTTP		RTTP		SSAP	
EEZ	**Releases**	**Recoveries**	**Releases**	**Recoveries**	**Releases**	**Recoveries**
Fiji		4	5,197	528	28,980	2,659
Federated States of Micronesia	24,759	2,505	11,711	1,779	8,791	330
Indonesia	40,416	6,643	13,740	2,653	-	37
Kiribati	33,968	4,150	14,754	851	5,212	449
New Zealand		2	-	2	15,020	1,000
Papua New Guinea	210,876	26,270	44,502	3,677	9,079	1,077
French Polynesia			-	1	29,693	128
Palau	7,304	246	7,495	142	8,663	114
Solomon Islands	56,515	8,274	15,226	2,372	7,870	597
Other	19,759	17,864	39,042	6,925	48,976	1,077
TOTAL	393,597	65,958	151,667	18,930	162,284	7,468

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