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# OVERVIEW OF TUNA FISHERIES IN THE WESTERN AND CENTRAL PACIFIC OCEAN, INCLUDING ECONOMIC CONDITIONS – 2016

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Paper prepared by

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# ABSTRACT

This paper provides a broad description of the major fisheries in the WCPFC Statistical Area (WCP-CA) highlighting activities during the most recent calendar year (2016) and covering the most recent version of catch estimates by gear and species.

The provisional **total WCP–CA tuna catch for 2016** was estimated at **2,717,850 mt**, the second highest on record and nearly 120,000 mt below the previous record catch in 2014 (2,851,087 mt); this catch represented 79% of the total Pacific Ocean catch of 3,406,269 mt, and 56% of the global tuna catch (the provisional estimate for 2016 is 4,795,867 mt, and when finalised is expected to be the second highest on record).

The **2016 WCP–CA catch of skipjack** (**1,816,650 mt** – 67% of the total catch) was the fourth highest recorded, nearly 160,000 mt less than the record in 2014 (1,977,019 mt). The **WCP–CA yellowfin catch** for 2016 (**650,491 mt** – 24%) was the highest recorded (more than 40,000 mt higher than the previous record catch of 2008 – 609,458 mt); the increase in yellowfin tuna catch from 2015 levels was mainly due to increased catches in the purse seine fishery and the Indonesia and Philippines domestic fisheries. The **WCP–CA bigeye catch** for 2016 (**152,806** mt – 6%) was an increase on 2015 catch and around average for the past ten years. The **2016 WCP–CA albacore catch** (**97,822 mt** – 4%) was the lowest since 1996 and around 50,000 mt lower than the record catch in 2002 at 147,793 mt. The **south Pacific albacore** catch in 2016 (68,601 mt) was about 13,000 mt lower than in 2015 and nearly 20,000 mt lower than the record catch in 2010 of 87,292 mt (although the 2016 estimates for some fleets are provisional).

The provisional **2016 purse-seine catch of 1,858,198 mt** was the third highest catch on record, higher than in 2016, but more than 160,000 mt lower than the record in 2014 (2,028,630 mt); the main reasons for the increase in catch compared to 2015 is related to increased effort and improved conditions (catch rates) in the fishery. The 2016 purse-seine skipjack catch (1,408,110 mt; 75% of total catch) was about 200,000 mt lower than the record in 2014, but almost identical to the 2015 catch level. The 2016 purse-seine catch estimate for yellowfin tuna (394,756 mt; 21%) was the second highest on record (423,788 mt in 2008) coming after a poor catch year in 2015 and appears to be due to increased catches of large yellowfin from unassociated-school set types. The provisional catch estimate for bigeye tuna for 2016 (63,304 mt) was an increase from the relatively low catch level in 2015.

The **provisional 2016 pole-and-line catch** (199,457 mt) was the lowest annual catch since the late-1960s, although estimates are typically revised upwards by the start of SC meetings each year. Japanese distant-water and offshore fleets (90,343 mt in 2016), and the Indonesian fleets (108,327 mt in 2016), account for nearly all of the WCP–CA pole-and-line catch (99% in 2016).

The **provisional WCP–CA longline catch** (231,860 mt) for 2016 was lower than the average for the past five years. The WCP–CA albacore longline catch (71,571 mt – 31%) for 2016 was the lowest since 2000, 30,000 mt. lower that the record of 101,816 mt attained in 2010. The provisional bigeye catch (64,131 mt – 28%) for 2016 was the lowest since 1996, mainly due to continued reduction in effort in the main bigeye tuna fishery (refer to Pilling et al., 2017 for more detail). The yellowfin catch for 2016 (90,539 mt – 39%) was around the average for the past five years.

The **2016 South Pacific troll albacore catch** (2,097 mt) was the lowest catch since 2009. The New Zealand troll fleet (137 vessels catching 1,952 mt in 2016) and the United States troll fleet (6 vessels catching 151 mt in 2016) accounted for all of the 2016 albacore troll catch.

**Market conditions for the tuna raw materials of the WCP-CA** during 2016 saw improvements in prices for canning lightmeat raw material (skipjack and yellowfin) and sashimi grade products but some deterioration in the price for albacore for canning.

Prices in the major markets for WCP-CA skipjack were higher in 2016 compared with 2015, underpinned by low supplies of raw material and despite continuing poor demand at end markets. The Bangkok benchmark (4-7.5lbs) and Thai import prices were higher by 23% ($1,395/mt) and 19% respectively. Similar trends occurred in other markets with prices in General Santos 17% higher while prices at Yaizu Port in Japan increased 21% in USD terms (9% in JPY terms). Yellowfin prices on canning markets in 2016 reversed recent declines, albeit moderately with Thai import prices increasing by 2% to US$1,605/mt and Yaizu prices by 11% to US$2,309/mt.

Japan fresh yellowfin import prices (c.i.f., USD) in 2016, from all sources, rose 9% (-2% in JPY terms) while Yaizu port fresh & frozen prices (ex-vessel) increased by 7% (-4%) reversing the previous year's respective declines of 11% and 18%. US fresh yellowfin import prices (f.a.s.) in 2016 declined 3% relative to 2015 following a 2% decline in 2015.

Japan fresh bigeye import prices (c.i.f., USD) in 2016, from all sources, improved by 12% in USD terms (up 1% in JPY terms) while Japan selected ports frozen longline prices (ex-vessel) improved 21% (9%) reversing the previous year's 14% decline partly as a result of the substantial strengthening of the Yen. US fresh bigeye import prices (f.a.s.) in 2016 registered a decline of 3% relative to 2015.

**The total estimated delivered value of catch in the WCP-CA increased by 11% to $5.3 billion during 2016**. This reverses the declining trend evident since the 2012 peak when the value reached $7.5 billion. The value of the purse seine tuna catch for 2016 is $2.8 billion (54% of total value) compared with $2.3 billion in 2015. The value of the longline tuna catch in the WCPFC area for 2016 is $1.5 billion (24% of total), a decrease of 5% on 2015. In terms of value by species, all species increased in value except for albacore which declined 13% to $293 million (6% of total catch value). The value of the bigeye catch increased by 8% to $697 million (13%). The value of the skipjack catch increased 19% to $2.7 billion (51%). The value of yellowfin catch increased by 7% to $1.6 billion (31%).

**Economic conditions in the purse seine, tropical longline and southern longline fisheries of the WCP-CA** – there was overall improvement in 2016 compared with 2015 across the fisheries. For the purse seine fishery, there was deterioration in catch rates but the declines in costs and improvements in prices more than offset this deterioration. For the tropical longline fishery conditions have improved noticeably since 2014 owing to significant declines in cost reflecting falls in fuel prices. For the southern longline fishery economic conditions have improved significantly since 2014 due to falling fuel costs with the fish price remaining around its long-term average. The economic conditions index in 2016 is at its highest level since 2008 with the improvement driven by low fuel prices but being hampered by persistent low catch rates.

# CONTENTS

## 1. INTRODUCTION

The tuna fishery in the Western and Central Pacific Ocean is 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 both the exclusive economic zones of Pacific states and on the 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*).

This review provides a broad description of the major fisheries in the WCPFC Statistical Area (**WCP–CA**; see Figure 1), highlighting activities during the most recent calendar year – 2016. The review draws on the latest catch estimates compiled for the WCP–CA, found in Information Paper WCPFC–SC13 ST IP–1 *(Estimates of annual catches in the WCPFC Statistical Area – OFP, 2017)*. Where relevant, comparisons with previous years' activities have been included, although data for 2016, for some fisheries, are provisional at this stage.

This paper includes sections covering a summary of total target tuna and swordfish (*Xiphias gladius*) catch in the WCP–CA tuna fisheries and an overview of the WCP–CA tuna fisheries by gear, including economic conditions in each fishery. In each section, the paper makes some observations on recent developments in each fishery, with emphasis on 2016 catches relative to those of recent years, but refers readers to the SC12 National Fisheries Reports, which offer more detail on recent activities at the fleet level.

Additional tabular and graphical information that provide more information related to the recent condition of the fishery and certain WCPFC Conservation and Management Measures (CCMs) have been provided in an APPENDIX.

This overview acknowledges, but does not currently include, detailed information on several WCP–CA fisheries, including the north Pacific albacore troll fishery, the north Pacific swordfish fishery, those fisheries catching north Pacific bluefin tuna and several artisanal fisheries. These fisheries may be covered in future reviews, depending on the availability of more complete data.

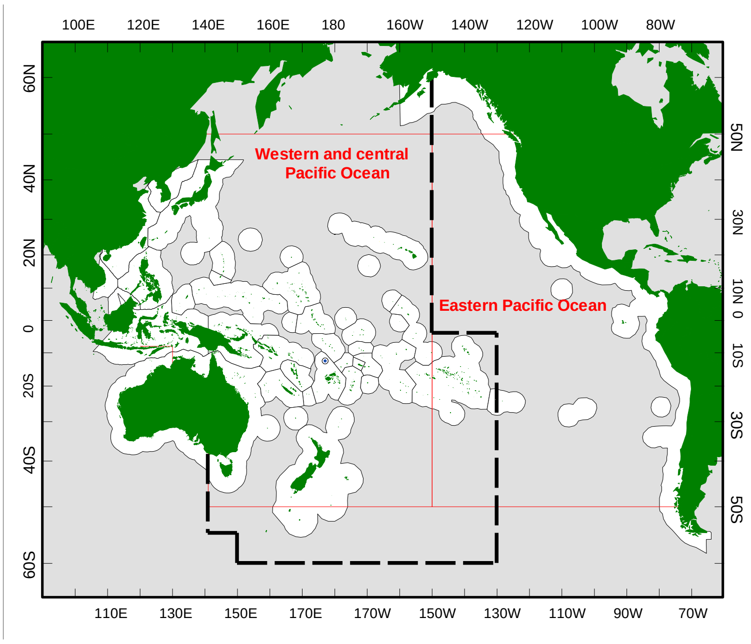



**Figure 1. The western and central Pacific Ocean (WCPO), the eastern Pacific Ocean (EPO) and the WCPFC Convention Area (WCP–CA in dashed lines)**

## 2. TOTAL TUNA CATCH FOR 2016

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, noting an exceptional catch during 1998. The increasing trend in total tuna catch continued to 2009, then followed two years (2010-2011) of reduced catches, but returned to record levels in successive years over the period 2012–2014 (Figure 2 and Figure 3).

The provisional total WCP–CA tuna catch for 2016 was estimated at **2,717,850 mt**, the second highest on record and nearly 120,000 mt below the previous record catch in 2014 (2,851,087 mt). During 2016, the **purse seine fishery** accounted for a catch of **1,868,189 mt** (69% of the total catch), with **pole-and-line** taking an estimated **199,457 mt** (7%), the **longline fishery** an estimated **231,860 mt** (9%), and the remainder (15%) taken by troll gear and a variety of artisanal gears, mostly in eastern Indonesia and the Philippines. The WCP–CA tuna catch (2,717,850 mt) for 2016 represented 79% of the total Pacific Ocean catch of 3,406,269 mt, and 56% of the global tuna catch (the provisional estimate for 2016 is 4,795,867 mt, and when finalised is expected to be the second highest on record).

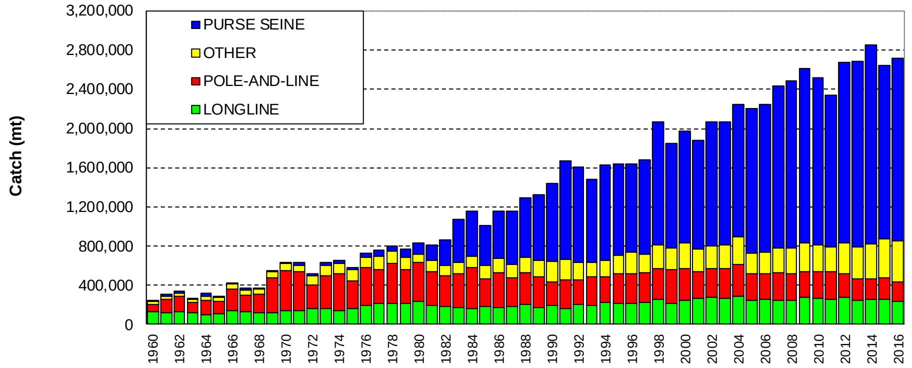



**Figure 2. Catch (mt) of albacore, bigeye, skipjack and yellowfin in the WCP–CA, by longline, pole-and-line, purse seine and other gear types**

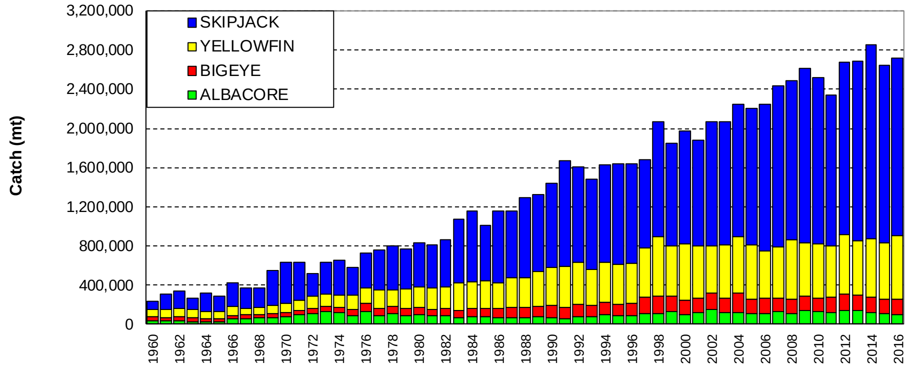
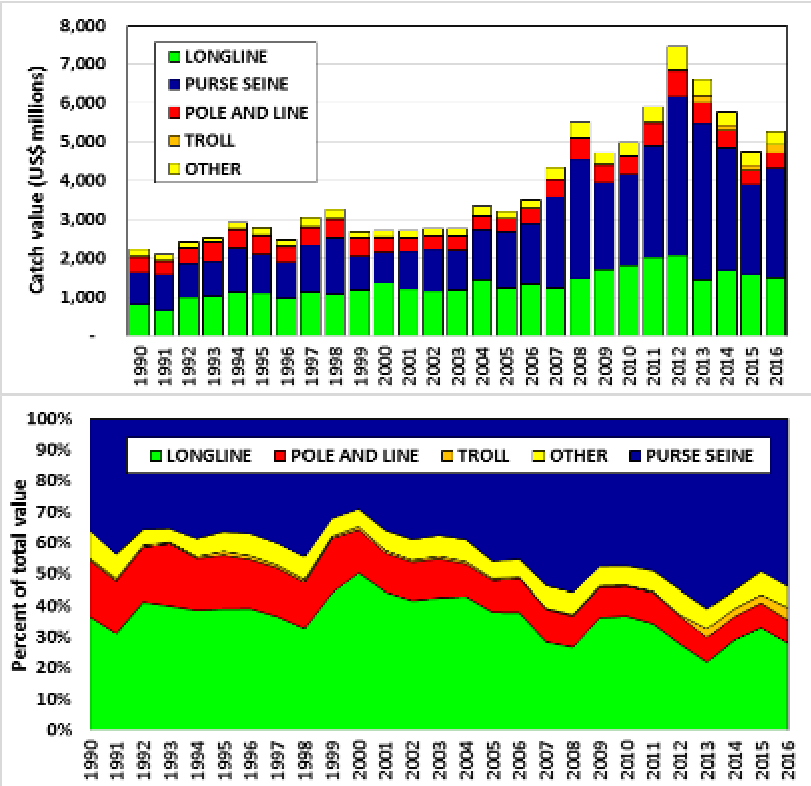


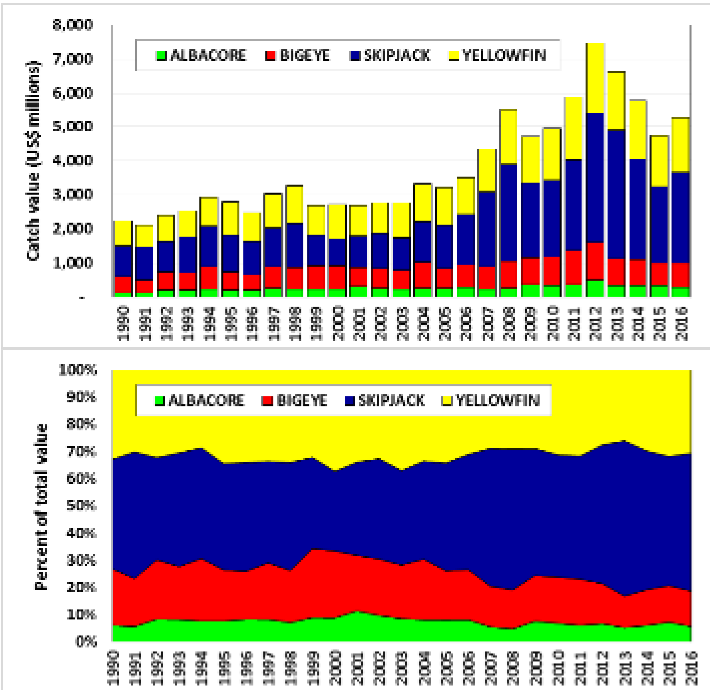

**Figure 3. Catch (mt) of albacore, bigeye, skipjack and yellowfin in the WCP–CA**.

The **2016 WCP–CA catch of skipjack** (**1,816,650 mt** – 67% of the total catch) was the fourth highest recorded, nearly 160,000 mt less than the record in 2014 (1,977,019 mt). The **WCP–CA yellowfin catch** for 2016 (**650,491 mt** – 24%) was the highest recorded (more than 40,000 mt higher than the previous record catch of 2008 – 609,458 mt); the increase in yellowfin tuna catch from 2015 levels was mainly due to increased catches in the purse seine fishery and the Indonesia and Philippines domestic fisheries. The **WCP–CA bigeye catch** for 2016 (**152,806** mt – 6%) was an increase on 2015 catch and around average for the past ten years. The **2016 WCP–CA albacore**[1] **catch** (**97,822 mt** – 4%) was the lowest since 1996 and around 50,000 mt lower than the record catch in 2002 at 147,793 mt.

[1] includes catches of north and south Pacific albacore in the WCP–CA, which comprised 82% of the total Pacific Ocean albacore catch of 119,851 mt in 2016; the section 7.4 "Summary of Catch by Species - Albacore" is concerned only with catches of south Pacific albacore (68,601 mt in 2016), which made up approximately 57% of the Pacific albacore catch in 2016.




**Figures 4a and 4b: Catch value by gear type and Relative value share of gear type in the estimated delivered values of WCP-CA catch, 1990–2016.**




**Figures 5a and 5b: Catch value by species and Relative share of species type in the estimated delivered values of WCP-CA catch, 1990–2016.**

# 3 WCP–CA PURSE SEINE FISHERY

## 3.1 Historical Overview

During the mid-1980s, the purse seine fishery (400,000-450,000 mt) accounted for only 40% of the total catch, but has grown in significance to a level now over 65% of total tuna catch volume (with more than 2,000,000 mt in 2014 – Figure 2). The majority of the historic WCP–CA purse seine catch has come from the four main Distant Water Fishing Nation (DWFN) fleets – Japan, Korea, Chinese-Taipei and USA, which combined numbered 163 vessels in 1992, but declined to a low of 111 vessels in 2006 (due to reductions in the US fleet), before some rebound in recent years (133 vessels in 2016[2]). The Pacific Islands fleets have gradually increased in numbers over the past two decades to a level of 116 vessels in 2016 (Figure 6Figure ). The remainder of the purse seine fishery includes several fleets which entered the WCPFC tropical fishery during the 2000s (e.g. China, Ecuador, El Salvador, New Zealand and Spain).

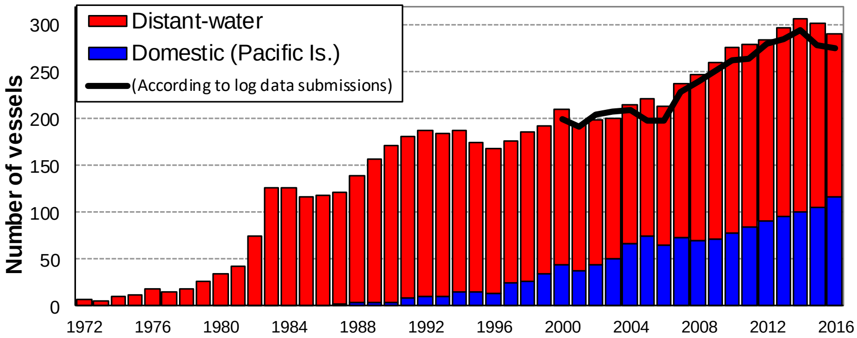



**Figure 6. Number of purse seine vessels operating in the WCP–CA tropical fishery**

(excludes Indonesia, Philippine and Vietnam domestic purse-seine/ringnet fleets)

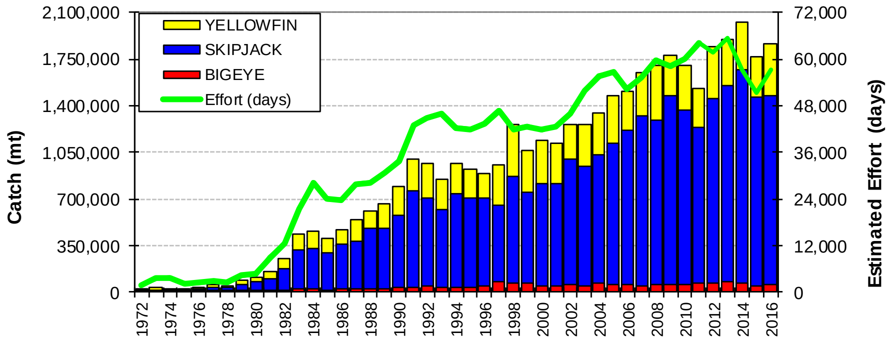



**Figure 7. Purse seine catch (mt) of bigeye, skipjack and yellowfin and estimated fishing effort (days fishing and searching) in the WCP–CA**

The total number of purse seine vessels was relatively stable over the period 1990-2006 (in the range of around 180–220 vessels), but thence until 2014, the number of vessels gradually increased, attaining a record level of 307 vessels in 2014, before declining over the past two years (291 vessels in 2016). Table A3 in the APPENDIX provides data on purse seine vessel numbers, tuna catch and effort by set type and species in the tropical tuna purse seine fishery based on raised logsheet data, with 275 vessels reported as operating in the tropical tuna purse seine fishery in 2016 (according to submitted logbook data). Figure A14 in the APPENDIX provides more information on vessel numbers and capacity. The estimated purse seine capacity declined in 2016, due to a reduction in vessels fishing in the WCPFC area for several distant-water fleets.

The WCP–CA purse-seine fishery is essentially a skipjack fishery, unlike those of other ocean areas. Skipjack generally account for 65–77% of the purse seine catch, with yellowfin accounting for 20–30% and bigeye accounting for only a small proportion – 2-5% (Figure ). Small amounts of albacore tuna are also taken in temperate water purse seine fisheries in the North Pacific.

Features of the purse seine catch by species during the past two decades include:

- Annual skipjack catches fluctuating between 600,000 and 850,000 mt prior to 2002, a significant increase in the catch during 2002, with catches now maintained well above 1,400,000 mt;

[2] The number of vessels by fleet in 1992 was Japan (38), Korea (36), Chinese-Taipei (45) and USA (44) and in 2016 the number of active vessels by fleet was Japan (37), Korea (25), Chinese Taipei (34) and USA (37). In 2016, there was an additional 30 vessels in the category less than 200 GRT which are a part of the Japanese offshore purse seine fleet but not included here.

- Annual yellowfin catches fluctuating considerably between 300,000 and 400,000 mt. The proportion of large yellowfin in the catch is generally higher during El Niño years and lower during La Niña years, although other factors appear to affect purse seine yellowfin catch;
- Increased bigeye tuna purse seine catch estimates, coinciding with the introduction of drifting FADs (since 1997). Significant bigeye catch years have been 1997 (82,649 mt), 1998 (76,283 mt), 2004 (72,507 mt), 2011 (72,548 mt) and 2013 (74,710 mt) which correspond to years with a relatively high proportion of associated sets, increased bigeye tuna availability to the gear and/or strong bigeye recruitment.

Total estimated effort tends to track the increase in the catch over time (Figure 7), with years of relatively higher catch rates apparent when the effort line intersects the histogram bar (i.e. in 1998 and 2006, 2009, 2012, 2014–2016). The total estimated purse seine effort and catch in 2016 increased from the relatively low level in 2015.

## 3.2 Provisional catch estimates, fleet size and effort (2016)

The provisional **2016 purse-seine catch of 1,858,198 mt** was the third highest catch on record, higher than in 2015, but more than 160,000 mt lower than the record in 2014 (2,028,630 mt); the main reasons for the increase in catch compared to 2015 is related to increased effort and improved conditions (catch rates) in the fishery. The 2016 purse-seine skipjack catch (1,408,110 mt; 75% of total catch) was about 200,000 mt lower than the record in 2014, but almost identical to the 2015 catch level. The 2016 purse-seine catch estimate for yellowfin tuna (394,756 mt; 21%) was the second highest on record (423,788 mt in 2008) coming after a poor catch year in 2015 and appears to be due to increased catches of large yellowfin from unassociated-school set types (see Figure 59). The provisional catch estimate for bigeye tuna for 2016 (63,304 mt) was an increase from the relatively low catch level in 2015.

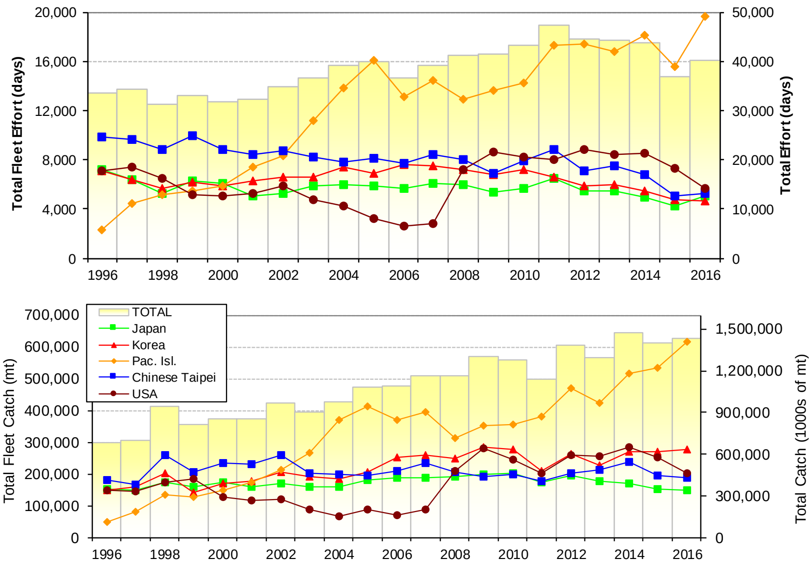



**Figure 8. Trends in annual effort (top) and catch (bottom) estimates for the top five purse seine fleets operating in the tropical WCP–CA, 1996–2016.**

Figure 8 compares annual purse seine effort and catches for the five main purse seine fleets operating in the tropical WCP–CA in recent years. The combined "main-fleet" effort was relatively stable over the period 2010–2014, before the clear decline in effort for 2015 and a slight rebound in 2016. In contrast, catches have tended to trend upwards over this period, suggesting increased efficiency and, in some instances, better catch rates. The decline in effort in recent years was related to several factors including reduced access to fishing areas for some fleets, economic conditions and simply a choice to fish in areas outside the WCPFC area.

The combined Pacific-Islands fleet has been clearly the highest producer in the tropical purse seine fishery since 2003 and unlike the other fleets shown in Figure 8, their catches continue to increase each year. There was a hiatus in the Pacific-Islands fleet development in 2008 (when some vessels reflagged to the US purse-seine fleet) but catch/effort has picked up in recent years and catch by this component of the fishery was clearly at its highest level in 2016. The fleet sizes and effort by the Japanese and Korean purse seine fleets have been relatively stable for most of this time series. Several Chinese-Taipei vessels re-flagged in 2002, dropping the fleet from 41 to 34 vessels, with fleet numbers stable since. The increase in annual catch by the Pacific Islands fleet until 2005 corresponded to an increase in vessel numbers, and to some extent, mirrors the decline in US purse seine catch, vessel numbers and effort over this period. However, the US purse-seine fleet commenced a rebuilding phase in late 2007, with vessel numbers more than doubling in comparison to recent years, but still below the fleet size in the early-mid 1990s. The increase in vessel numbers in the US purse seine fleet is reflected in the sharp increase in their catch and effort since 2007 (the US catch has been on par with the Korea purse seine fleet over the past five years, although effort by the Korean purse seine fleet in the past four years was clearly lower than the US effort, suggesting higher catch rates or potential issues with effort reporting by the Korean fleet).

The total number of Pacific-island domestic vessels has gradually increased over the past two decades, attaining its highest level in 2016 (116 vessels). The combined Pacific-islands purse seine fleet cover vessels fishing under the FSM Arrangement, bilateral agreements and domestically-based vessels and comprise vessels from the Federated States of Micronesia (FSM; 16 vessels), Kiribati (27 vessels), Marshall Islands (10 vessels), PNG (Papua New Guinea; 51 vessels including their chartered vessels), Solomon Islands (8 vessels), Tuvalu (1 vessel) and Vanuatu (3 vessels).

The domestic Philippine purse-seine and ring-net fleets operate in Philippine and northern Indonesian waters, and prior to 2010, the high seas pocket between Palau, Indonesia, FSM and PNG; this fleet accounted for 190,000-250,000 mt annually in the period 2004-2009. The high seas pocket closure (2010–2012) resulted in a considerable decline in the domestic Philippine purse-seine catch, but with an increase in activities by Philippine-flagged vessels fishing in PNG under bilateral arrangements. With an exemption under CMM 2012-01 and CMM 2014-01, the domestic-based Philippine fleet resumed activities in the high seas pocket between Palau, Indonesia, FSM and PNG in 2013 and activities over the past four years have been reported in the respective SC Philippines National Reports (WCPFC Part 1 Reports). Prior to 2013, the domestic Indonesian purse-seine fleet accounted for a catch similar level to the Philippines domestic fishery but generally has not fished in high seas areas. During 2013, the Indonesian fleet catch increased substantially (215,582 mt) with increased on-shore processing facilities and more vessels entering the fishery, although the purse seine catch in 2015 (56,000 mt) dropped considerably from this level, mainly due to the introduction of a ban on transhipment-at-sea for vessels not built in Indonesia (which is nearly all of the current fleet). The Indonesia purse seine catch recovered in 2016 (127,000 mt) mainly due to increased catches by the smaller-scale purse seine component of this fleet, but also good conditions (catch rates) in general. Prior to 2009, the domestic fleets of Indonesia and Philippines accounted for about 13-16% of the WCP-CA total purse seine catch, although this proportion dropped below 10% since then, with a low in 2015 of only 6% but recovered to around 10% in 2016.

Figure 9 shows annual trends in sets by set type (left) and total tuna catch by set type (right) for the major purse-seine fleets. Sets on free-swimming (unassociated) schools of tuna predominate during recent years (70% of all sets for these fleets in 2016). The proportion of sets on drifting FADs in 2016 (24%) remains consistent with recent years (in the range of 21–24% since 2012). The number and proportion (5%) of sets on natural logs is now stable at a much lower level than prior to 2010, in line with the improvements in technology/efficiency involving drifting FAD use. Associated set types, particularly drifting FAD sets, generally account for a higher average catch per set than unassociated sets, so the percentage of catch for drifting FADs (for 2016 = 36%: Figure 9–right) will be higher than the percentage of sets for drifting FADs (for 2016 = 24%: Figure 9–left). In contrast, the catch from unassociated schools in 2016 was 56% of the total catch, but taken from 70% of the total sets. Table A3 in the APPENDIX provides a more detailed breakdown of catch and effort by set type in 2000-2016 using available logsheet and observer data.

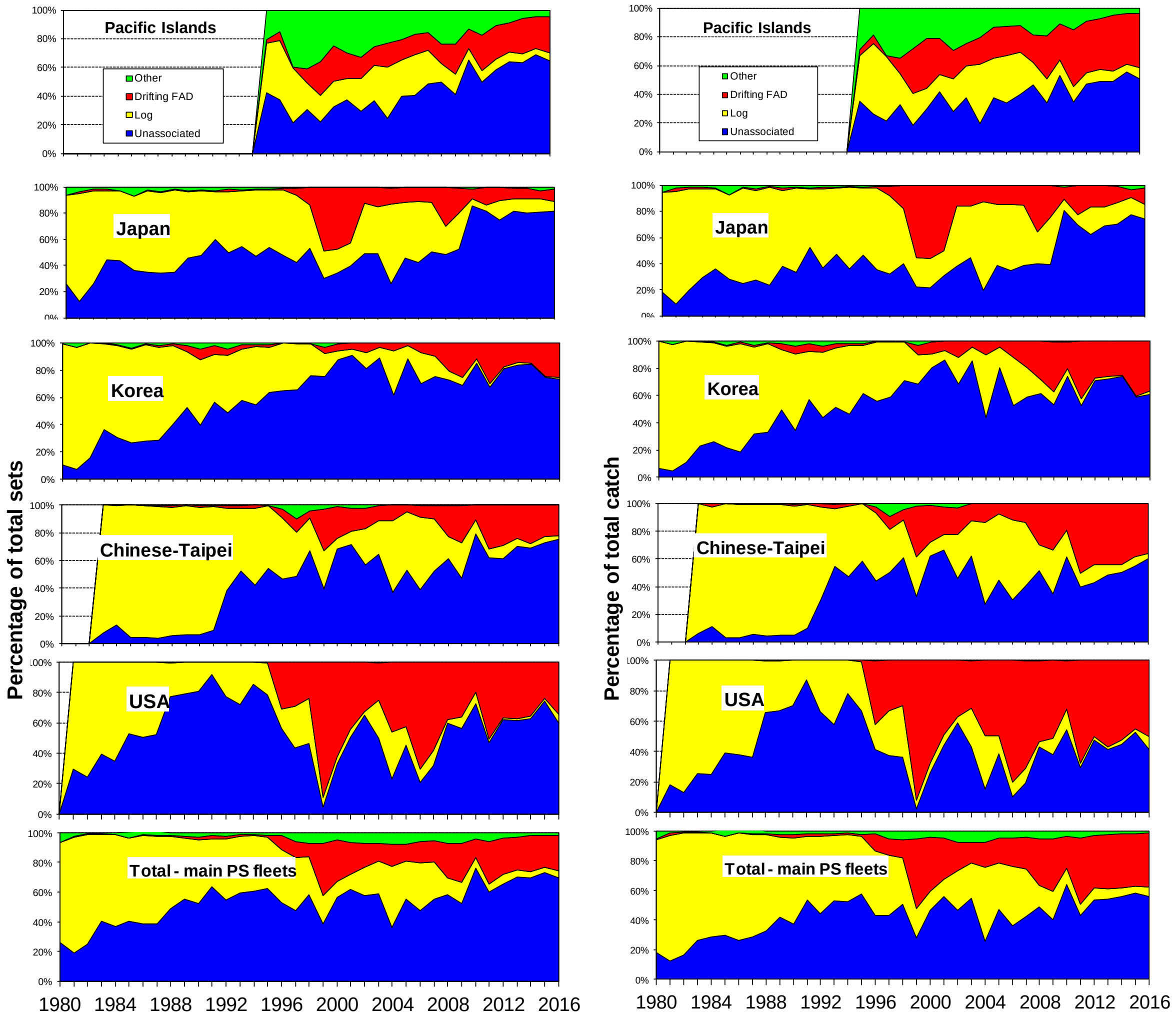



**Figure 9. Time series showing the percentage of total sets (left) and total catch (right), by school type for the major purse-seine fleets operating in the WCP–CA.**

## 3.3 Environmental conditions

The purse-seine catch/effort distribution in tropical areas of the WCP–CA is strongly influenced by El Nino–Southern Oscillation Index (ENSO) events (Figure 10). Figure 11 (left) demonstrates the effect of ENSO events on the spatial distribution of the purse-seine activity, with fishing effort typically expanding further to the east during El Niño years and contracting to western areas during La Niña periods.

The WCP–CA fishery experienced an El Niño period into the first quarter of 2010 with conditions then moving to a strong La Niña state over the latter months of 2010 and into the first half of 2011. It weakened, and then strengthened toward the end of 2011. The fishery experienced a return to neutral ENSO conditions during 2012. Weak-moderate La Niña conditions were experienced during 2013, then neutral conditions into early 2014. El Niño conditions developed during 2014 and strengthened in 2015 to a level not experienced in the fishery for almost 20 years (i.e. since 1997/1998). El Niño conditions continued into the first half of 2016 but then abruptly moved to a neutral state by the middle of the year which presided over the fishery into 2017. The most recent forecast for the remainder of 2017 is a maintenance of neutral ENSO conditions.

In line with the prevailing ENSO conditions, fishing activity during 2014–2015 (strong El Niño conditions) extended to the more central/eastern area of the WCPO compared to 2013 (La Niña conditions). There was more purse-seine effort in the area to the east of longitude 160°E (Figure 11 – left) during 2014/2015 than the previous 6 years when effort is usually concentrated to the west of this longitude (i.e. PNG, FSM and Solomon Islands). During 2016, in line with the move from El Nino to neutral ENSO conditions, the fishery started to move back to the west, although not quite as far west as in 2012, the most recent year with predominant neutral ENSO conditions.

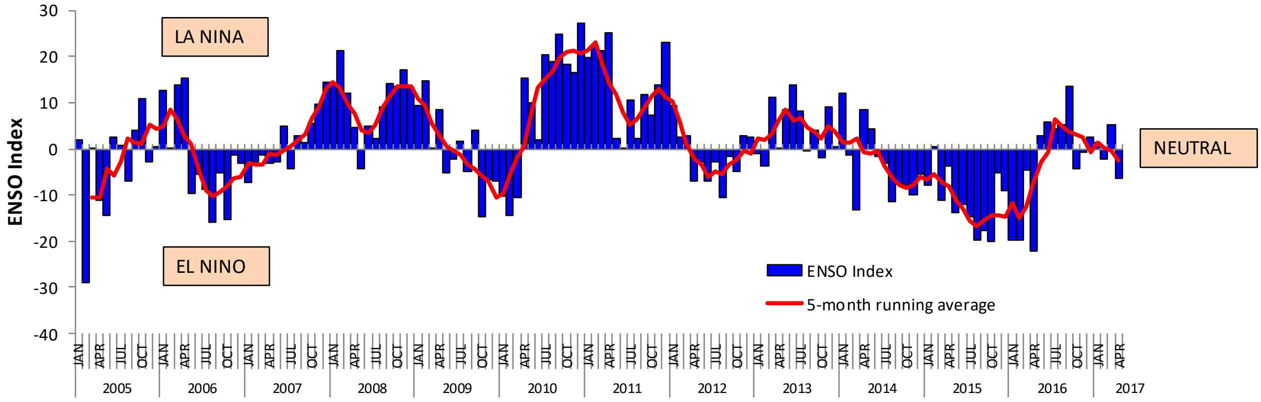



**Figure 10. Trends in El Nino Southern Oscillation Index (ENSO), 2005-2017**

### 3.4 Distribution of fishing effort and catch

Despite the FAD closure for certain periods in each year since 2010, drifting FAD sets remain an important fishing strategy (Figure 11–right), particularly to the east of 160°E where most of the purse seine effort was directed during 2016. The relatively high proportion of unassociated sets in the eastern areas (e.g. Gilbert Islands) was a feature of the fishery in 2014–2015 and into the first half of 2016 (i.e. corresponding to El Nino conditions). The FAD closure periods (since 2010) have clearly contributed to an increase in unassociated sets, although in some years (e.g. 2016 – see Figure 23), this set type appears to have dominated in the non-FAD closure months as well, due to prevailing environmental conditions which were conducive to sets on free-swimming schools.

Figures 12 through 16 show the distribution of purse seine effort for the five major purse seine fleets during 2015 and 2016. The El Nino-like conditions of 2015 meant that effort by most fleets remained in the eastern areas including Nauru, Gilbert/Phoenix groups of Kiribati and Tuvalu waters. The transition from El Nino to neutral ENSO conditions in the middle of 2016 resulted in a clear move westwards for some fleets (e.g. Korea). The US fleet typically fishes in the more eastern areas and this was again the case during 2015/2016, with effort extended into the Phoenix Islands, the Cook Islands, Tokelau and the adjacent eastern high seas areas with hardly any effort west of 160°E. The difference in areas fished by the Asian fleets (Japan, Korean and Chinese Taipei fleets) in 2015/2016 (Figures 13, 14 and 15) is related to the areas they have access to and perhaps also related to fishing strategy (e.g. use of traditional fishing grounds, e.g. FSM, PNG and the Solomon Islands by the Japan fleet). During 2016, effort by the combined Pacific Islands fleet extended from west (the domestic PNG fishery) through to the eastern extent of the tropical WCPO (Line Group), albeit more reduced in this eastern area than in 2015.

Figure 17 shows the distribution of catch by species for the past seven years, Figure 18 shows the distribution of skipjack and yellowfin catch by set type for the same period, and Figure 19 shows the distribution of estimated bigeye catch by set type for the past seven years. There are some instances where the composition of the skipjack catch by set type is clearly different to the composition of the yellowfin catch by set type; for example, in 2016, unassociated sets clearly accounted for a far greater proportion of the total yellowfin catch in the area to the east of 160°E than they did for the total skipjack catch. In contrast, associated sets usually account for a higher proportion of the skipjack catch (than yellowfin), in the respective total catch of each species (Figure 16–left). Higher proportions of yellowfin in the overall catch (by weight) usually occur during El Niño years as fleets have access to “pure” schools of large yellowfin that are more available in the eastern tropical areas of the WCP–CA. There was some evidence of this in 2014 and 2016 (under El Nino-like conditions), with a higher proportion of large yellowfin (fish >120cm) taken in the fishery (Figure 17, Figure 18–right and Figure 59). In contrast, there were lower yellowfin tuna catches from unassociated sets in the central/eastern areas during 2013 (under La Nina-like conditions) which is understood to be the primary reason for the low overall yellowfin tuna catch in that year.

The estimated bigeye catch in the area to the west of 160°E tends to be taken by a mixture of anchored and drifting FADs and logs, but in contrast, is (increasingly) dominated by drifting FAD sets in the area to the east of 160°E (Figure 19). During both 2015 and 2016, unassociated sets appear to have accounted for a higher proportion of the bigeye tuna catch in the area bounded by 160°–170°E than previous years, possibly due to environmental conditions related to the El Nino in that area (see Pilling et al., 2016).

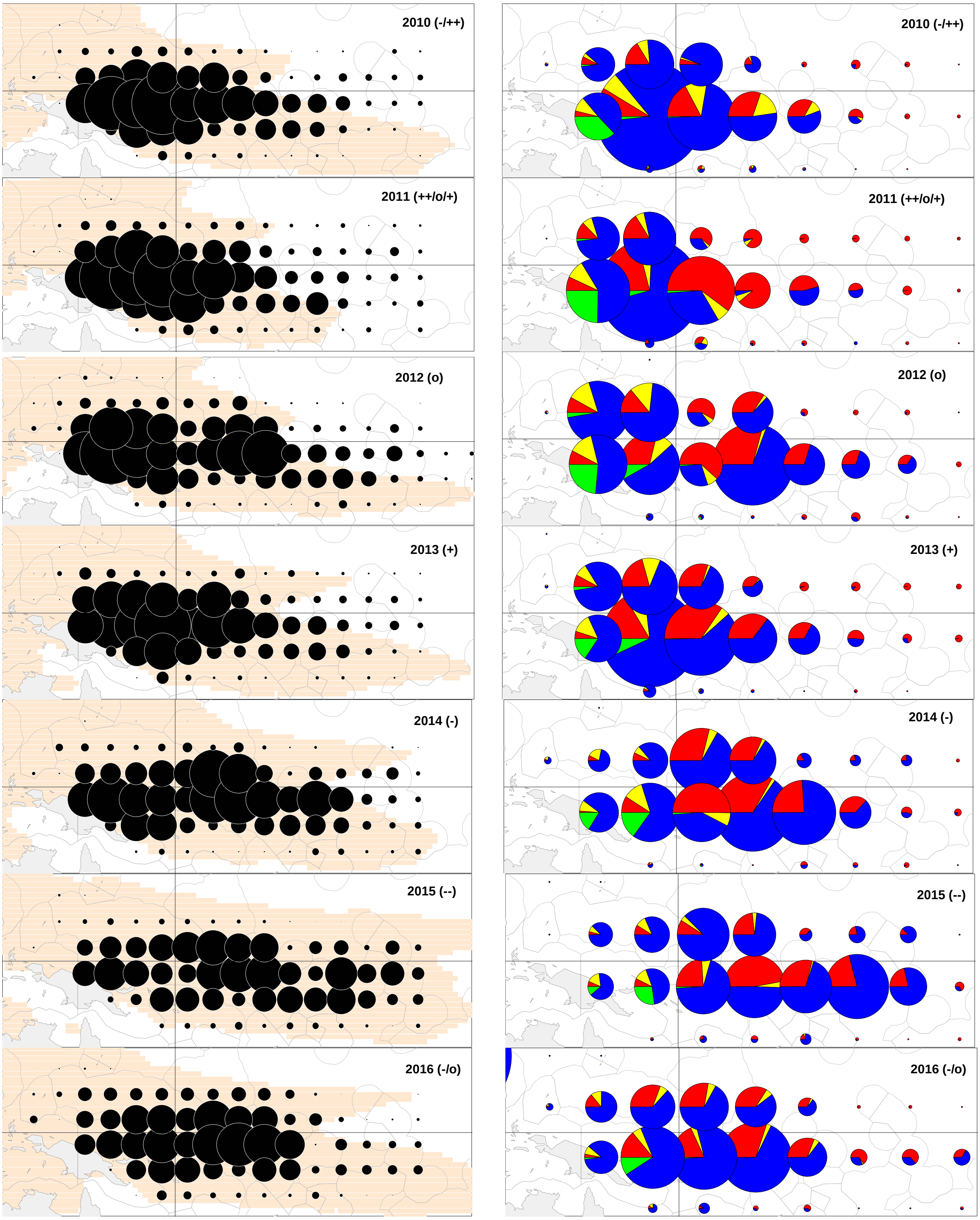



**Figure 11. Distribution of purse-seine effort (days fishing – left; sets by set type – right), 2010–2016. (Blue–Unassociated; Yellow–Log; Red–Drifting FAD; Green–Anchored FAD).**

Pink shading represents the extent of average sea surface temperature > 28.5°C

ENSO periods are denoted by "+": La Niña; "-": El Niño; "o": transitional period.

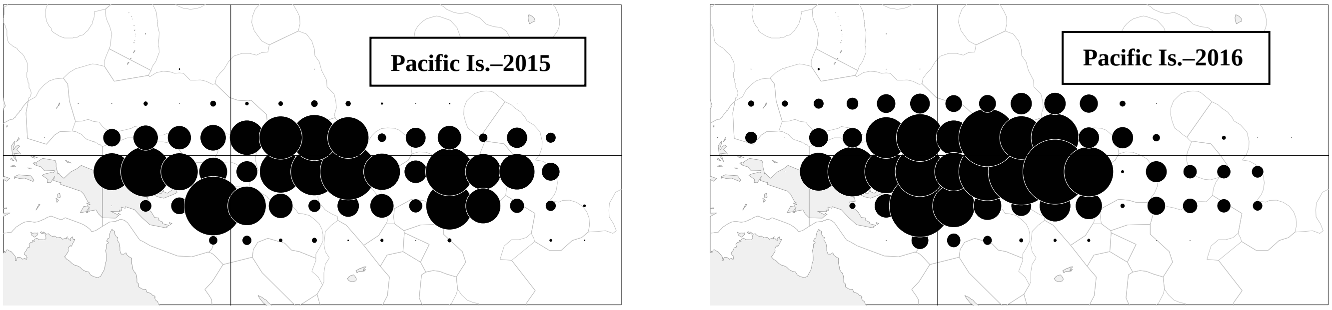



**Figure 12. Distribution of effort by Pacific Islands fleets during 2015 and 2016**
lines for the equator (0° latitude) and 160°E longitude included.

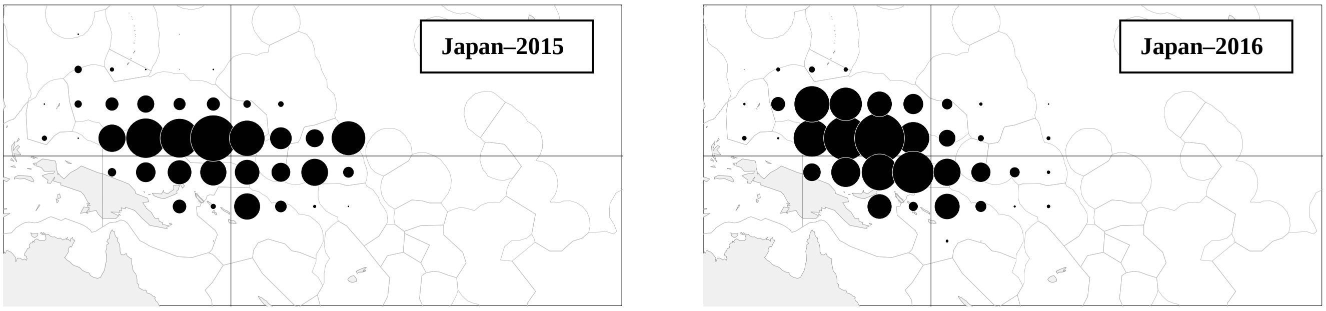



**Figure 13. Distribution of effort by the Japanese purse seine fleet during 2015 and 2016**
lines for the equator (0° latitude) and 160°E longitude included.

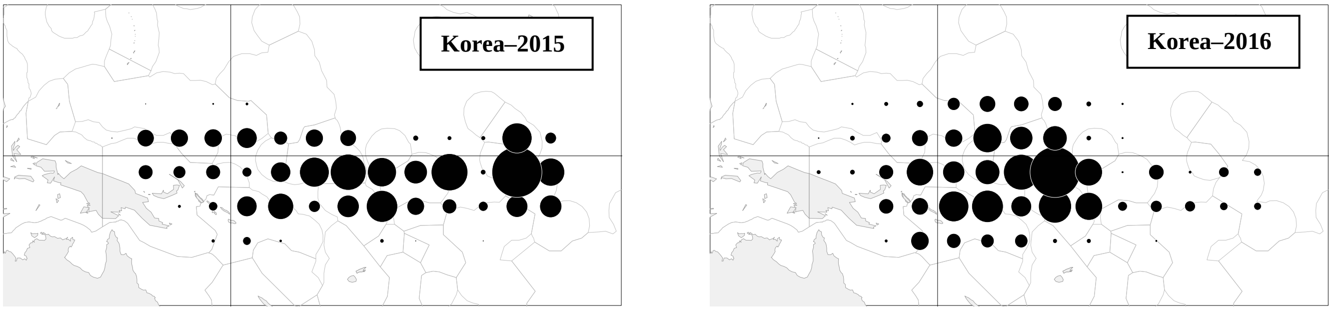



**Figure 14. Distribution of effort by the Korean purse seine fleet during 2015 and 2016**
lines for the equator (0° latitude) and 160°E longitude included.

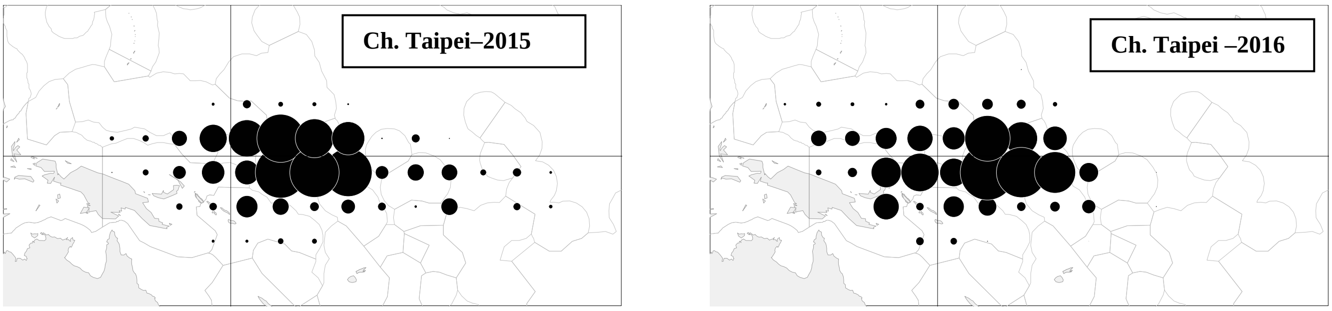



**Figure 15. Distribution of effort by the Chinese-Taipei purse seine fleet during 2014 and 2016**
lines for the equator (0° latitude) and 160°E longitude included.


**Figure 16. Distribution of effort by the US purse seine fleet during 2015 and 2016**
lines for the equator (0° latitude) and 160°E longitude included.

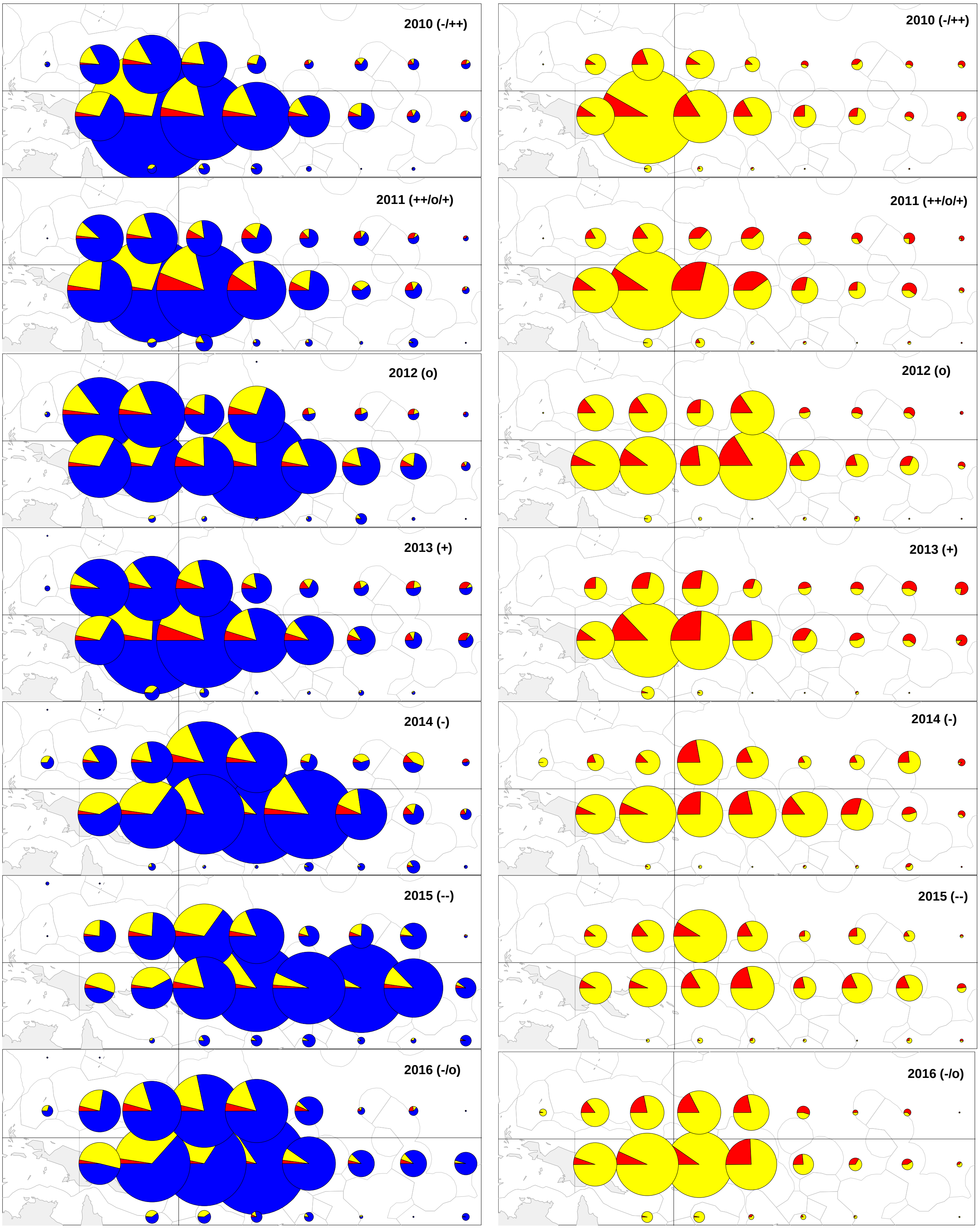



**Figure 17. Distribution of purse-seine skipjack/yellowfin/bigeye tuna catch (left) and purse-seine yellowfin/bigeye tuna catch only (right), 2010–2016 (Blue–Skipjack; Yellow–Yellowfin; Red–Bigeye).**

ENSO periods are denoted by "+": La Niña; "-": El Niño; "o": transitional period.

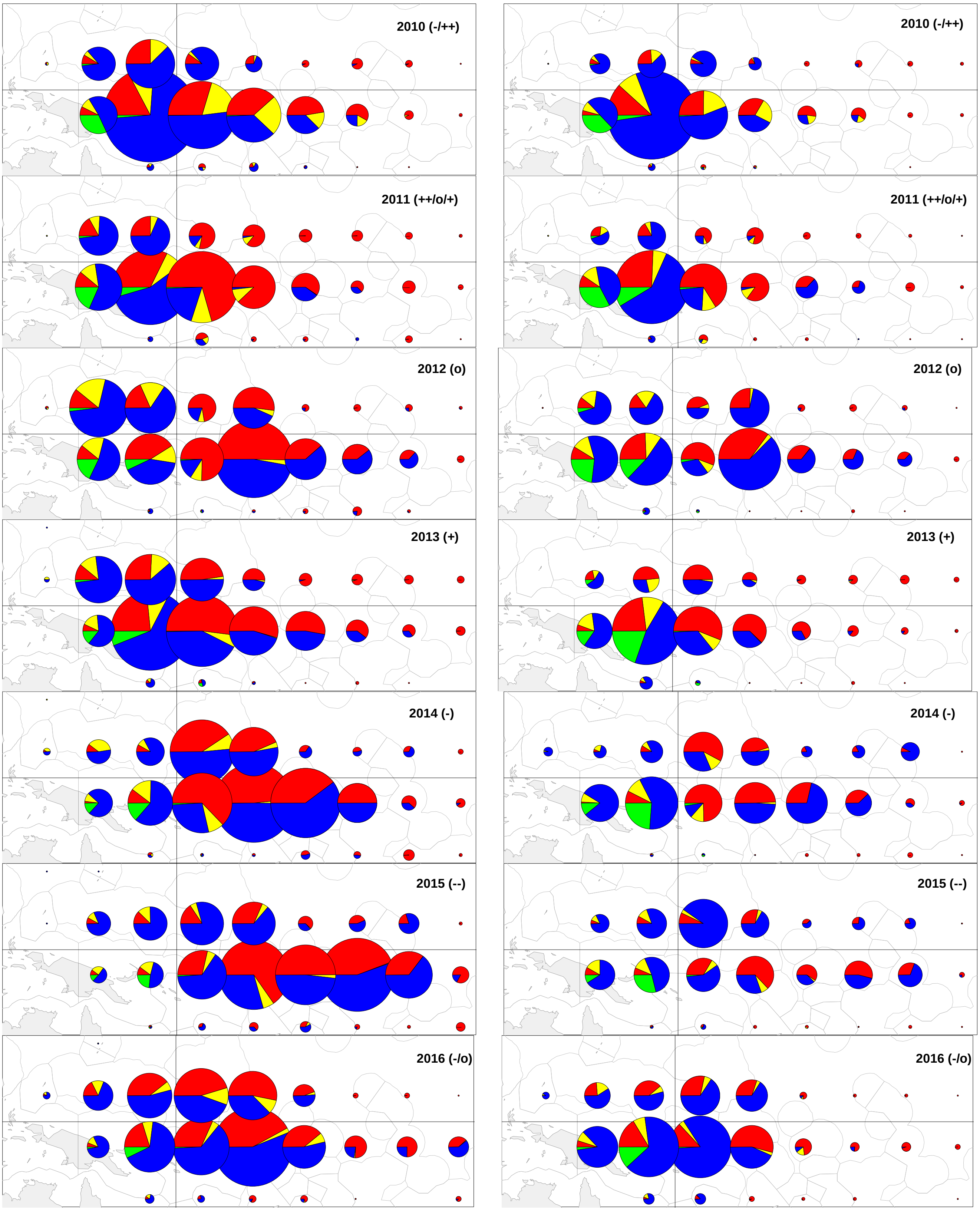



**Figure 18. Distribution of skipjack (left) and yellowfin (right) tuna catch by set type, 2010–2016 (Blue–Unassociated; Yellow–Log; Red–Drifting FAD; Green–Anchored FAD).**

ENSO periods are denoted by "+": La Niña; "-": El Niño; "o": transitional period.

Sizes of circles for all years are relative for that species only.

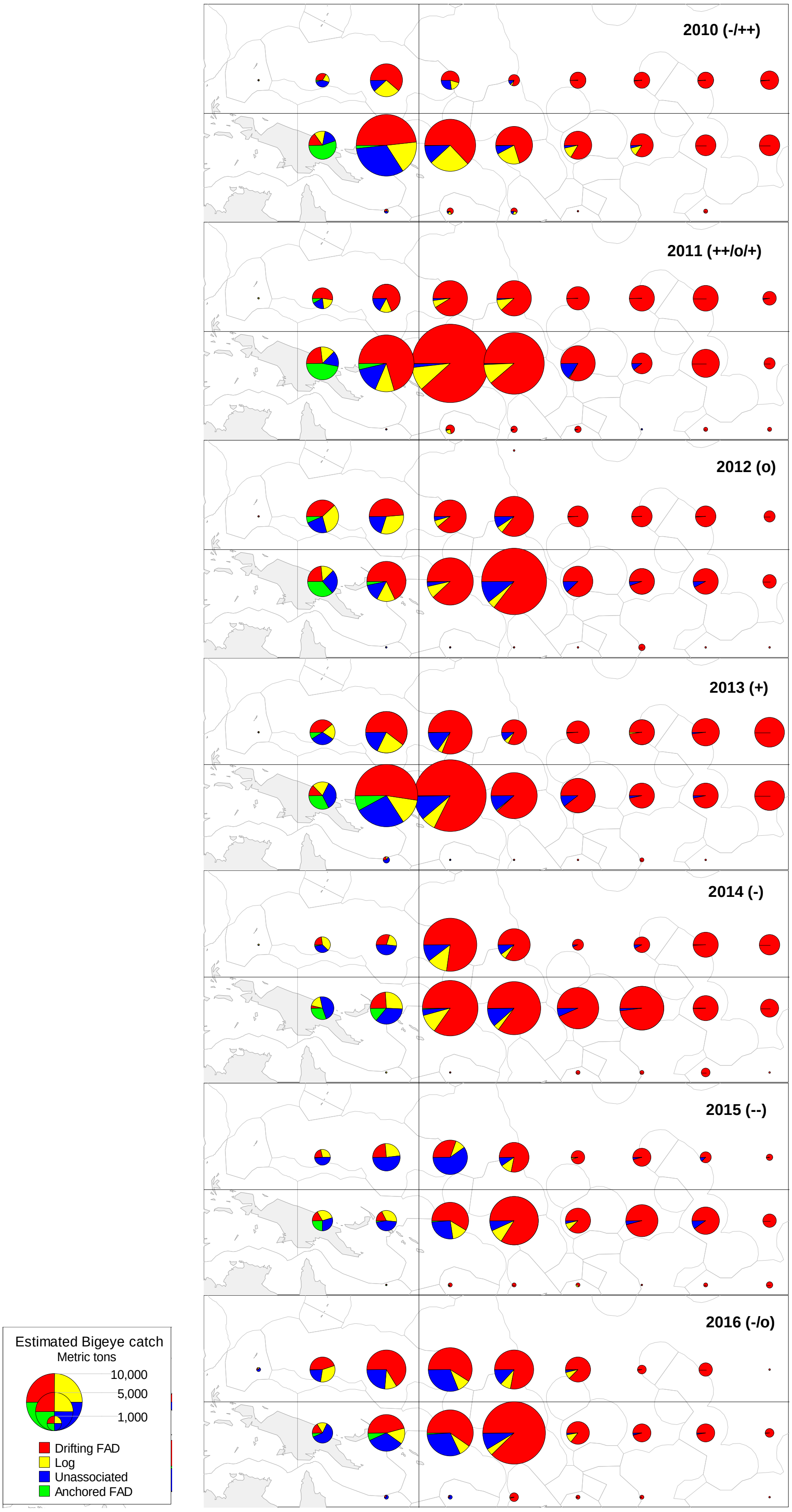



**Figure 19. Distribution of estimated bigeye tuna catch by set type, 2010–2016 (Blue–Unassociated; Yellow–Log; Red–Drifting FAD; Green–Anchored FAD).**
ENSO periods are denoted by "+": La Niña; "-": El Niño; "o": transitional period.

### 3.5 Catch per unit of effort

Figure 20 shows the annual time series of nominal CPUE by set type and vessel nation for skipjack (left) and yellowfin (right). These trends are not standardised for factors that may relate to the efficiency of the fleets, e.g. technological improvements and increased vessel power, so therefore must be interpreted with caution. Recent reviews of the available logsheet data used to determine nominal CPUE highlight an apparent change in reporting behaviour with a clear increase in the reporting of transit days (over days searching); since transit days are not included as purse seine effort (and days searching is included), this change will inevitably result in a positive bias in the nominal CPUE data presented herein.

Yellowfin purse-seine CPUE shows strong inter-annual variability and there are more differences in CPUE among the fleets. School-set yellowfin CPUE appears influenced by ENSO variation in the WCP–CA, with CPUE generally higher during El Niño episodes. This is believed to be related to increased catchability of yellowfin tuna due to a shallower surface-mixed layer during these periods. Associated (log and drifting FAD) sets generally yield higher catch rates (mt/day) for skipjack than unassociated sets, while unassociated sets sometimes yield a higher catch rate for yellowfin than associated sets. The higher yellowfin CPUE from free-schools occurs when "pure" schools of large, adult yellowfin are more available to the gear in the more eastern areas of the tropical WCP-CA, and so account for a larger catch (by weight) than the (mostly) juvenile yellowfin encountered in associated sets.

Purse seine skipjack CPUE continued to be around record levels in 2016 (the Korean fleet in particular). The overall 2016 skipjack catch rate was the lowest for the Japanese fleet and no doubt related to concentrating their effort in the western areas where catch rates were lower than the eastern tropical areas (under El Nino conditions). Over the entire time series, the trend for skipjack CPUE is clearly upwards, although, as noted, these graphs present nominal CPUE and do not take into account the increase in fishing efficiency.

The purse seine yellowfin CPUE for free-schools increased for most fleets in 2016 and contributed to the relatively high catch reported for this year (see Figure 59 for proportion of large yellowfin from free- schools in overall purse seine catch). This increase may in part be related to the prevailing El Nino conditions with large yellowfin more available to vessels fishing in the central and eastern tropical areas (see Figure 17–right and Figure 18–right). Yellowfin catch rates on drifting FADs also increased for most fleets in 2016 and remain at elevated levels compared to the average over the last 10 years. The long-term time series for yellowfin CPUE shows more inter-annual variability and overall, a flatter trend in than the skipjack tuna CPUE. It is unknown whether these trends reflect an increasing ability to target skipjack tuna at the expense of yellowfin or reflect a change in yellowfin abundance, given that fishing efficiency has increased.

The difference in the time of day that sets are undertaken is thought to be one of the main reasons why bigeye tuna are rarely taken in unassociated schools compared to log and drifting FAD schools, which have catch rates of this species an order of magnitude higher (Figure 21). The trends in estimated bigeye tuna CPUE since 2000 varies by fleet and set type with no clear pattern evident; drifting FADs account for the highest catches and most variability. The time series of bigeye catch rates for the Japanese fleet is now more in line with the other fleets as a result a new data submission with a revision to their species composition.

Figure 22 shows the inverse relationship between monthly CPUE (total tuna catch (mt) per day) and average trip length estimates (from logsheets and VMS); logsheet trip length tends to fluctuate in synchrony with CPUE, with shorter trips corresponding to higher CPUE. Average trip length (from VMS data) generally compares well to average trip length (from logsheet data), but as logsheet coverage declines (e.g. early 2017), estimates from these two sources tend to diverge since available logsheets are probably not representative. The FAD closure period each year (commencing in 2010) generally coincides with a decline in total tuna CPUE, with longer trips and apparent difficulties obtaining consistent catches from free-swimming schools. The pattern in high CPUE in the months immediately following the FAD closure periods is understood to be mainly due to the build-up of unexploited biomass which then become available through FADs. The drop in CPUE during the 2$^{nd}$ quarter of 2016 may simply be due to a return to conditions prior to the most recent El Nino of 2014–2016. It is also important to note that fluctuations in catch levels in certain periods are also influenced by economic conditions.

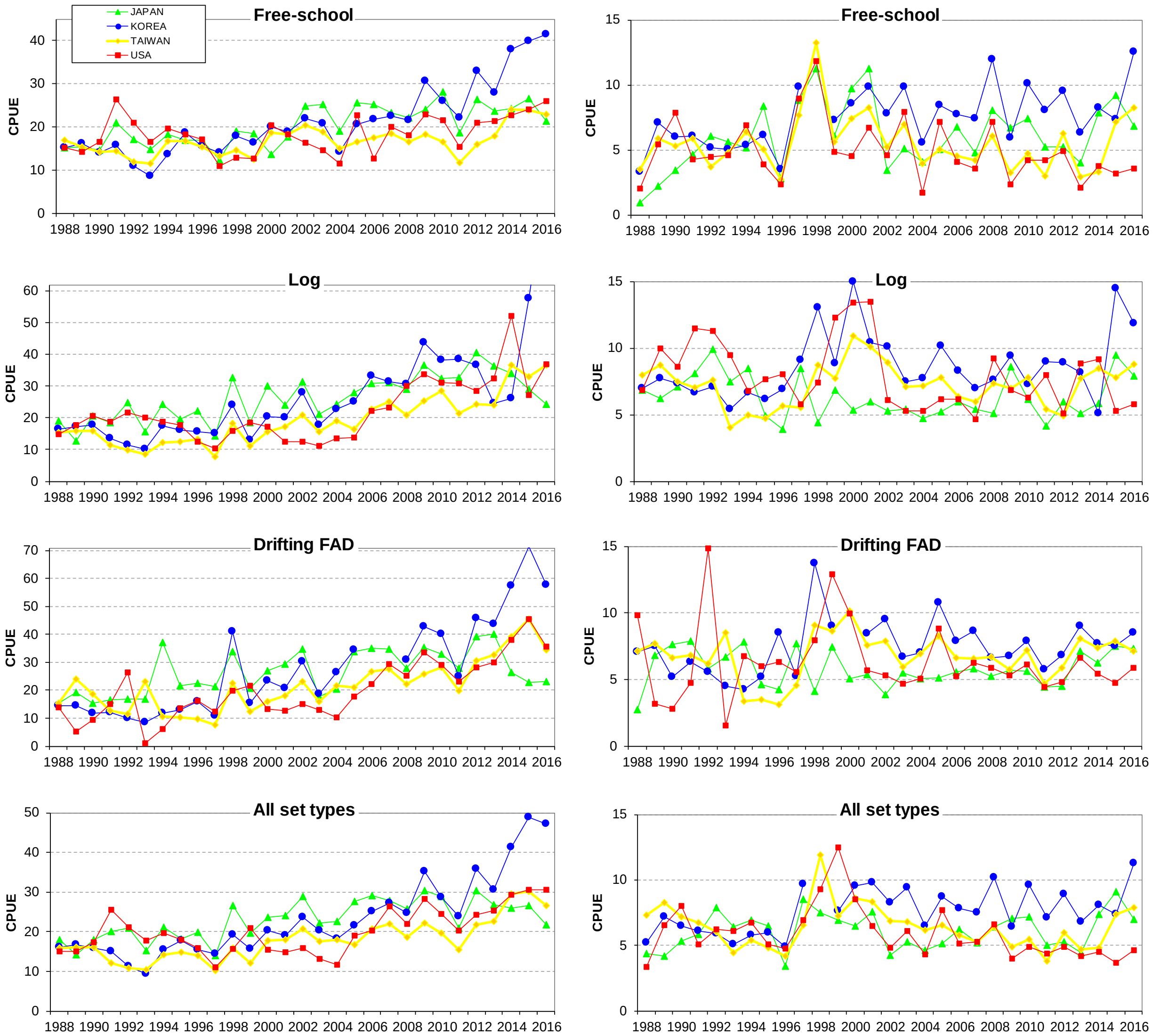



**Figure 20**. **Skipjack tuna CPUE (mt per day–left) and yellowfin tuna CPUE (mt per day–right) by set-type, and all set types combined, for selected purse-seine fleets fishing in the tropical WCP–CA.**
Effort and CPUE were partitioned by set type according to the proportions of total sets attributed to each set type.

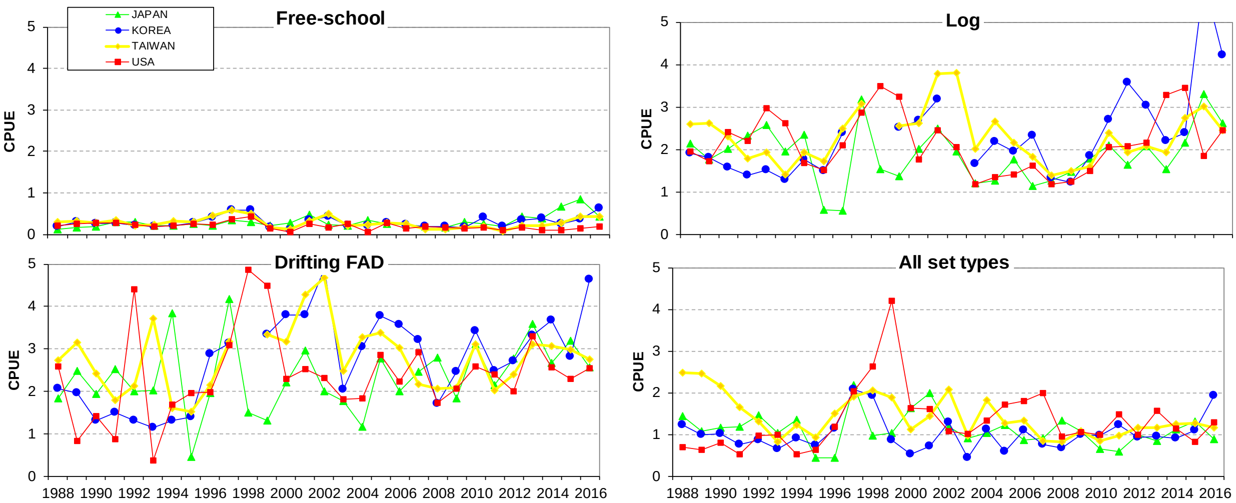



**Figure 21. Estimated bigeye tuna CPUE (mt per day) by major set-type categories (free-school, log and drifting FAD sets) and all set types combined for Japanese, Korean, Chinese-Taipei and US purse seiners fishing in the tropical WCP–CA.**
Effort and CPUE were partitioned by set type according to the proportions of total sets attributed to each set type.

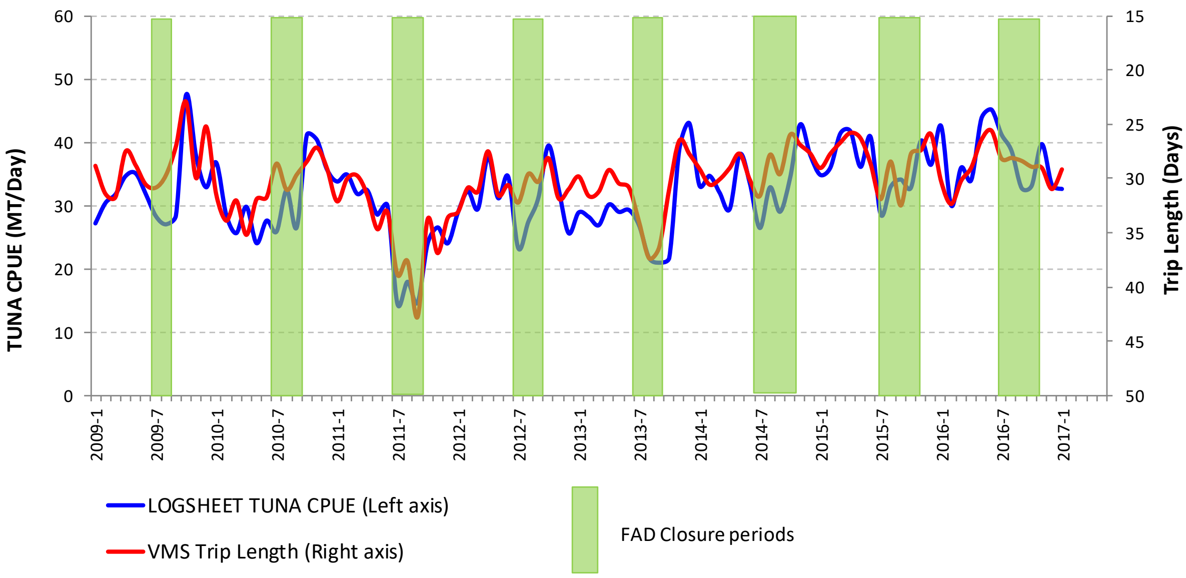



**Figure 22. Monthly purse-seine tuna CPUE (mt/day) and average trip length (VMS days), 2005–2016.**

### 3.6 Seasonality

Figures 23 and 24 show the seasonal average CPUE for skipjack and yellowfin tuna in the purse seine fishery for the period 2010–2016, respectively. Figure 25 shows the distribution of effort by quarter for the period 2010-2015 in comparison to effort by quarter in 2016. Prior to implementation of the FAD closure, the average monthly skipjack CPUE was generally highest in the first half of the year and slightly lower thereafter, which is in contrast to the yellowfin CPUE, which was at its lowest during the first six months, but higher thereafter. This situation corresponds to the seasonal eastwards extension of the fishery in the second half of the year, to an area where schools of large yellowfin are thought to be more available than areas to the west due to, *inter alia*, a shallower surface-mixed layer. The FAD closure implementation since 2009 has tended to reduce catch rates during those [FAD-closure] months, with relatively high catch rates experienced immediately following the last FAD-closure month.

The trend in monthly skipjack CPUE for 2016 was below the 2010-2015 monthly average for months Jan–April, but from May–August (i.e. including initial FAD closure months), catch rates were clearly above this average, suggesting fleets were able to maintain good catch rates from free-swimming schools in the absence of FAD fishing. The monthly yellowfin CPUE for 2016 was mostly well above the 2010-2015 average, consistent with the relatively high yellowfin catch from this fishery in 2016 (Figure 24).

The El Nino-like conditions in 2015 continued into the first half of 2016 with evidence of the more eastwards extension of the warm pool (i.e. surface water >28.5°C on average) compared to the long-term average (2000-2015 – contrast the shading representing sea surface temperature in each quarter in Figure 25). However, by the 4$^{th}$ quarter of 2016, the distribution of the 'warm pool' (under neutral ENSO conditions) was similar to the long-term 2000-2015 average. The distribution of effort and catch (Figure 25–right) remained under the influence of the El Nino in the first quarter of 2016 but there was evidence of the fishery moving westwards in subsequent months of 2016. This situation is in contrast with the long-term average (Figure 25–left) where the majority of the purse seine catch is taken in the area west of 160°E during the first two quarters and only changing with the seasonal eastern extension of the fishery in the second half of the year. Catches in the third quarter of 2016 (when the FAD closure was in force) do not appear to be as constrained as in previous years, confirming good catch rates from free-swimming schools. Note the relatively high proportion of yellowfin tuna catch in the 3$^{rd}$ quarter 2016 in the areas [0°–5°S, 165°E–170°E] and [0°–5°N, 165°E–180°], which coincide with the relatively high yellowfin CPUE for these months, as shown in Figure 25.

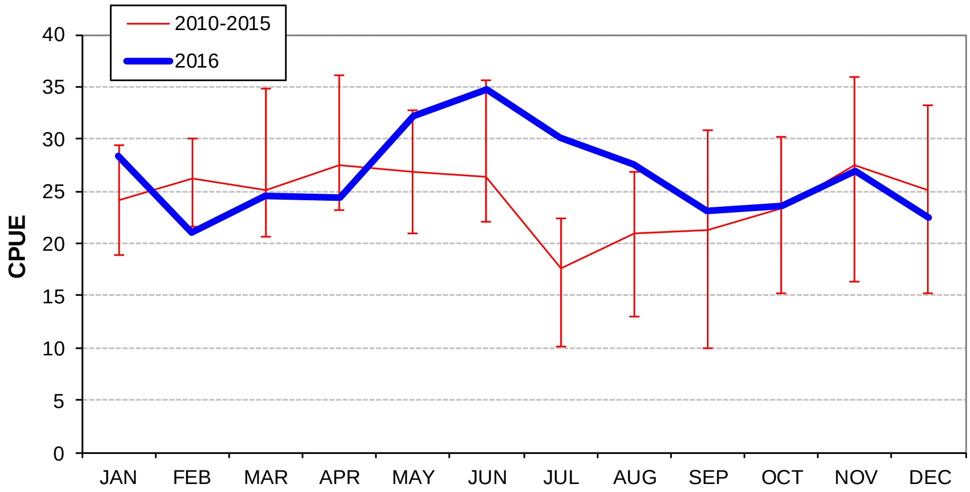



**Figure 23. Average monthly skipjack tuna CPUE (mt per day) for purse seiners fishing in the tropical WCP–CA, 2010–2016.**

Red line represents the period 2010–2015 and the blue line represents 2016.
The bars represent the range (i.e. minimum and maximum) of monthly values for the period 2010–2015.

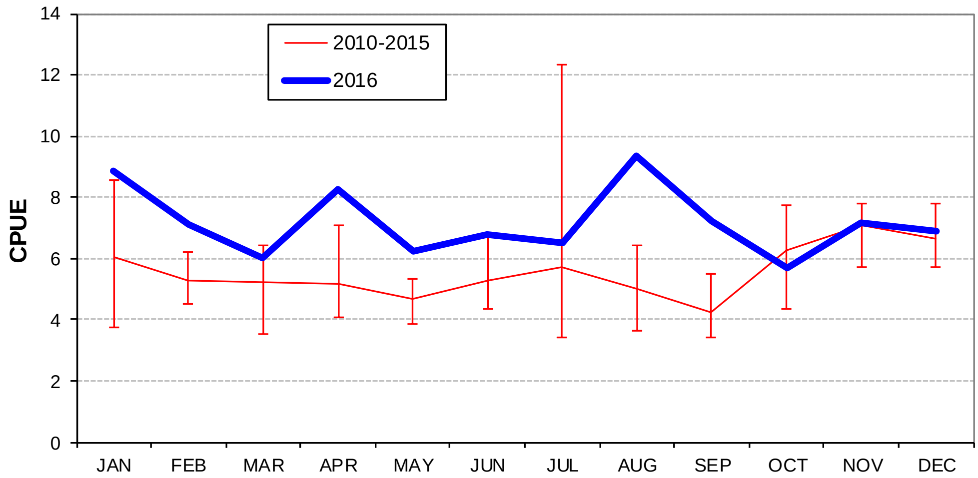



**Figure 24. Average monthly yellowfin tuna CPUE (mt per day) for purse seiners fishing in the tropical WCP–CA, 2010–2016.**

Red line represents the period 2010–2015 and the blue line represents 2016.
The bars represent the range (i.e. minimum and maximum) of monthly values for the period 2010–2015.

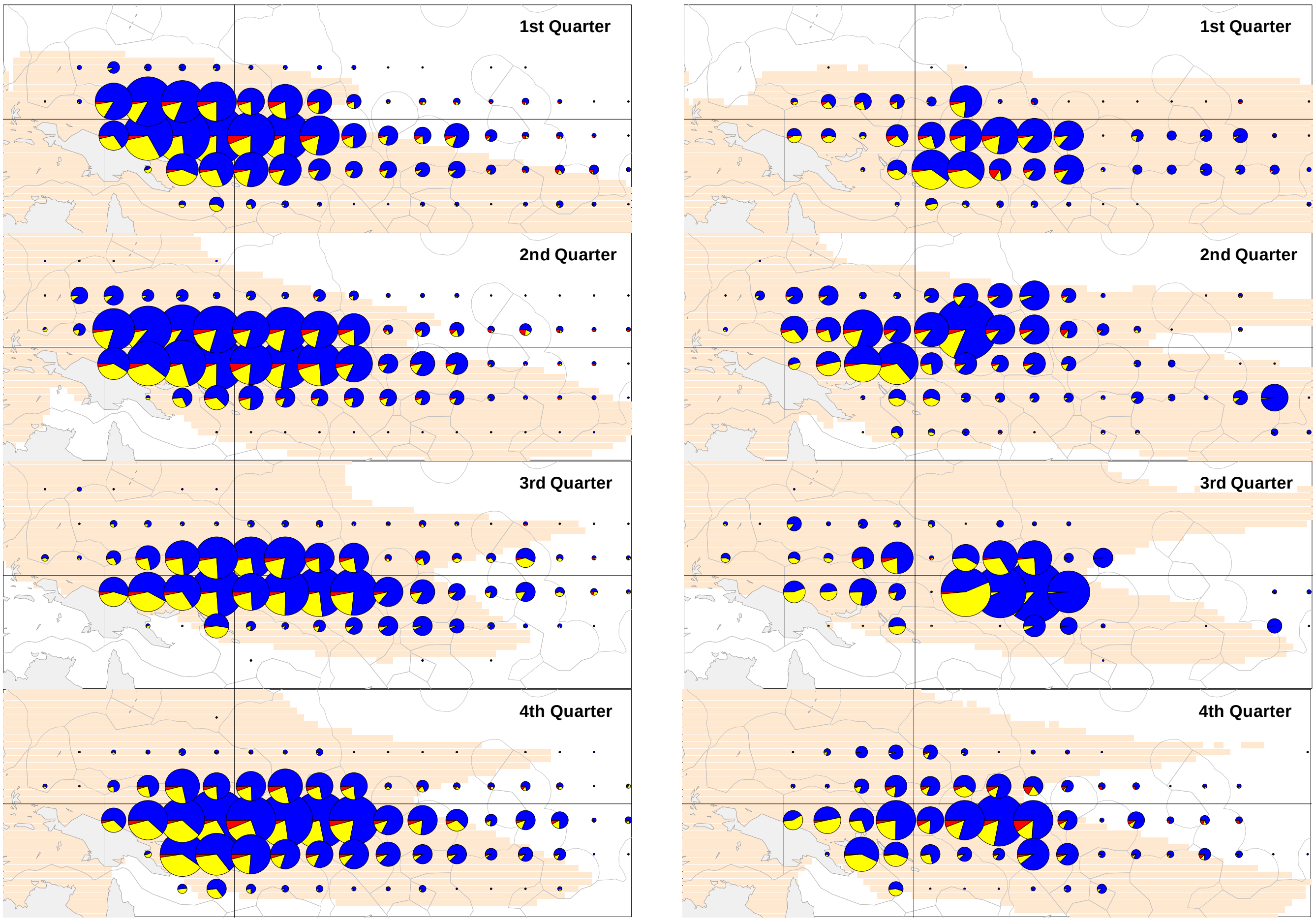



**Figure 25. Quarterly distribution of purse-seine catch by species for 2000–2015 (left) and 2016 (right).**
(Blue–Skipjack; Yellow–Yellowfin; Red–Bigeye)
Pink shading represents the extent of average sea surface temperature >28.5°C by quarter for the period 2000–2015 (left) and 2016 (right)

## 3.7 Purse seine: Prices, value and economic conditions

### *3.7.1 Prices*

*Skipjack*

Prices in the major markets for WCPO skipjack were significantly higher in 2016 compared with 2015. The Bangkok market (4-7.5lbs) and Thai average import prices rose 23% and 19% respectively, General Santos prices were 17% higher, the Yaizu Port price 21% higher in USD terms (9% up in JPY) and the Japan selected ports average price 18% higher in USD terms (6% in JPY).
With regard to recent trends, following the record prices of 2012 prices declined through 2015 with Bangkok skipjack prices (4-7.5lbs) declining from $2,074/mt in 2012 to $1,128/mt in 2015. So while 2016 saw year on year increases to average $1,395/mt it is still around one-third lower than that seen in 2012.

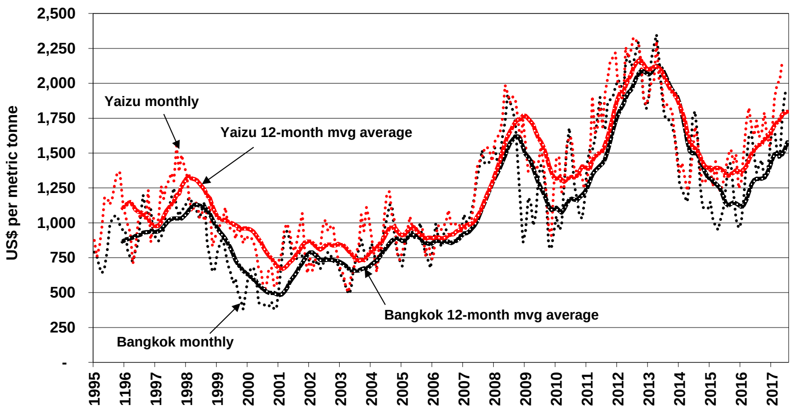



**Figure 26. Skipjack prices, Bangkok (4-7.5lbs, c&f) and Yaizu (ex-vessel) monthly and 12 month moving average**

The supply situation over the course of the first half of 2017 has been relatively poor and this, combined with the need for canners to stock up prior to the July-October FAD closure in the WCPO, has resulted in the strong increases in prices. Bangkok prices have increased by around 30% to be currently (mid-July) trading at around US$1,950/mt (4.-7.5lbs, c&f) while prices in General Santos are up around 25% and Yaizu USD prices increased by around 40% to May.
Prices vary in response to a range of factors including inventories of raw material held by processors, the pace in the sales of processed goods and supply situation as determined by environment conditions and management measures in place (such as the seasonal FAD closure July to September/October) and time closures (Eastern Pacific). However, as noted in previous year the price level around which these variations occur appear to be driven by global food prices trends with annual skipjack prices tending to track the FAO food price index (Figure 27). The recent increase in the Bangkok skipjack price has led to its price index now being considerable higher than the FAO Food price index.

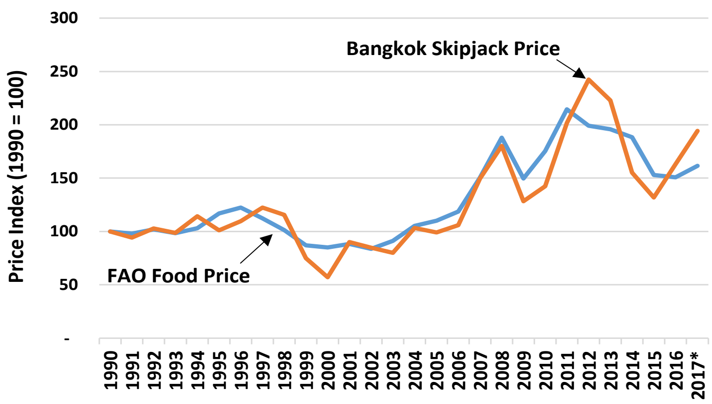



**Figure 27. Annual FAO food price index and Bangkok skipjack price index**
**For period to June*

*Yellowfin*

Yellowfin prices on canning markets in 2016 reversed recent declines, albeit moderately with Thai import prices increasing by 2% to US$1,605/mt and Yaizu prices in US$ by 11% to US$2,309/mt.

### *3.7.2 Value*

As a means of examining the effect of the changes in prices and catch levels, estimates of the “delivered” value of the purse seine fishery tuna catch in the WCPFC Area from 1997 to 2016 were obtained. In deriving these estimates certain assumptions were made due to data and other constraints that may or may not be valid and as such caution is urged in the use of these figures.[3]

The estimated delivered value of the purse seine tuna catch in the WCP-CA area for 2016 is $2,843 million compared with $2,327 million in 2015. This represents an increase of $516 million (22%) from 2015. This increase resulted from the $317 million (18%) increase in the delivered value of the skipjack catch (worth $2,071 million in 2016) as well as the increase of $178 million (35%) in the value of the yellowfin catch. The increase in the delivered value of skipjack resulted from the 19% increase in the skipjack composite price that more than offset the 1% decrease in catch. The increase in the delivered value for yellowfin was caused by increases in price and catch, 3% and 31% respectively[4].

### *3.7.3 Economic Conditions*

According to the FFA purse seine fishery economic conditions index,[5] the greatest determinant behind changes in economic conditions for the purse seine fishery, historically, appears to have been movements in fish prices. In recent years, however, increases in catch rate have had a significant impact on overall economic conditions (Figure 28).

The FFA index indicates that economic conditions returned to more average levels in 2014 following the exceptionally good conditions seen in 2012 and 2013 when fish prices were well above average. In 2015 prices continued to decline, however, falls in fuel costs and increases in catch rates saw an improvement in economic conditions from 2014 levels. The improvement in conditions continued in 2016 with catch rates, while lower than 2015 levels, significantly higher than the long term average, costs below average and prices marginally higher than average resulting in the index being at its 3rd highest level  over the period covered. .

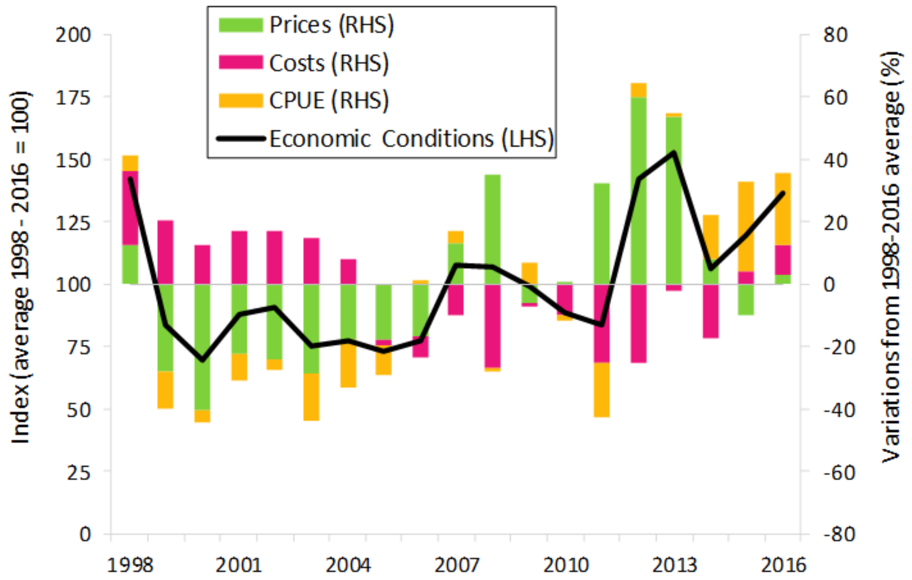



**Figure 28. Economic conditions index for the purse seine fishery (LHS) and variance of component indices against average (1998-2016) conditions (RHS)**

[3] The delivered value of each year's catch was estimated as the sum of the product of the annual purse catch of each species, excluding the Japanese purse seine fleet's catch, and the average annual Thai import price for each species (bigeye was assumed to attract the same price as for skipjack) plus the product of the Japanese purse seine fleet's catch and the average Yaizu price for purse seine caught fish by species. Thai import and Yaizu market prices were used as they best reflect the actual average price across all fish sizes as opposed to prices provided in market reports which are based on benchmark prices, for example, for skipjack the benchmark price is for fish of size 4-7.5lbs.

[4] Further details of the value of tuna catches in WCPFC Convention Area can be obtained from the Forum Fisheries Agency website (www.ffa.int/node/862).

[5] For a full description of the index and its components please refer to SC12-ST-WP-04

# 4 WCP–CA POLE-AND-LINE FISHERY

## 4.1 Historical Overview

The WCP–CA pole-and-line fishery has several components:

- the year-round tropical skipjack fishery, mainly involving the domestic fleets of Indonesia, Solomon Islands and French Polynesia, and the distant water fleet of Japan
- seasonal sub-tropical skipjack fisheries in the domestic (home) waters of Japan, Australia, Hawaii and Fiji
- a seasonal albacore/skipjack fishery east of Japan (largely an extension of the Japan home-water fishery).

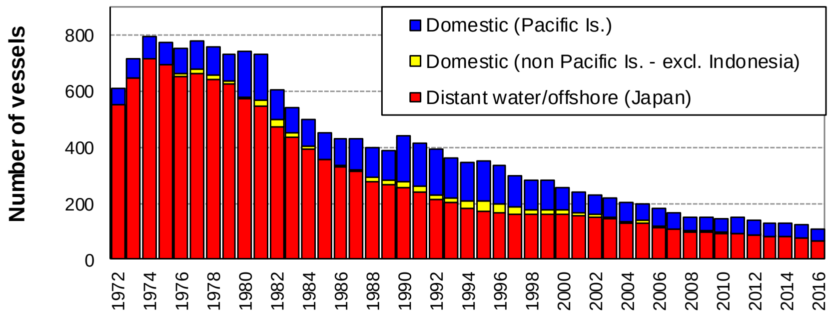



**Figure 29. Pole-and-line vessels operating in the WCP–CA**
(excludes pole-and-line vessels from the Japanese Coastal and Indonesian domestic fisheries)

Economic factors and technological advances in the purse seine fishery (primarily targeting the same species, skipjack) have seen a gradual decline in the number of vessels in the pole-and-line fishery (Figure 29) and in the annual pole-and-line catch during the past 15–20 years (Figure 30). The gradual reduction in numbers of vessels has occurred in all pole-and-line fleets over the past decade. Pacific Island domestic fleets have declined in recent years – fisheries formerly operating in Fiji, Palau and Papua New Guinea are no longer active, only one vessel is now operating (occasionally) in Kiribati, and fishing activity in the Solomon Islands fishery during the 2000s was reduced substantially from the level experienced during the 1990s. Several vessels continue to fish in Hawai'i, and the French Polynesian *bonitier* fleet remains active (43 vessels in 2016), but an increasing number of vessels have turned to longline fishing. Vessel and catches from Indonesian pole-and-line fleet have also declined over recent years. However, there is at least one initiative underway to revitalize the domestic pole-and-line fisheries with increased interest in pole-and-line fish associated with certification/eco-labelling.

## 4.2 Catch estimates (2016)

The provisional 2016 pole-and-line catch (199,457 mt) was the lowest annual catch since the late-1960s, although estimates are typically revised upwards by the start of SC meetings each year.

Skipjack tends to account for the majority of the catch (~70-83% 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 north Pacific. Yellowfin tuna (5–16%) and a small component of bigeye tuna (1–4%) make up the remainder of the catch. There are only five pole-and-line fleets active in the WCPO (French Polynesia, Japan, Indonesian, Kiribati and Solomon Islands). Japanese distant-water and offshore fleets (90,343 mt in 2016), and the Indonesian fleets (108,327 mt in 2016), account for nearly all of the WCP–CA pole-and-line catch (99% in 2016). The catches by the Japanese distant-water and offshore fleets in

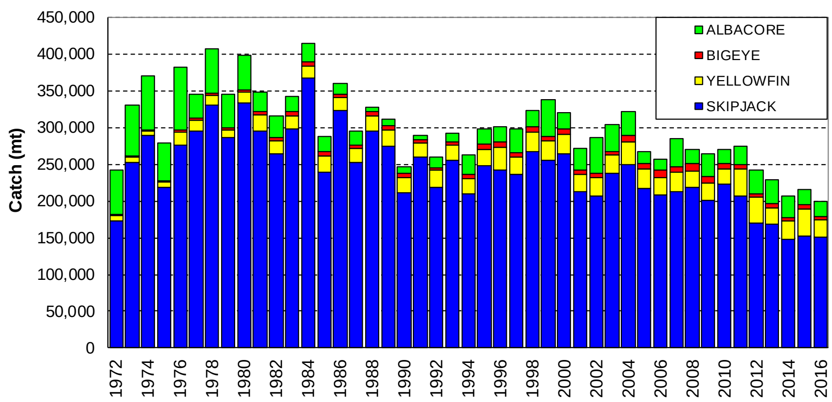



**Figure 30. Pole-and-line catch in the WCP–CA**

recent years have been the lowest for several decades and this is no doubt related to the continued reduction in vessel numbers (in 2016 reduced to only 66 vessels, the lowest on record). The Solomon Islands fleet recovered from low catch levels experienced in the early 2000s (only 2,773 mt in 2000 due to civil unrest) to reach a level of 10,448 mt in 2003. This fleet ceased operating in 2009, but resumed fishing in 2011 with catches generally around 1,000 mt (420 mt in 2016 from 2 vessels).

Figure 31 shows the average distribution of pole-and-line effort for the period 1995–2016. Effort in tropical areas is usually year-round and includes domestic fisheries in Indonesia and the Solomon Islands, and the Japanese distant-water fishery. The pole-and-line effort in the vicinity of Japan by both offshore and distant-water fleets is seasonal (highest effort and catch occurs in the 2nd and 3rd quarters). There was also some seasonal effort by pole-and-line vessels in Fiji and Australia during this period. The effort in French Polynesian waters is essentially the *bonitier* fleet. Effort by the pole-and-line fleet based in Hawaii is not shown in this figure because spatial data are not available.

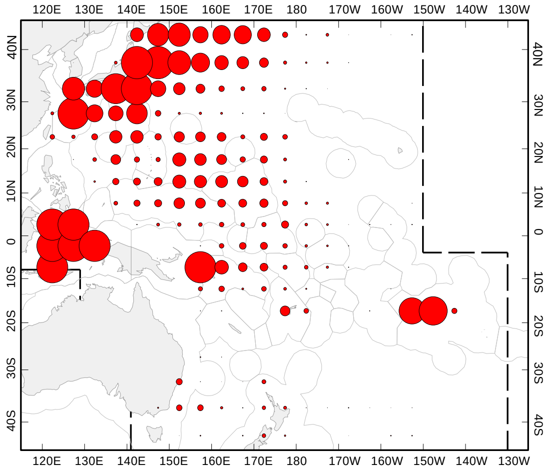



**Figure 31. Average distribution of WCP–CA pole-and-line effort (1995–2016).**

## 4.3 Pole and Line: Prices and value

### *4.3.1 Prices*

Japan skipjack pole and line fishing is seasonal with the period of southern skipjack pole and line fishing normally between November and June and then both near shore albacore and eastern offshore skipjack mainly during the period from July to October.

The price of pole and line caught skipjack at Yaizu in 2016 averaged $2,351/mt compared with $2,054/mt in 2015, a rise of 14%. The price of catch in waters off Japan averaged $2,260/mt (JPY246/kg), a rise from $1,942/mt (¥235/kg) in 2015. The price of skipjack caught in waters south of Japan also increased, by 13% to $2,425/mt (JPY264/kg) from $2,140/mt (+2% to ¥259/kg).

Over the first half of 2017 Yaizu pole and line prices have improved further. The overall average at $3,390/mt is 47% higher than the same period last year and 41% higher than the preceding six-month period.

### *4.3.2 Value*

As a means of examining the effect of the changes in price and catch levels over the period 1997-2016, an estimate of the annual delivered value of the tuna catch in the pole and line fishery in the WCP-CA is provided in Figure 32. The estimated delivered value of the total catch in the WCPFC pole and line fishery for 2016 is $384 million.[6] This is a modest increase of $9 million (2%) on 2015 caused by the 11% increase in price that more than offset the 8% decline in catch.

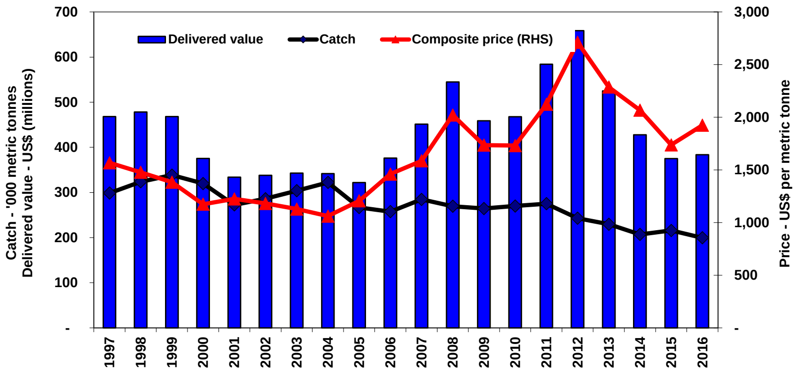



**Figure 32. All tuna in the WCPFC pole and line fishery – Catch, delivered value of catch and composite price**

The estimated delivered value of the skipjack catch for 2016 is $276 million. This represents an increase of 13% ($32 million) compared to 2015 and results from the increase of 14% in price that more than offset the 1% decrease in catch. The estimated delivered value for albacore comes to $62 million, a 3% ($2 million) decrease on the value in 2015 and reflected the decrease of 3% in price against stable catches.

[6] Delivered skipjack prices for the Japanese pole and line fleet are based on a weighted average of the Yaizu 'south' and 'other' pole and line caught skipjack prices. Delivered yellowfin price for the Japanese pole and line fleet are based on the Yaizu purse seine caught yellowfin price. All other prices are based on Thai import prices.

# 5 WCP–CA LONGLINE FISHERY

## 5.1 Overview

The longline fishery continues to account for around 10–13% of the total WCP–CA catch (OFP, 2017), but rivals the much larger purse seine catch in landed value. It provides the longest time series of catch estimates for the WCP–CA, with estimates available since the early 1950s. The total number of vessels involved in the fishery has generally fluctuated between 3,000 and 6,000 for the last 30 years (Figure 33), although for some distant-water fleets, vessels operating in areas beyond the WCP–CA could not be separated out and more representative vessel numbers for WCP–CA have only become available in recent years. In recent years, total vessel numbers are just above 3,000 vessels.

The fishery involves two main types of operation –

- large (typically >250 GRT) **distant-water** freezer vessels which undertake long voyages (months) and operate over large areas of the region. These vessels may target either tropical (yellowfin, bigeye tuna) or subtropical (albacore tuna) species. Voluntary reduction in vessel numbers by at least one fleet has occurred in recent years;
- smaller (typically <100 GRT) **offshore** vessels which are usually **domestically-based**, undertaking trips of less than one month, with ice or chill capacity, and serving fresh or air-freight sashimi markets, or [albacore] canneries. There are several foreign offshore fleets based in Pacific Island countries.

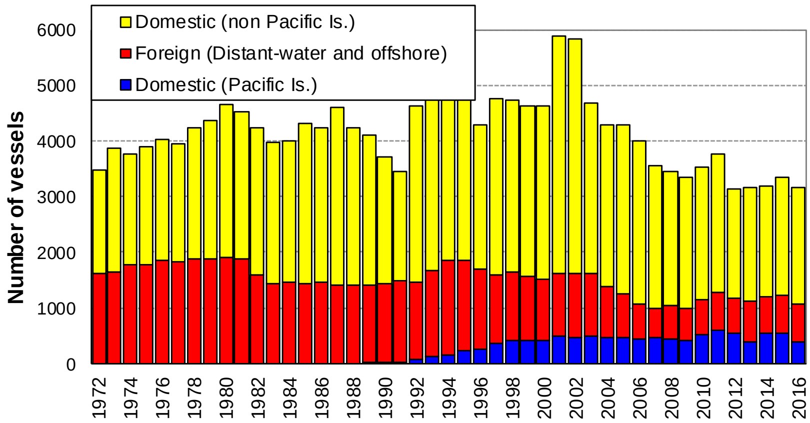



**Figure 33. Longline vessels operating in the WCP–CA**
(Available data does not make the distinction between foreign "distant-water" and "offshore")

The following broad categories of longline fishery, based on type of operation, area fished and target species, are currently active in the WCP–CA:

- **South Pacific offshore albacore fishery** comprises Pacific-Islands domestic "offshore" vessels, such as those from American Samoa, Cook Islands, Fiji, French Polynesia, Kiribati, New Caledonia, PNG, Samoa, Solomon Islands, Tonga, Tuvalu and Vanuatu; these fleets mainly operate in subtropical waters, with albacore the main species taken. Two new entrants, Tuvalu and Wallis & Futuna, joined this category during 2011, although the latter fleet has not fished recently. Vessel numbers have stabilised in recent years but they may also vary depending on charter arrangements.
- **Tropical offshore bigeye/yellowfin-target fishery** includes "offshore" sashimi longliners from Chinese-Taipei, based in Micronesia, Guam, Philippines and Chinese-Taipei, mainland Chinese vessels based in Micronesia, and domestic fleets based in Indonesia, Micronesian countries, Philippines, PNG, the Solomon Islands and Vietnam.
- **Tropical distant-water bigeye/yellowfin-target fishery** comprises "distant-water" vessels from Japan, Korea, Chinese-Taipei, mainland China and Vanuatu. These vessels primarily operate in the eastern tropical waters of the WCP–CA (and into the EPO), targeting bigeye and yellowfin tuna for the frozen sashimi market.
- **South Pacific distant-water albacore fishery** comprises "distant-water" vessels from Chinese-Taipei, mainland China and Vanuatu operating in the south Pacific, generally below 20°S, targeting albacore tuna destined for canneries.
- **Domestic fisheries in the sub-tropical and temperate WCP–CA** comprise vessels targeting different species within the same fleet depending on market, season and/or area. These fleets include the domestic fisheries of Australia, Japan, New Zealand and Hawaii. For example, the Hawaiian longline fleet has a component that targets swordfish and another that targets bigeye tuna.
- **South Pacific distant-water swordfish fishery** is a relatively new fishery and comprises "distant-water" vessels from Spain and Portugal (one vessel started fishing in 2011).
- **North Pacific distant-water albacore and swordfish fisheries** mainly comprise "distant-water" vessels from Japan (swordfish and albacore), Chinese-Taipei (albacore only) and Vanuatu (albacore only).

Additionally, small vessels in Indonesia, Philippines and Vietnam use handline and small vertical longline gears, usually fishing around the numerous arrays of anchored FADs in home waters and more recently, fishing at night using intense lights to attract prey for the tuna (these types of vessels are not included in Figure 33). The commercial handline fleets target large yellowfin tuna which comprise the majority of their overall catch (> 90%).

The WCP–CA longline tuna catch steadily increased from the early years of the fishery (i.e. the early 1950s) to 1980 (230,625 mt), but declined to 162,111 mt in 1984 (Figure 34). Since then, catches steadily increased over the next 15 years until the late 1990s, when catch levels were again similar to 1980. Annual catches in the longline fishery since 2000 have been amongst the highest ever, but the composition of the catch in recent years (e.g. ALB–31%; BET–28%; YFT–39% in 2016) differs from the period of the late 1970s and early 1980s, when yellowfin tuna contributed a higher proportion of catch (e.g. ALB–18%; BET–27%; YFT–54% in 1980).

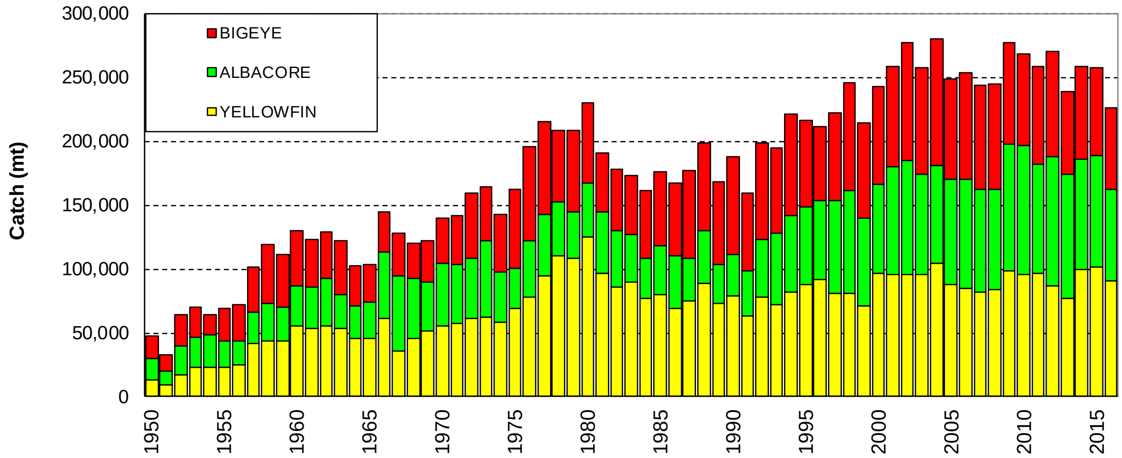



**Figure 34. Longline catch (mt) of target tunas in the WCP–CA**

## 5.2 Provisional catch estimates and fleet sizes (2016)

The provisional WCP–CA longline catch (231,860 mt) for 2016 was lower than the average for the past five years. The WCP–CA albacore longline catch (71,571 mt – 31%) for 2016 was the lowest since 2000, 30,000 mt. lower that the record of 101,816 mt attained in 2010. The provisional bigeye catch (64,131 mt – 28%) for 2016 was the lowest since 1996, mainly due to continued reduction in effort in the main bigeye tuna fishery (refer to Pilling et al., 2017 for more detail). The yellowfin catch for 2016 (90,539 mt – 39%) was around the average for the past five years.

A significant change in the WCP–CA longline fishery over the past 10 years has been the growth of the Pacific Islands domestic albacore fishery, which has risen from taking 33% of the total south Pacific albacore longline catch in 1998 to accounting for around 50-60% of the catch in recent years. The combined national fleets (including chartered vessels) mainly active in the Pacific Islands domestic albacore fishery have numbered more than 500 (mainly small "offshore") vessels in recent years and catches are now at a similar level as the distant-water longline vessels active in the WCP–CA.

The distant-water fleet dynamics continue to evolve in recent years, with catches down from record levels in the mid-2000s initially due to a reduction in vessel numbers, although vessel numbers for some fleets appear to be on the rise again in recent years, but with variations in areas fished and target species. The Japanese distant-water and offshore longline fleets have experienced a substantial decline in both bigeye catches (from 20,725 mt in 2004 to 5,746 mt in 2016) and vessel numbers (366 in 2004 to 97 in 2016). The Chinese-Taipei distant-water longline fleet bigeye catch declined from 16,888 mt in 2004 to 4,751 mt in 2016, mainly related to a substantial drop in vessel numbers (137 vessels in 2004 reduced to 79 vessels in 2016). The Korean distant-water longline fleet also experienced a decline in bigeye and yellowfin catches since the period of highest catches 15–20 years ago in line with a reduction in vessel numbers – from 184 vessels active in 2002 reduced to 96 vessels in 2016.

With domestic fleet sizes continuing to increase as foreign-offshore and distant-water fleets decrease (Figure 33), this evolution in fleet dynamics no doubt has some effect on the species composition of the catch. For example, the increase in effort by the Pacific Islands domestic fleets has primarily been in albacore fisheries, although this had been balanced to some extent by the switch to targeting bigeye tuna (from albacore) by certain vessels in the distant-water Chinese-Taipei fleet almost a decade ago. More detail on individual fleet activities during recent years is available in WCPFC–SC13 National Fisheries Reports.

### 5.3 Catch per unit effort

Time series of nominal CPUE provide a broad indication of the abundance and availability of target species to the longline gear, and as longline vessels target larger fish, the CPUE time series should be more indicative of adult tuna abundance. However, more so than purse-seine CPUE, the interpretation of nominal longline CPUE is confounded by various factors, such as the changes in fishing depth that occurred as longliners progressively switched from primarily yellowfin tuna targeting in the 1960s and early 1970s to bigeye tuna targeting from the late 1970s onwards. Such changes in fishing practices will have changed the effectiveness of longline effort with respect to one species over another, and such changes need to be accounted for if the CPUE time series are to be interpreted as indices of relative abundance.

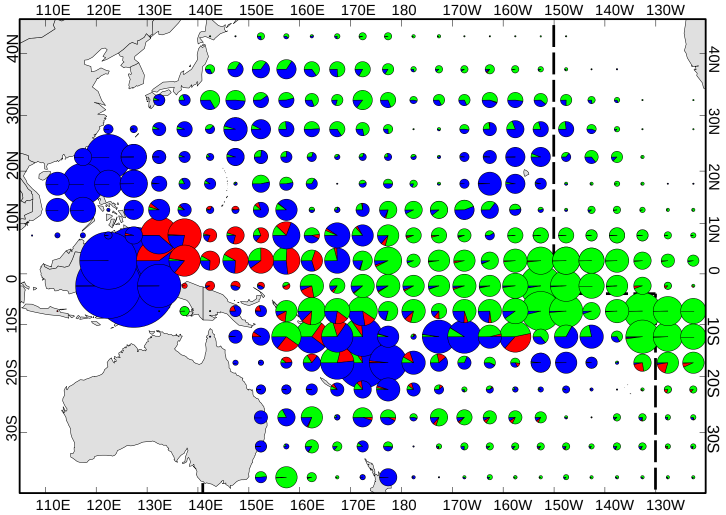



**Figure 35. Distribution of longline effort for distant-water fleets (green), foreign-offshore fleets (red) and domestic fleets (blue) for the period 2000–2016.**

(Note that distant-water effort for Chinese-Taipei and other fleets targeting albacore in the North Pacific is poorly covered)

This paper does not attempt to present or explain trends in longline CPUE or effective effort, as this is dealt with more appropriately in specific studies on the subject and CPUE standardisation papers regularly prepared as WCPFC Scientific Committee (SC) papers.

### 5.4 Geographic distribution

Figures 36 and 37 show the distribution of effort by category of fleet for the period 2000–2016. Effort by the **large-vessel, distant-water fleets** of Japan, Korea and Chinese-Taipei account for most of the effort but there has been some reduction in vessel numbers in some fleets over the past decade. Effort is widespread as sectors of these fleets target bigeye and yellowfin for the frozen sashimi market in central and eastern tropical waters, and albacore for canning in the more temperate waters, mainly in international waters (see Figure 37).

Activity by the **foreign-offshore fleets** from Japan, mainland China and Chinese-Taipei is restricted to tropical waters, targeting bigeye and yellowfin for the fresh sashimi market; these fleets have limited overlap with the distant-water fleets. The substantial "**offshore**" effort in the west of the region is primarily by the Indonesian, Chinese-Taipei and Vietnamese **domestic fleets** targeting yellowfin and bigeye.

The growth in **domestic fleets** targeting albacore tuna in the South Pacific over the past decade has been noted; the most prominent fleets in this category are the Cook Islands, Samoan, Fijian, French Polynesian, Solomon Islands (when chartering arrangements are active) and Vanuatu fleets (Figure 36).

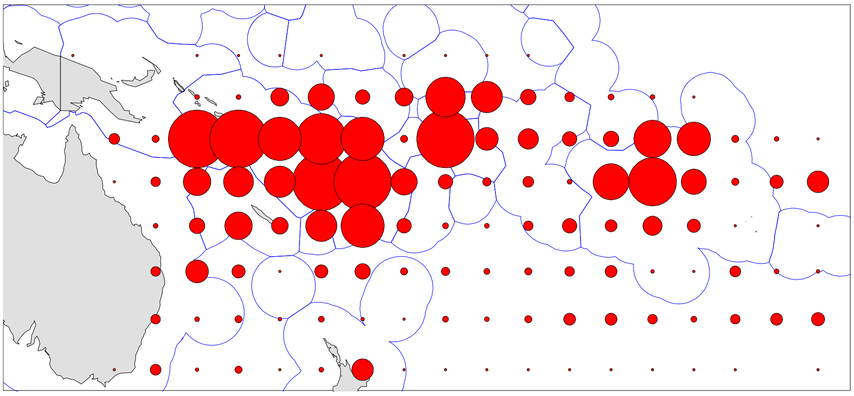


**Figure 36. Distribution of south Pacific albacore-target DOMESTIC longline fleets**

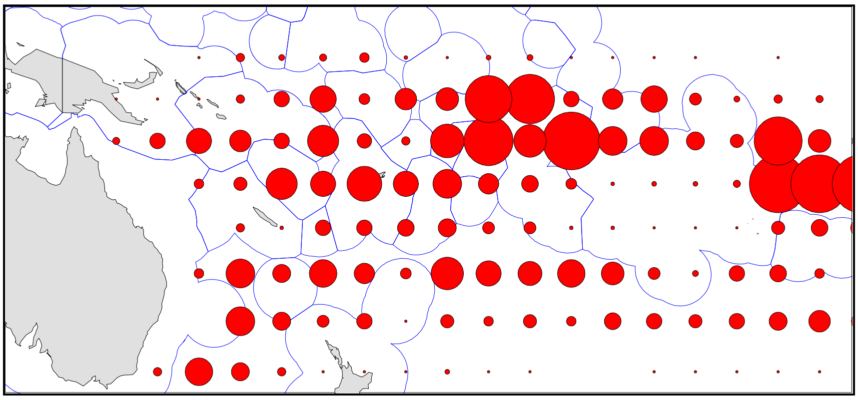


**Figure 37. Distribution of south Pacific albacore-target FOREIGN longline fleets**

Figure 38 shows quarterly species composition by area for the period 2000–2015 and 2016. The majority of the yellowfin catch is taken in tropical areas, especially in the western parts of the region, with smaller amounts in seasonal subtropical fisheries. The majority of the bigeye catch is also taken from tropical areas, but in contrast to yellowfin, mainly in the eastern parts of the WCP–CA, adjacent to the traditional EPO bigeye fishing grounds. The albacore catch is mainly taken in subtropical and temperate waters in both hemispheres. In the North Pacific, albacore are primarily taken in the 1st and 4th quarters. In the South Pacific, albacore are taken year round, although they tend to be more prevalent in the catch during the 3rd quarter. Species composition also varies from year to year in line with changes in environmental conditions, particularly in waters where there is some overlap in species targeting, for example, in the latitudinal band from 0°–20°S. The decline in bigeye catches in the tropical eastern areas is evident when comparing the 2000-2015 quarterly averages (Figure 38–left) with the 2016 catches (Figure 38–right).

The 2016 data are considered preliminary for some fleets, but nonetheless provide some insights into the fishery. For example, in the area 0°-10°S/180–160°W, it is interesting to note the change in the species composition from the 3rd quarter, which is dominant with yellowfin and albacore tuna, to the 4th quarter, when bigeye tuna are the dominant species in the catch. This period coincides with an abrupt change in ENSO conditions from the strong El Nino to a neutral state (see Figure 10), which may have affected environmental conditions and the relative availability of these tuna species to the longline gear.

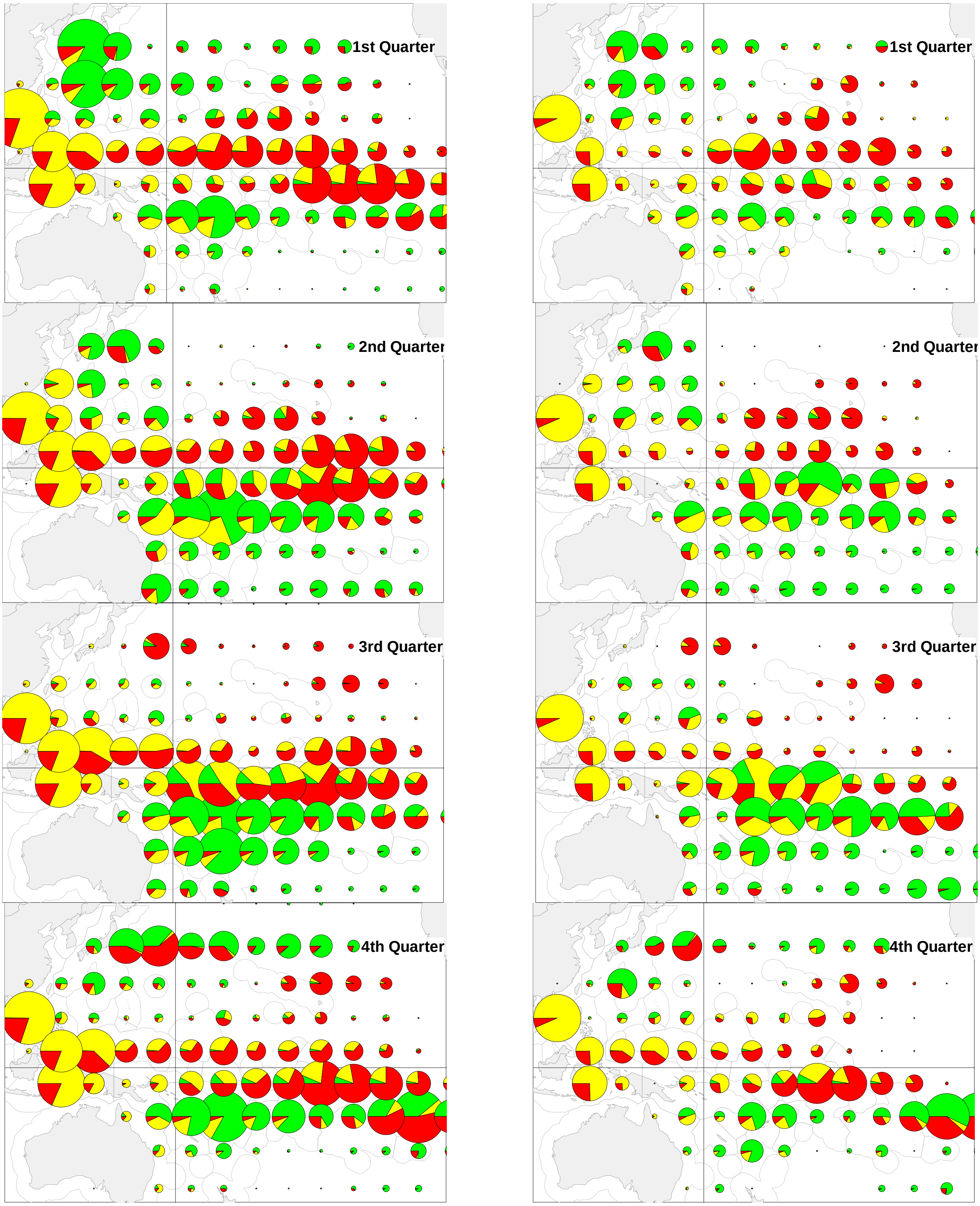



**Figure 38. Quarterly distribution of longline tuna catch by species, 2000-2015 (left) and 2016 (right)**
(Yellow–yellowfin; Red–bigeye; Green–albacore)
(Note that catches from some distant-water fleets targeting albacore in the North Pacific may not be fully covered)

## 5.5 Longline: Prices, value and economic conditions

### *5.5.1 Prices*

*Yellowfin*

Japan fresh yellowfin import prices (c.i.f., USD) in 2016 rose 9% (-2% in JPY terms) while Yaizu port fresh & frozen prices (ex-vessel) increased by 7% (-4%) reversing the previous year's respective declines of 11% and 18%. US fresh yellowfin import prices (f.a.s.) in 2016 marginally declined 3% relative to 2015 that follows from a 2% decline in 2015.

The average price in 2016 for Japan fresh yellowfin imports averaged $9.21/kg, higher by 9% compared to 2015 average price. Over the first quarter of 2017, however, overall import price remained broadly stable relative to the whole of 2016 and the same period in 2016.

The Yaizu port 2016 longline caught yellowfin fresh/frozen prices (ex-vessel) decreased by 7% to $5.69/kg. Over the first five months of 2017, however, the average price was 16% over the latter half of 2016 and 20% over the same period in 2016.

Over the long-term Japan fresh yellowfin prices in USD terms follow an upward trend until 2012 when they declined or levelled off. In contrast the trends in JPY terms show generally broad stability over the period 1997 to 2013 but then moved to higher levels in 2014 and remained at these relatively high levels through to 2016. The contrast in these trends is driven by exchange rate movements (Figures 39 and 40).

The US fresh yellowfin import prices from all sources averaged $9.12 (f.a.s.) in 2016, modestly down on the levels in the preceding two years. Over the first five months of 2017, prices have been lower against the corresponding months in 2016. Over the long-term US fresh yellowfin import prices broadly show the same trend as the Japanese prices (in USD terms) but have been relatively stable in recent years. Imports of fresh yellowfin have been broadly steady at around 16,000 Mt annually over recent years. Imports from Oceania which declined significantly between 2001 and 2011 have now stabilized at around 1,200 Mt.

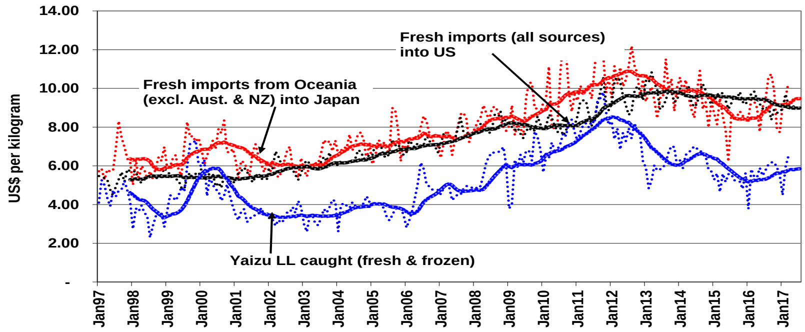



**Figure 39. Yellowfin prices in US dollars: US fresh imports (f.a.s.), Japanese fresh imports from Oceania (c.i.f.) and Yaizu longline caught (ex-vessel)**

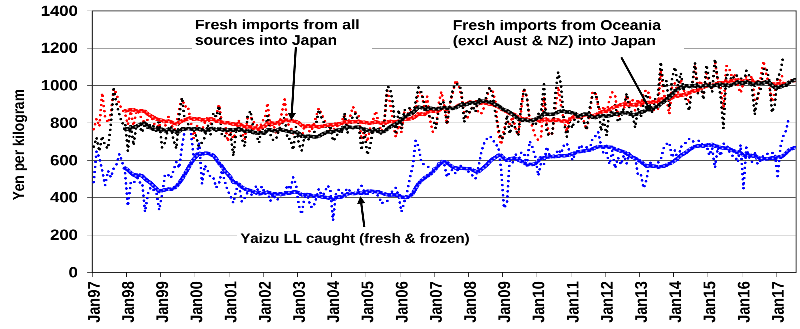



**Figure 40. Yellowfin prices on Japanese markets; fresh imports from all sources (c.i.f.), fresh imports from Oceania (c.i.f.) and Yaizu longline caught (ex-vessel)**

(Monthly price given by dashed lines, 12 month moving average price given by solid line)

*Bigeye*

Japan fresh bigeye import prices (c.i.f., USD) in 2016, from all sources, improved by 12% in USD terms (up 1% in JPY terms) while Japan selected ports frozen longline prices (ex-vessel) improved 21% (9%) reversing the previous year's 14% decline partly as a result of the substantial strengthening of the Yen. US fresh bigeye import prices (f.a.s.) in 2016 registered a decline of 3% relative to 2015.

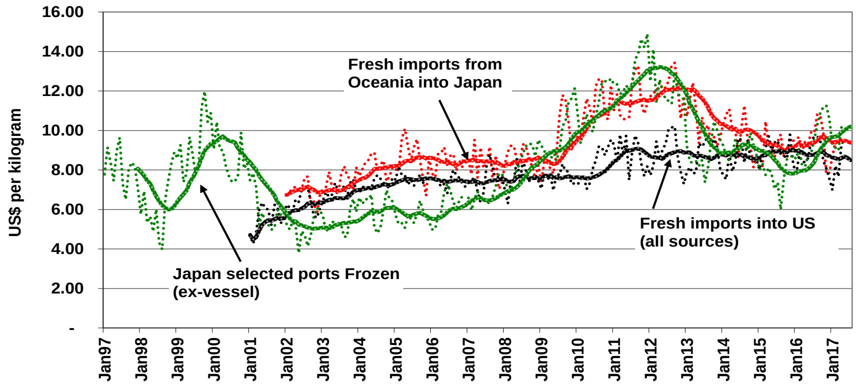



**Figure 41. Bigeye prices in US dollars: US fresh imports (f.a.s.) and Japanese markets; fresh imports from Oceania (c.i.f.) and Japan selected ports (ex-vessel)**

Sources: Ministry of Finance (www.customs.go.jp), FFA Tuna Industry Advisor, and US National Marine and Fisheries Service (swr.nmfs.noaa.gov)

The average price in 2016 for the Japan fresh bigeye prices from all sources averaged $9.73/kg, up by 12% compared to 2015. Over the first quarter of 2017, however, the overall import price improved by 6% to $10.34/kg compared to the whole of 2016 and up 7% compared to same period in 2016.

2016 Japan selected ports longline caught bigeye frozen prices (ex-vessel) increased by 21% to $9.40/kg. Over the first five months of 2017, however, prices have increased 9% over the comparable period for last year.

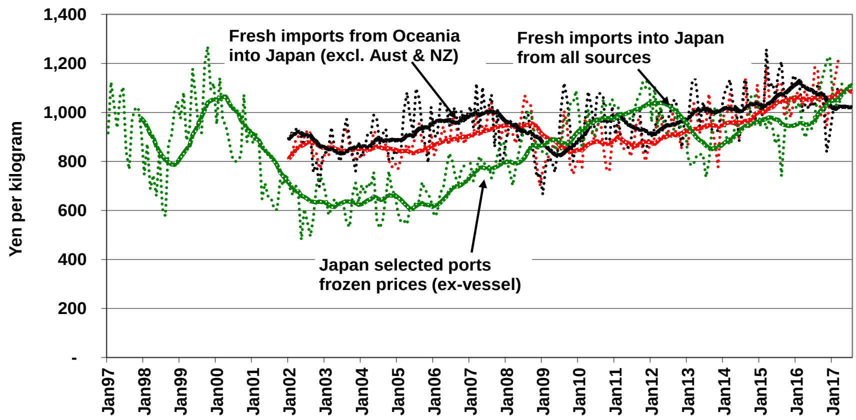



**Figure 42. Bigeye prices on Japanese markets; fresh imports all sources (c.i.f.), fresh imports from Oceania (c.i.f.) and Japan selected ports (ex-vessel)**

Sources: Ministry of Finance (www.customs.go.jp), FFA Tuna Industry Advisor, and US National Marine and Fisheries Service (swr.nmfs.noaa.gov)

Over the long-term Japan fresh bigeye import prices from all sources in USD terms rose gradually between 2002 and 2010 followed by steeper increases over the period 2011 to 2012 but have been on a downtrend since. In contrast the trends in JPY terms show a broadly gradual uptrend over the period between 2002 and 2008 followed by declines in 2009. There has been gradual uptrend since that has picked up pace in recent years.

The volume of fresh imports has been on a downward trend; fresh bigeye imports have steadily declined over the years with imports in 2016 at 5,000mt being the lowest on record that represents a decline of 14% on last year's and 73% from a high of 22,000mt in 2002.

The price of fresh bigeye imports into the US in 2016 was $8.75/kg, marginally down 3% on 2015. Over the first five months of 2017, however, the average price was comparable to the price in same period last year. Import volumes for fresh bigeye into the US have also been on a long-term declining trend. Imports in 2016 came to more than 4,000mt, a decrease of 16% on 2015 but substantially down by 40% on the past peak of more than 7,000 Mt in 2003.

*Albacore*

Albacore frozen prices experienced slight declines during 2016 across all major markets led by the Bangkok benchmark (10kg and up) with a modest 2% decline (following a 7% rise the previous year). The Thai frozen imports declined 3% (+5%), Japan selected ports frozen 2% and US frozen imports 10%. Japan selected ports frozen (ex-vessel) also slightly down 2% (+10%). The albacore fresh markets on the other hand moderately rose in both the US and Japan selected ports landings. US imports fresh (f.a.s.) rose 13% (+7%) while Japan selected ports fresh landings price rose 15%. The price movements across markets were against the backdrop of a 11% reduction in albacore catch in the WCPO. The Bangkok benchmark frozen price averaged around $2,860/mt in 2016.

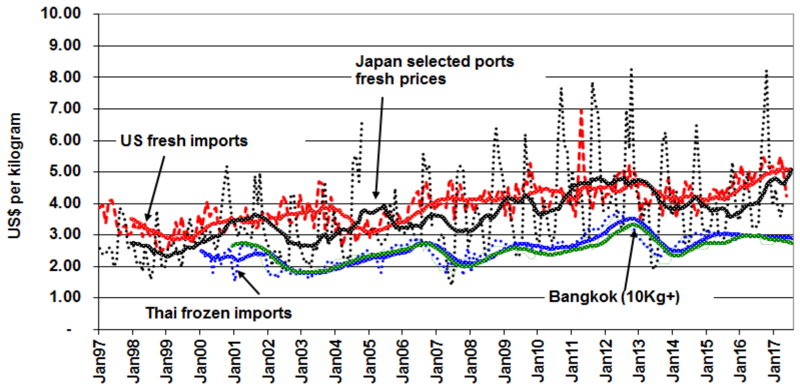



**Figure 43. Albacore prices in $: Thai frozen imports, Japan fresh / frozen selected ports (ex-vessel) and US fresh imports (f.a.s.)**

There has been an uptrend in the Bangkok benchmark frozen prices, to an average of $2,871/mt over the first half of 2017, which is 6% higher than the latter half of 2017 but nonetheless still lower than the first half of 2017 by 3%.

*Swordfish*

The US swordfish market weighted average price (fresh and frozen, f.a.s.) averaged $8.27/kg in 2016, up by 5% compared to 2015. Against the moderate price increase, the volume of imports remained stable at 7,800mt while in value terms the increase was 4% to $64 million. The weighted ex-vessel average price for swordfish at Japan selected ports in 2015 was $8.18 (¥892/kg), a 11% increase (stable in JPY terms) from the previous year's while the landed volume rose by 17% to 5,258mt.

Over the first five months of 2017, the US fresh/frozen import prices averaged $7.65/kg, an increase of 3% and imports rose 24% in volume and 22% in value compared to the same period last year. The Japan market prices, based on landings at Japan major ports over the first four months, averaged $8.82/kg (¥994/Kg), 6% (7% up in JPY terms) against the corresponding period last year while landings declined 18%.

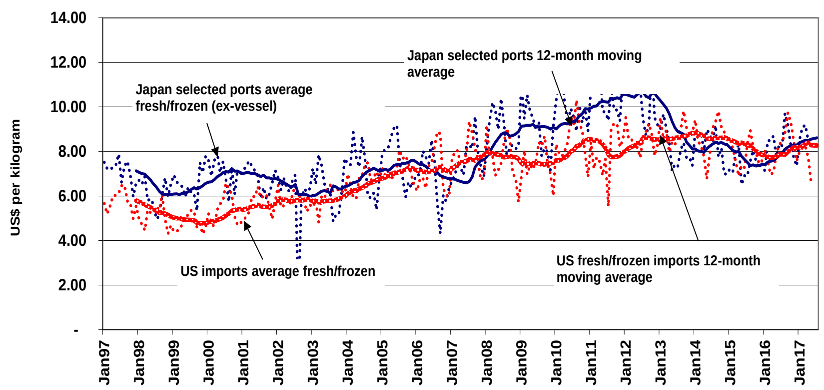



**Figure 44. Swordfish prices in $: Japan selected ports fresh/frozen (ex-vessel) and US fresh/frozen import prices (f.a.s.)**

For purposes of estimating the annual value of swordfish taken in the WCPO, the Japan selected ports fresh and frozen market prices (ex-vessel) are used with the assumption that all DW longline fleets of Japan and Taiwan along with all Korean longline catches are frozen and the remaining catches constitute fresh deliveries.[7] The estimated delivered value of the longline swordfish catch in the WCPO for 2016 is $116 million, only 2% down on the estimated value of the catch in 2015 resulting from the offsetting price increase of 10% and the 11% decrease in catch.

[7] The Japan market prices are used given the larger portion of swordfish catch in the WCP-CA is accounted for by Japanese fleets.

### *5.5.2 Value*

*WCP-CA area (excluding swordfish)*

As a means of examining the effect of changes in price and catch levels since 1997, an estimate of the "delivered" value of the longline fishery tuna catch in the WCPFC Area from 1997 to 2016 was obtained (Figure 45). In deriving these estimates certain assumptions were made due to data and other constraints that may or may not be valid and as such caution is urged in the use of these figures.[8]

The estimated delivered value of the longline tuna catch in the WCPFC area for 2016 is $1.48 billion. This represents a decrease of $83 million (5%) on the estimated value of the catch in 2015. The albacore catch value decreased by $42 million (16%), while bigeye increased $13 million (2%) and yellowfin decreased $60 million (8%) respectively.

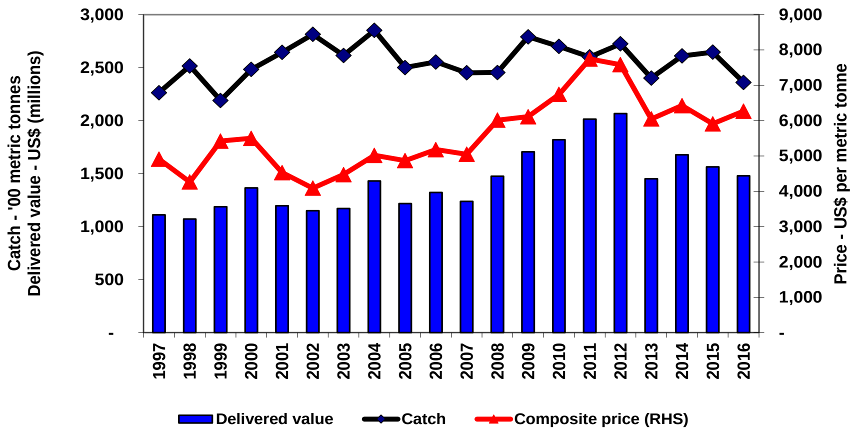



**Figure 45. All tuna in the WCPFC longline fishery – Catch, delivered value of catch and composite price**

The longline albacore catch was estimated to be worth $222 million in 2016 with the 16% decrease on 2015 resulting from a 13% decrease in catch and a 3% decrease in the albacore composite price. The longline bigeye catch was estimated to be worth $574 million in 2016, an increase of 2% compared to 2015 accounted for by the 9% decrease in catch offset by the increase of 12% in price. The estimated delivered value of the yellowfin catch was $676 million in 2016, a decrease of 8% from 2014 resulting from 14% decrease in catch offset by a 6% increase in price.

*Tropical longline*[9]

Estimates of the "delivered" values of the tuna catch for the tropical longline fishery were also derived. In deriving these estimates certain assumptions were made due to data and other constraints that may or may not be valid and as such caution is urged in the use of these figures[10].

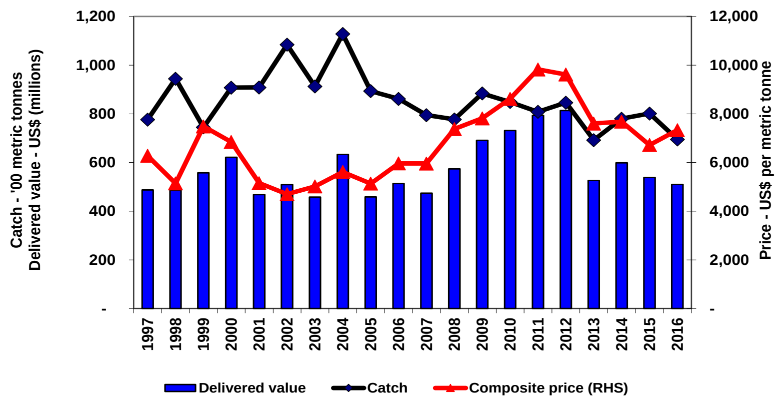



**Figure 46. All tuna in the WCPFC tropical longline fishery – Catch, delivered value of catch and composite price**

The estimated delivered value of the tropical tuna longline tuna catch in the WCP-CA for 2016 is $510 million (Figure 46). This represents a decrease of $29 million (-5%) on the estimated value of the catch in 2015. Marginal increases in the value of albacore and

[8] For the yellowfin and bigeye caught by fresh longline vessels it is assumed that 80% of the catch is of export quality and 20% is nonexport quality. For export quality the annual prices for Japanese fresh yellowfin and bigeye imports from Oceania are used, while it is simply assumed that non-export grade tuna attracted $1.50/kg throughout the period 1997-2013. For yellowfin caught by frozen longline vessels the delivered price is taken as the Yaizu market price for longline caught yellowfin. For bigeye caught by frozen longline vessels the delivered price is taken as the frozen bigeye price at selected major Japanese ports. For albacore caught by fresh and frozen longline vessel the delivered prices is taken as the Thai import price. The frozen longline catch is taken to be the catch from the longline fleets of Japan and Korea and the distant water longline fleet of Chinese Taipei.

[9] The tropical longline fishery is defined as the longline fishery between $10^0$N and $10^0$S in the WPCFC-CA excluding the waters of Indonesia, Philippines and Vietnam. The southern longline fishery is defined as all longline activities south of $10^0$S.

[10] The estimated values are based on aggregation of all relevant EEZs and international waters values for the respective fisheries, noting the spillover of some waters over boundaries which therefore would render possible overestimate or underestimate in the estimates.

bigeye catch were more than offset by the a $31 million (-16%) decline in the value of the yellowfin catch The bigeye catch value, estimated to be worth $312 million in 2016, increased 2% with reductions in catch (-13%) being offset by price increases (15%). The estimated delivered value of the yellowfin catch was $167 million in 2016 driven by 16% reduction in catch.

*Southern longline fisheries catch*[11]

Estimates of the "delivered" values of the southern longline fishery were also derived. In deriving these estimates certain assumptions were made due to data and other constraints that may or may not be valid and as such caution is urged in the use of these figures[12].

The estimated delivered value of the tuna catch in the southern longline fishery within the WCP-CA for 2016 is $364 million (Figure 47). This represents a decrease of $74 million (-17%) on the estimated value of the catch in 2015. The overall decrease resulted from declines in values for albacore, bigeye and yellowfin. The albacore catch was estimated to be worth $129 million in 2016, a 17% decrease on 2015 resulting from the decreases in both catch (-15%) and price (-3%). The bigeye catch value, estimated to be worth $71 million in 2016 represented a marginal decrease of 2% with a 10% decline in catch (10%) being largely offset by an increase in price. The estimated delivered value of the yellowfin catch was $163 million in 2016, a decrease of 22% which was driven by a 25% reduction in catch.

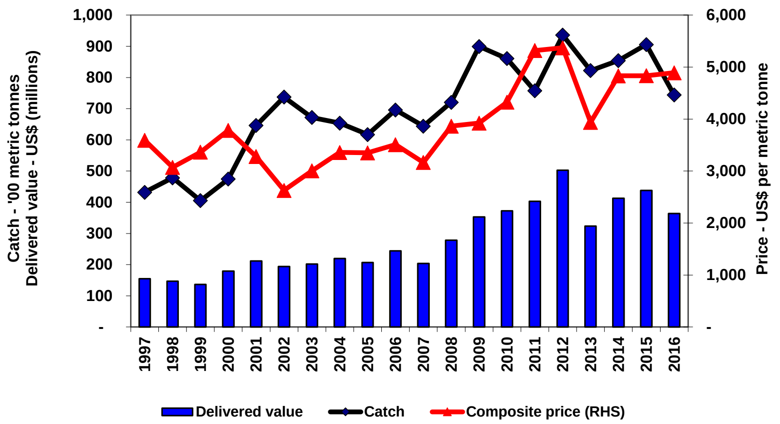



**Figure 47. All tuna in the WCPFC Southern longline fishery – Catch, delivered value of catch and composite price**

### 5.5.3 *Economic conditions*

*Tropical longline*

The FFA economic conditions index for the tropical longline fishery appear to indicate that between 1998 and 2008 there was a continuous and rapid decline as costs increased and prices and catch rates declined. There was significant improvement in economic conditions to above average in 2009 as costs fell driven by falls in the global fuel price improvements in catch rates. Conditions then deteriorated again and from 2011 through to 2015 economic conditions for the fishery were persistently poor. In 2016 economic conditions improved as fuel prices fell and the index returned to around its long term average.

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[11] The tropical longline fishery is defined as the longline fishery between $10^0$N and $10^0$S in the WPCFC-CA excluding the waters of Indonesia, Philippines and Vietnam. The southern longline fishery is defined as all longline activities south of $10^0$S.

[12] The estimated values are based on aggregation of all relevant EEZs and international waters values for the respective fisheries, noting the spillover of some waters over boundaries which therefore would render possible overestimate or underestimate in the estimates.

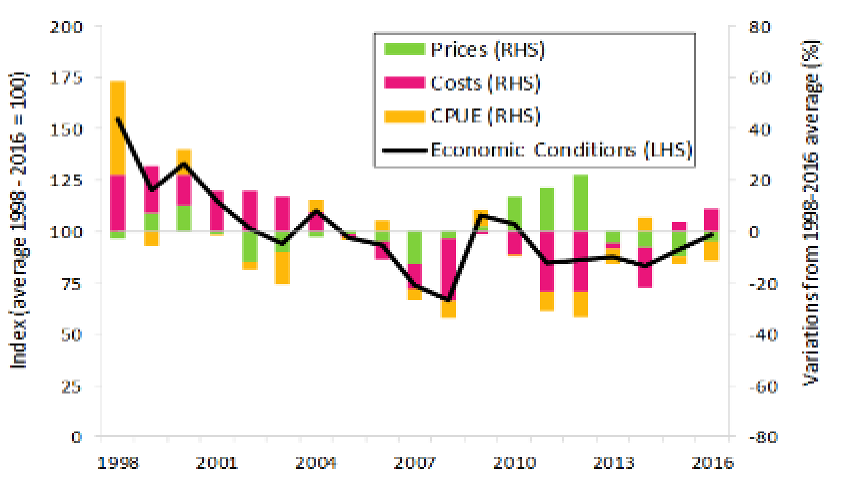


**Figure 48. Economic conditions index for the tropical longline fishery (LHS) and variance of component indices against average (1998-2016) conditions**

*Southern Longline*

The FFA economic conditions index for the southern longline fishery shows a broadly declining trend over the period from 1998 to 2010 and then a period of persistent poor conditions from 2010 to 2014, caused primarily by low catch rates and high real fuel prices.. Economic conditions improved significantly in 2015 and 2016, compared to 2014, owing to falling fuel costs with the fish price remaining around its long-term average. The economic conditions index in 2016 is at its highest level since 2008 with the improvement driven by low fuel prices but being hampered by persistent low catch rates (Figure 49).

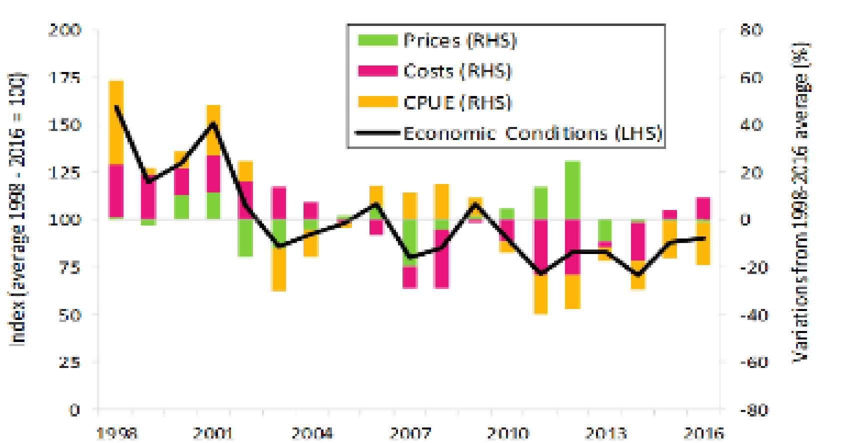


**Figure 49. Economic conditions index for the southern longline fishery (LHS) and variance of component indices against average (1998-2016) conditions**

# 6 SOUTH-PACIFIC TROLL FISHERY

## 6.1 Overview

The South Pacific troll fishery is based in the coastal waters of New Zealand, and along the Sub-Tropical Convergence Zone (STCZ, east of New Zealand waters located near 40°S). The fleets of New Zealand and the United States have historically accounted for the great majority of the catch that consists almost exclusively of albacore tuna.

The fishery expanded following the development of the STCZ fishery after 1986, with the highest catch attained in 1989 (8,370 mt). In recent years, catches have declined to range from 2,000–4,000 mt, low catch levels which have not been experienced since prior to 1988 (Figure 50). The level of effort expended by the troll fleets each year can be driven by the price conditions for the product (albacore for canning), and by expectations concerning likely fishing success.

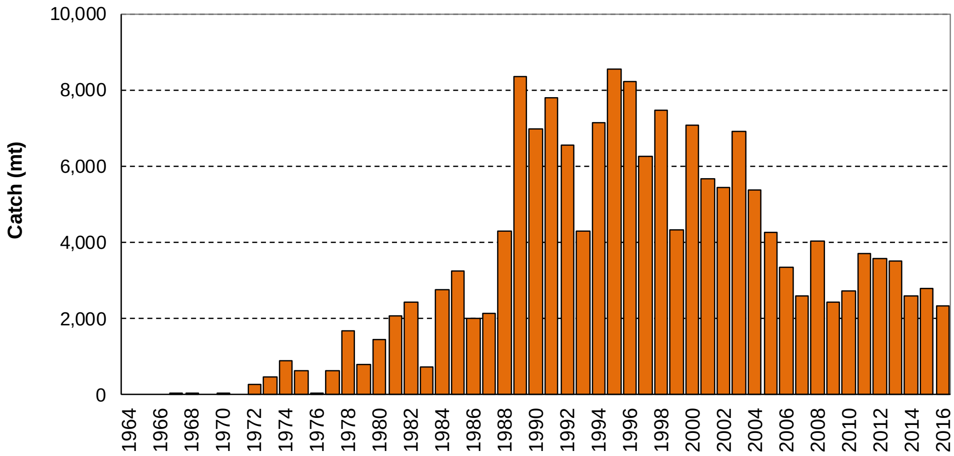


**Figure 50. Troll catch (mt) of albacore in the south Pacific Ocean**

## 6.2 Provisional catch estimates (2016)

The 2016 South Pacific troll albacore catch (2,097 mt) was the lowest catch since 2009. The New Zealand troll fleet (137 vessels catching 1,952 mt in 2016) and the United States troll fleet (6 vessels catching 151 mt in 2016) accounted for all of the 2016 albacore troll catch, although minor contributions have also come from the Canadian, the Cook Islands and French Polynesian fleets when their fleets were active in the past.

Effort by the South Pacific albacore troll fleets is concentrated off the coast of New Zealand and across the Sub-Tropical Convergence Zone (STCZ) – refer to Figure 51.

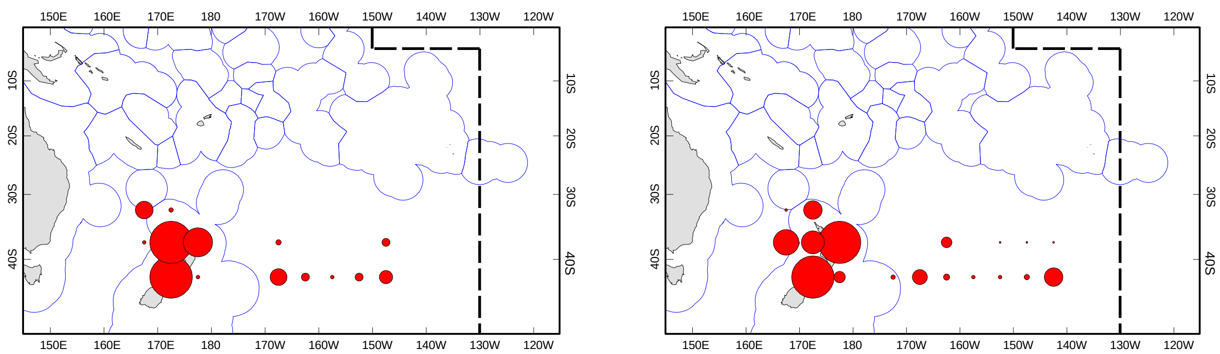


**Figure 51. Distribution of South Pacific troll effort during 2015 (left) and 2016 (right)**

# 7. SUMMARY OF CATCH BY SPECIES

## 7.1 SKIPJACK

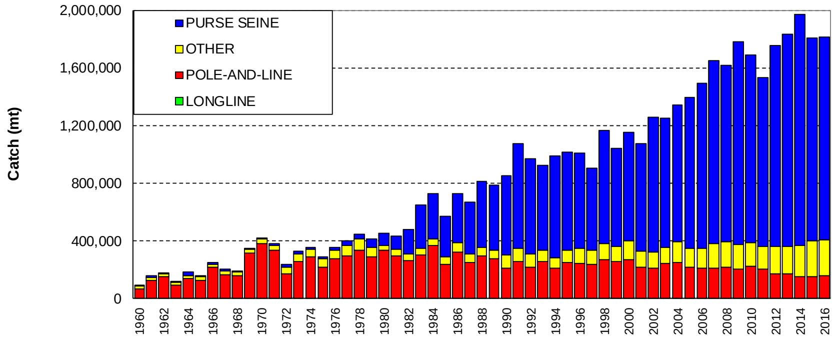


**Figure 52. WCP–CA skipjack catch (mt) by gear**

Total skipjack catches in the WCP–CA have increased steadily since 1970, more than doubling during the 1980s, and continuing to increase in subsequent years. Annual catches exceeded 1.5 million mt in the last five years (Figure 52). Pole-and-line fleets, primarily Japanese, initially dominated the fishery, with the catch peaking at 380,000 mt in 1984. The relative importance of the pole-and-line fishery, however, has declined over the years primarily due to economic constraints (the 2009 and 2016 WCP-CA pole-and-line catches were the lowest since 1965). The skipjack catch increased during the 1980s due to growth in the international purse seine fleet, combined with increased catches by domestic fleets from Philippines and Indonesia (which have made up around 10% of the total skipjack catch in WCP–CA.

The 2016 WCP–CA skipjack catch of 1,816,650 mt was the third highest catch recorded and around 160,000 mt lower than the previous record in 2014 (1,977,019 mt). The **purse-seine** catch (1,408,110 mt – 78%) was very similar to 2015 and the fifth highest. The **pole-and-line** catch (151,441 mt – 8%) was relatively stable, and the "**artisanal**" gears in the domestic fisheries including Indonesia, Philippines and Japan (166,301 mt – 12%). The **longline** fishery accounted for less than 1% of the total catch.

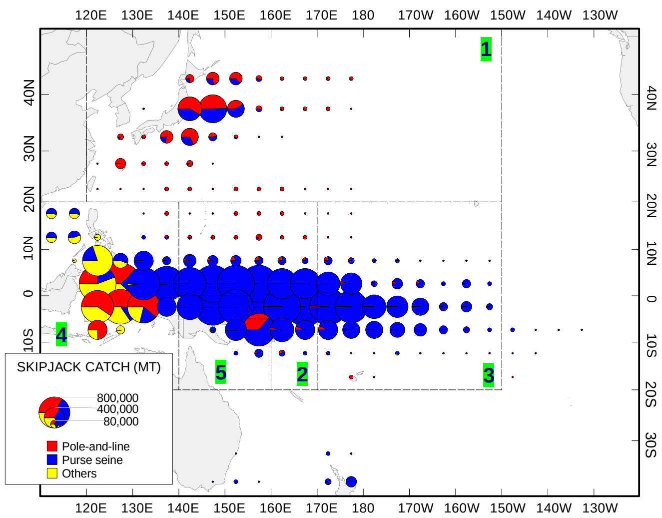


**Figure 53. Distribution of skipjack tuna catch, 1990–2016.**

The five-region spatial stratification used in stock assessment is shown.

The majority of the skipjack catch is taken in equatorial areas, and most of the remainder is taken in the seasonal domestic (home-water) fishery of Japan (Figure 53). The domestic fisheries in Indonesia (purse-seine, pole-and-line and unclassified gears) 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. Central tropical waters are dominated by purse-seine catches from several foreign and domestic fleets. As mentioned in Section 3, the spatial distribution of skipjack catch by purse-seine vessels in the central and eastern equatorial areas is influenced by the prevailing ENSO conditions.

The Philippines and Indonesian domestic fisheries (archipelagic waters) account for most of the skipjack catch in the 20–40 cm size range (Figure 54). The dominant mode of the WCP–CA skipjack catch (by weight) typically falls in the size range between 40–60 cm, corresponding to 1–2+ year-old fish (Figure 54). There was a greater proportion of medium-large (60–80 cm) skipjack caught in the purse seine fishery in 2010 and 2012 (unassociated, free swimming school sets account for most of the large skipjack). The overall purse-seine skipjack size distribution has been very similar for the last four years (2013–2016); most of the catch by weight in 2016 was from the unassociated set type, with a clear mode of relatively large fish (60–65 cm). Another feature of the skipjack catch over the last two years was the relatively large number of small fish (20-30 cm) in the Indonesia/Philippines domestic fisheries (Figure 54).

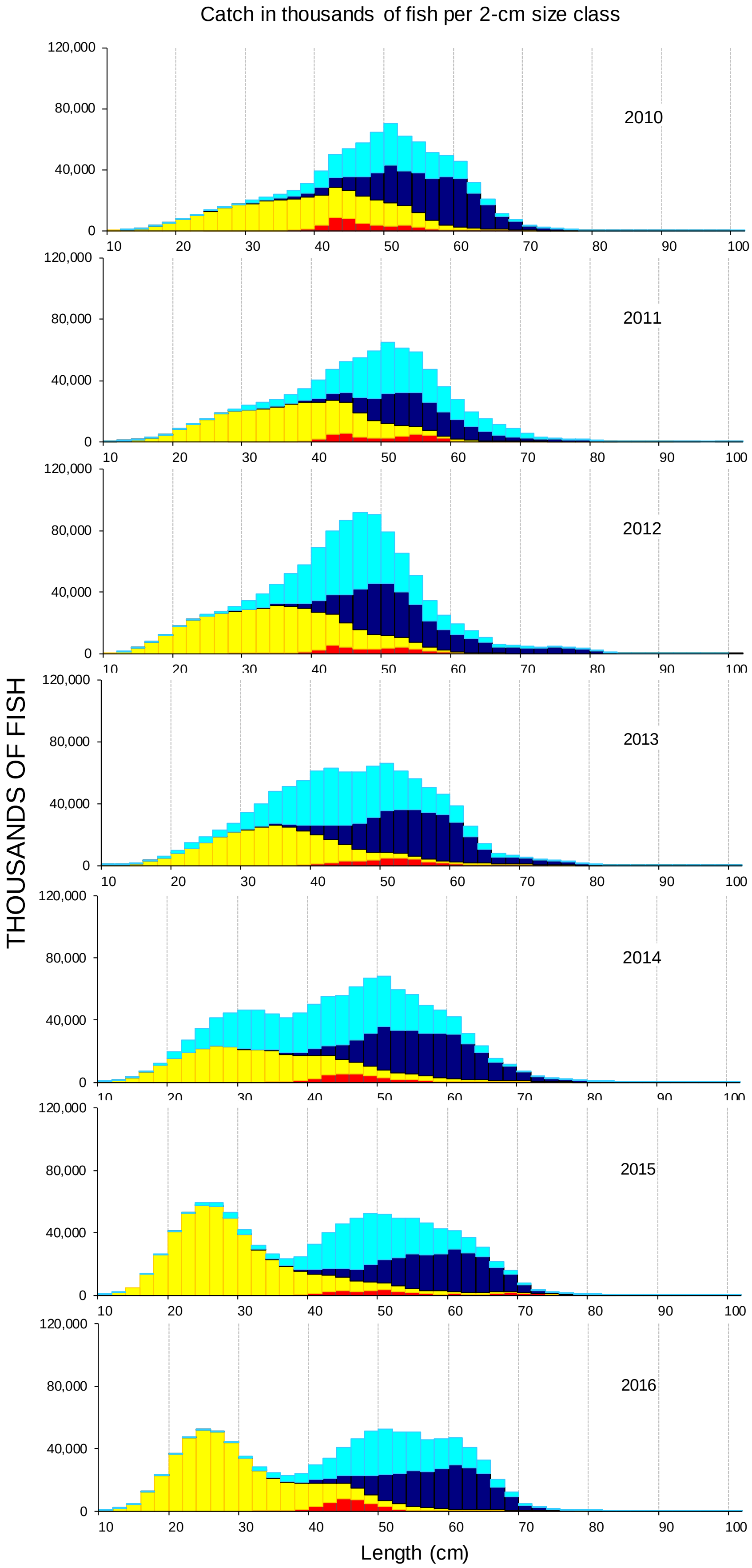


**Figure 54. Annual catches (no. of fish) of skipjack tuna in the WCPO by size and gear type, 2010–2016.**
**(red–pole-and-line; yellow–Phil-Indo archipelagic fisheries; light blue–purse seine associated; dark blue–purse seine unassociated)**

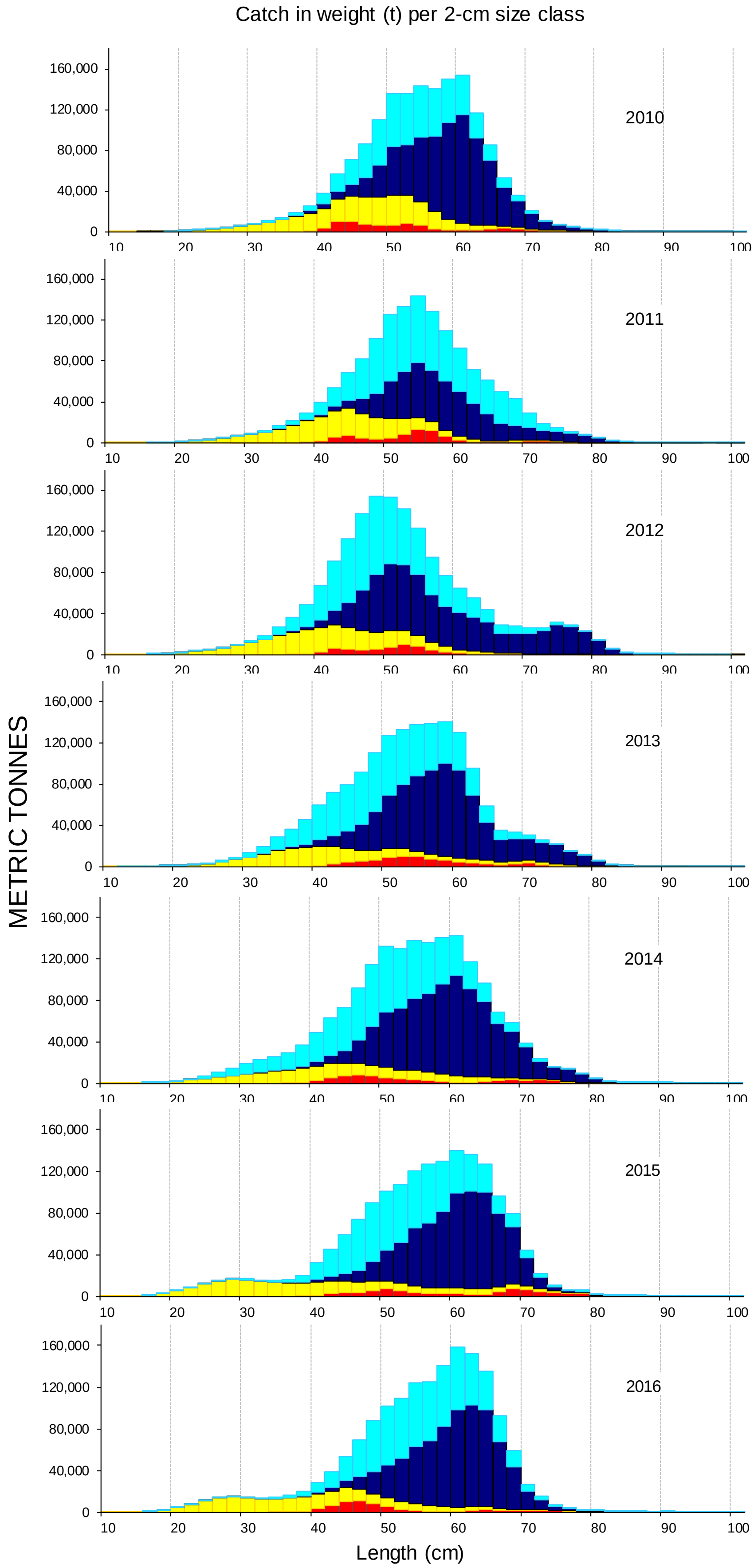


**Figure 55. Annual catches (MT) of skipjack tuna in the WCPO by size and gear type, 2010–2016.**
**(red–pole-and-line; yellow–Phil-Indo archipelagic fisheries; light blue–purse seine associated; dark blue–purse seine unassociated)**

## 7.2 YELLOWFIN

The total yellowfin catch in the WCP–CA has slowly increased over time but since 1998, jumped to a new level with annual catches regularly exceeding 500,000 mt (Figure 56), mainly due to increased catches in the purse seine fishery. The 2016 yellowfin catch (**650,491 mt**) was a record and more than 40,000 mt higher than the previous record in 2008 and mainly due to a continuation of relatively high catches in the domestic Indonesia and Philippines fisheries, but also good catches in the purse seine fishery (the yellowfin catch in the **purse-seine** fishery [394,756 mt – 61%] was the second highest on record).

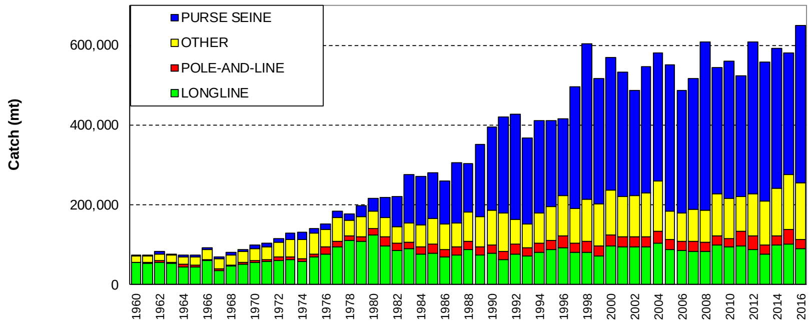


**Figure 56. WCP–CA yellowfin catch (mt) by gear**

The WCP–CA **longline** catch for 2016 (90,551 mt–14%) was around the average for recent years. Since the late 1990s, the **purse-seine** catch of yellowfin tuna has accounted for about 3-5 times the **longline** yellowfin catch.

The **pole-and-line** fisheries took 23,074 mt during 2016 (4% of the total yellowfin catch) which is lower than the 10-year average for this fishery. Catches in the '**other**' category (140,000mt–22% in 2016) are largely composed of yellowfin taken by various assorted gears (e.g. troll, ring net, bagnet, gillnet, large-fish handline, small-fish hook-and-line and seine net) in the domestic fisheries of the Philippines and eastern Indonesia. Figure 57 shows the distribution of yellowfin catch by gear type for the period 1990–2016. As with skipjack, the great majority of the catch is taken in equatorial areas by large purse seine vessels, and a variety of gear types in the Indonesian and Philippine fisheries.

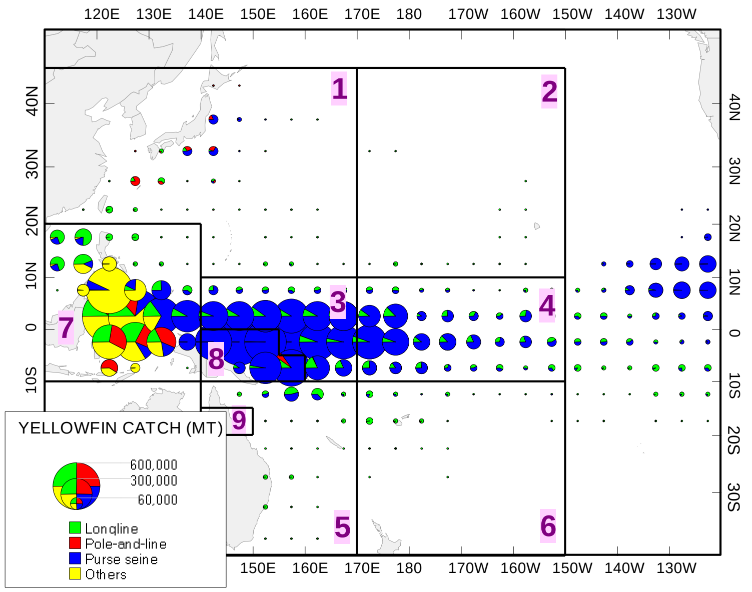


**Figure 57. Distribution of yellowfin tuna catch in the WCP–CA, 1990–2016.**

**The nine-region spatial stratification used in stock assessment is shown.**

The domestic surface fisheries of the Philippines and Indonesia (archipelagic waters) take large numbers of small yellowfin in the range of 20–50 cm (Figure 58), and their deep-water handline fisheries take smaller quantities of large yellowfin tuna (> 110 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 is adult (> 100 cm) yellowfin tuna, to the extent that the purse-seine catch (by weight) of adult yellowfin tuna is clearly higher than the longline catch. Increased catches of large yellowfin tuna in the size range 120–130 cm from the purse seine unassociated sets appear on a biennial basis over the past seven years (2010, 2012, 2014 and 2016 – see Figure 59). Inter-annual variability in the size of yellowfin taken exists in all fisheries. The strong mode of large (120–135cm) yellowfin from (purse-seine) unassociated-sets in 2010 corresponds to good catches experienced during the early months of El Nino which transitioned into the strong La Niña event by the 3rd and 4th quarters (Figure 18–right and Figure 24–right). In 2014, the El Nino-like conditions in the latter half of the year no doubt contributed to increased catches of large yellowfin in the eastern tropical WCP-CA, but this level of catch was not as strong in 2015. Note the two modes of small fish (25cm and 40 cm) in the Indonesia/Philippines fishery in 2015 and again in 2016.

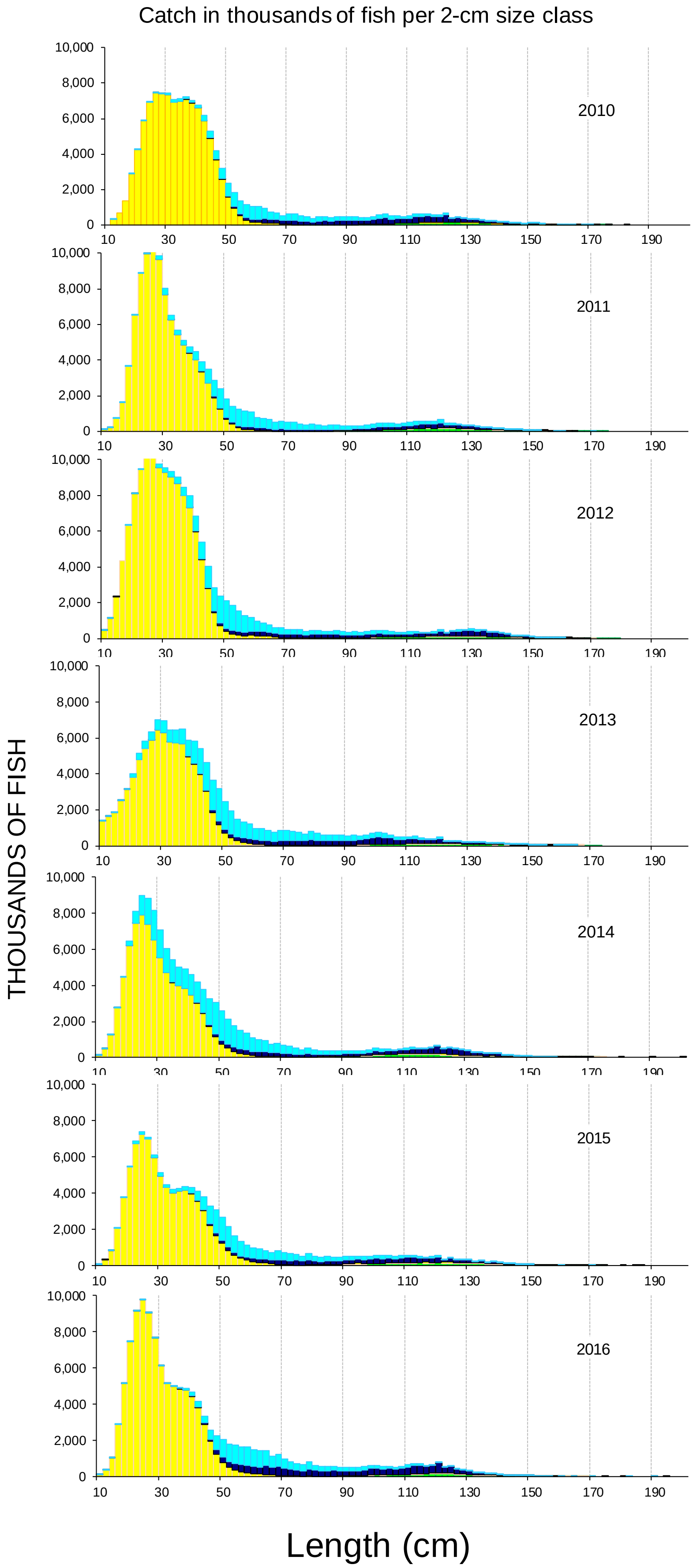


**Figure 58. Annual catches (no. of fish) of yellowfin tuna in the WCPO by size and gear type, 2010–2016.**
**(green–longline; yellow–Phil-Indo archipelagic fisheries; light blue–purse seine associated; dark blue–purse seine unassociated)**

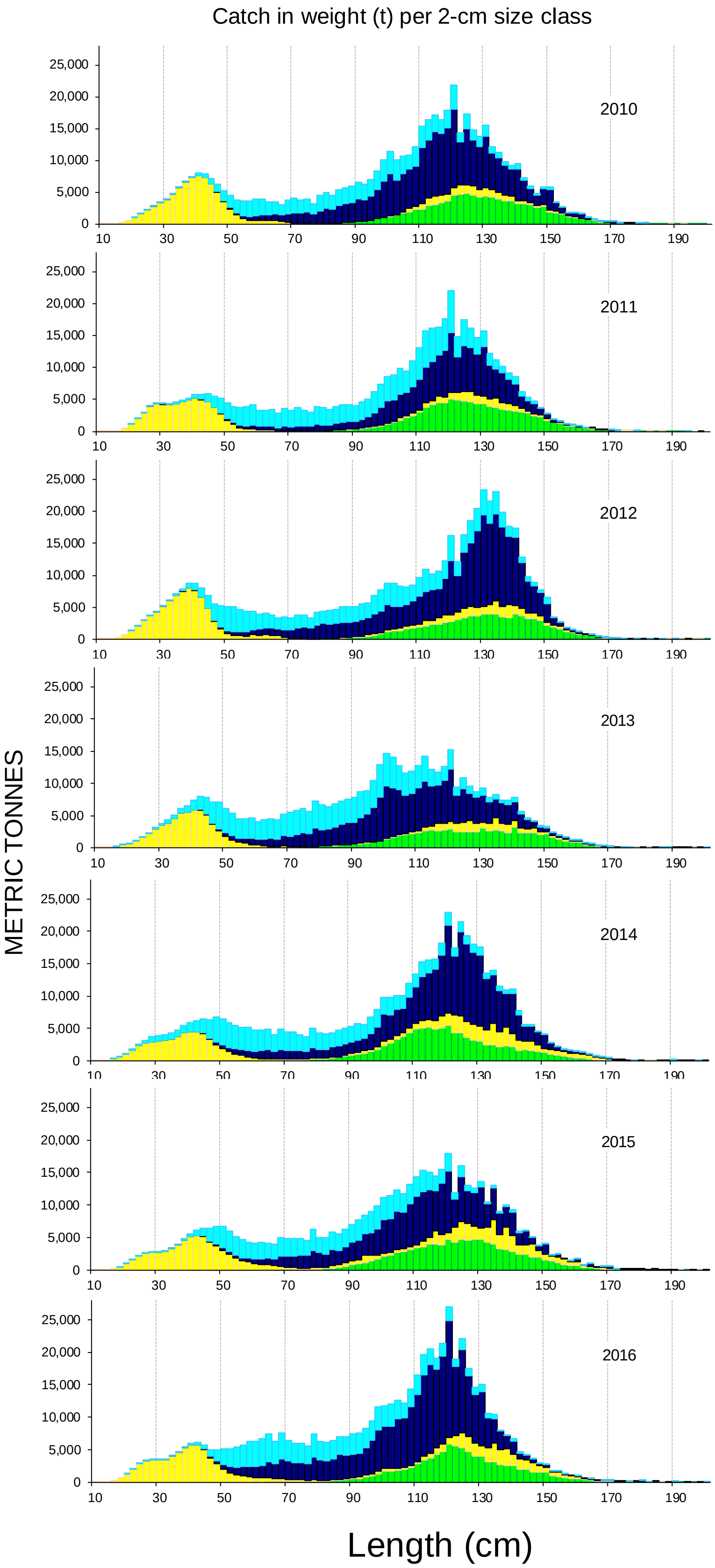


**Figure 59. Annual catches (MT) of yellowfin tuna in the WCPO by size and gear type, 2010–2016.**
**(green–longline; yellow–Phil-Indo archipelagic fisheries; light blue–purse seine associated; dark blue–purse seine unassociated)**

## 7.3 BIGEYE

Since 1980, the Pacific-wide total catch of bigeye (all gears) has varied between 120,000 and 290,000 mt (Figure 60), with Japanese longline vessels generally contributing over 80% of the catch until the early 1990s. The provisional 2016 bigeye catch for the **Pacific Ocean** (248,142 mt) was slightly higher than the average for the past ten years.

The **purse-seine** catch in the **EPO** (provisionally 61,635 mt in 2016) continues to account for a significant proportion (61%) of the total EPO bigeye catch. The 2015 EPO longline bigeye catch estimate (39,026 mt; 2016 estimate not yet available) was the highest since 2005. The EPO catch estimates are acknowledged to be preliminary[13] and may increase when more data become available.

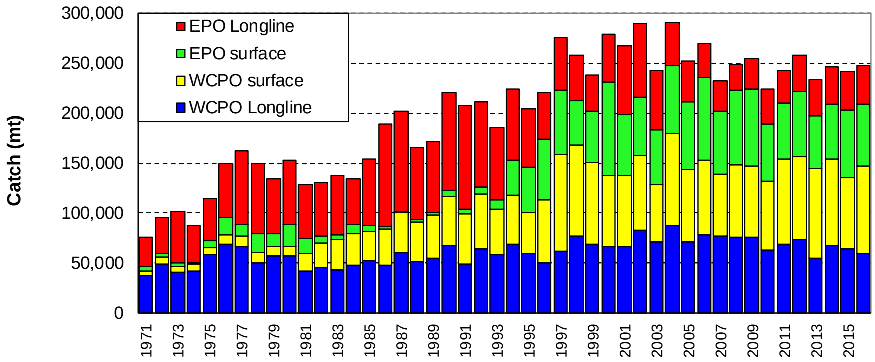


**Figure 60. Pacific bigeye catch (mt) by gear**
(excludes catches by "other" gears)

The provisional **WCP-CA longline** bigeye catch for 2016, at 64,132 mt is the lowest catch since 1997 (slightly higher than in 2013 – 64,420 mt – also a low catch year), although estimates for the previous calendar year are known to be preliminary at the writing of this paper. The provisional **WCP–CA purse seine** bigeye catch for 2016 was estimated to be 63,304 mt which was about average over the past ten years (Figure 61). In 2013, the WCP-CA purse-seine bigeye catch exceeded the longline catch for the first time, and in 2016, we note that catches for both fisheries were similar.

The **WCP–CA pole-and-line** fishery has generally accounted for between 3,000–10,000 mt (2-6%) of bigeye catch annually over the past decade. The "**other**" category, representing various gears (including troll) in the Philippine, Indonesian[14] and Japanese domestic fisheries, has accounted for an estimated 12,000–16,000 mt (3–7% of the total WCP–CA bigeye catch) over time, but in 2016 was estimated to be over 20,000 mt (14%) for the first time.

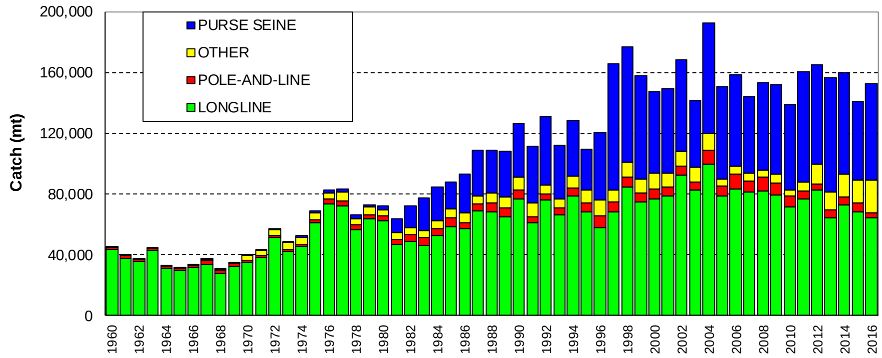


**Figure 61. WCP–CA bigeye catch (mt) by gear**

Figure 62 shows the spatial distribution of bigeye catch in the Pacific for the period 1990–2016. 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, continuous with the important traditional bigeye longline area in the eastern Pacific.

[13] Catch estimates for the EPO longline fishery for 2015-2016 and the EPO purse seine fishery for 2016 are preliminary

[14] Indonesia revised the proportion of catch by species for their domestic fisheries which has resulted in differences in species composition by gear type since 2000 compared to what has been reported in previous years. Bigeye tuna estimates in the Indonesian troll fishery were provided for the first time for 2013.

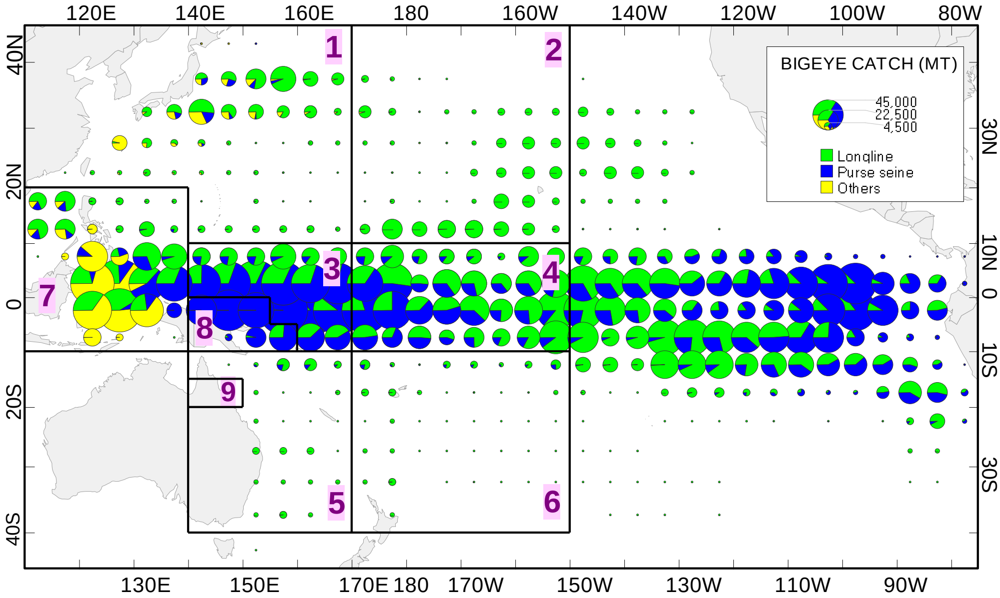


**Figure 62. Distribution of bigeye tuna catch, 1990–2016.**

**The nine-region spatial stratification used in stock assessment for the WCP–CA is shown.**

As with skipjack and yellowfin tuna, the domestic surface fisheries of the Philippines and Indonesia (archipelagic waters) take relatively large numbers of small bigeye in the range 20–60 cm (Figure 63). The longline fishery clearly accounts for most of the catch (by weight) of large bigeye in the WCP–CA (Figure 63). This is in contrast to large yellowfin tuna, which (in addition to 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 tuna are very rarely taken in the WCPO purse seine fishery and only a relatively small amount come from the handline fishery in the Philippines. Bigeye tuna sampled in the longline fishery are predominantly adult fish with a mean size of ~130 cm FL (range 80–170+ cm FL). Associated sets account for nearly all the bigeye catch in the WCP–CA purse seine fishery with considerable variation in the sizes from year to year, but the majority of associated-set bigeye tuna are generally in the range of 45–75 cm.

A year class represented by the mode of fish in the size range of about 25-30 cm in the Philippines/Indonesian domestic fisheries in 2011, appears to progress to a mode of 50-60 cm in the purse seine associated in 2012 and then possibly again in the associated-set and longline catch in 2013 (Figure 63).

In contrast to other years, the majority of the associated-set purse seine catch in 2011 appears to come from larger fish (i.e. 80-120cm), with a pulse of recruitment evident in the size data (WCPFC Databases), and perhaps a change in catchability due to the areas fished and conditions in the fishery. These age classes (i.e. those predominant in 2011) are possibly represented as the large fish (130-150cm) taken in unassociated sets during 2012 (Figure 63). The graphs for 2016 show that (i) the average size of longline-caught bigeye was larger than in previous years, with a narrower size range, (ii) the size composition of the purse seine associated-set catch is similar to other years with most fish in the range 50–70 cm (but with significant numbers of fish in 2016 out to 90cm), and (iii) the maintenance of relatively high numbers of bigeye tuna taken in unassociated sets (which is similar to recent years).

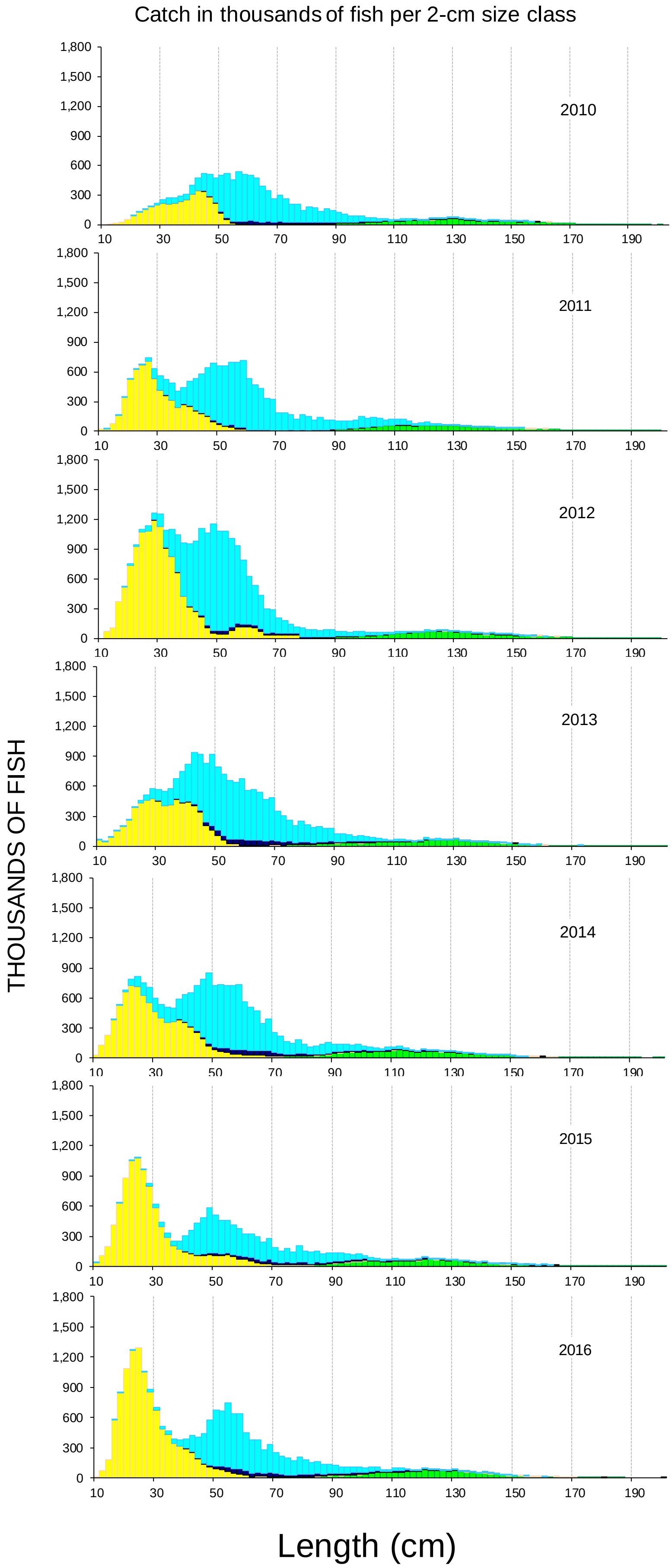


**Figure 63. Annual catches (no. of fish) of bigeye tuna in the WCPO by size and gear type, 2010–2016.**
**(green–longline; yellow–Phil-Indo archipelagic fisheries; light blue–purse seine associated; dark blue–purse seine unassociated)**

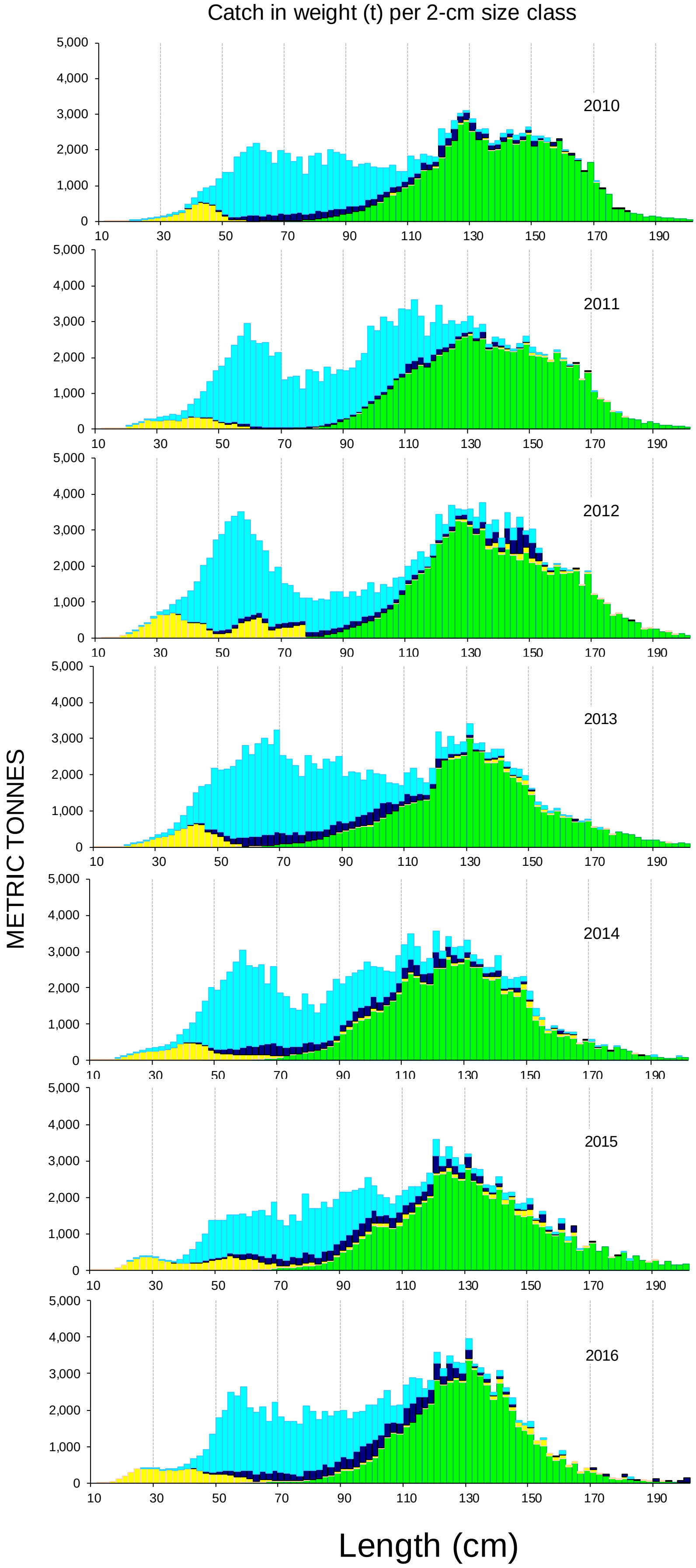


**Figure 64. Annual catches (MT) of bigeye tuna in the WCPO by size and gear type, 2010–2016.**
**(green–longline; yellow–Phil-Indo archipelagic fisheries; light blue–purse seine associated; dark blue–purse seine unassociated)**

## 7.4 SOUTH PACIFIC ALBACORE

Prior to 2001, south Pacific albacore catches were generally in the range 25,000–50,000 mt, with a significant peak in 1989 (49,076 mt) when driftnet fishing was in existence. Since 2001, catches have greatly exceeded this range, primarily as a result of the growth in several Pacific Islands domestic longline fisheries. The **south Pacific albacore** catch in 2016 (68,601 mt) was about 13,000 mt lower than in 2015 and nearly 20,000 mt lower than the record catch in 2010 of 87,292 mt (although the 2016 estimates for some fleets are provisional).

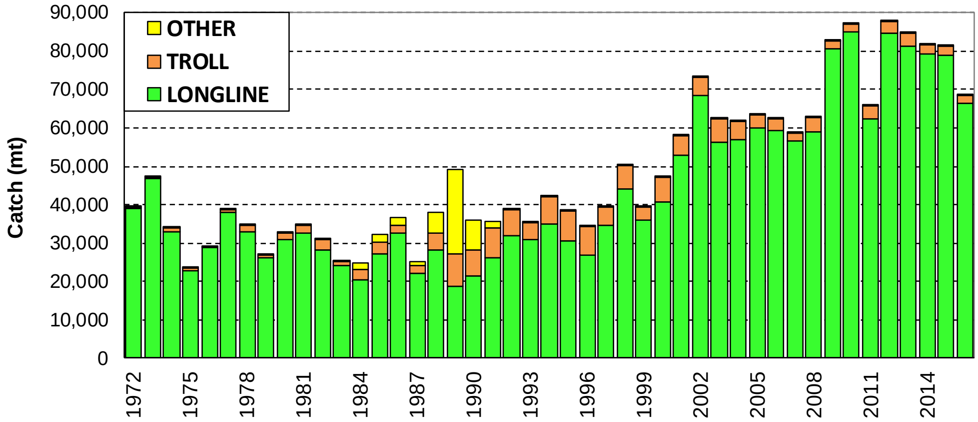


**Figure 65. South Pacific albacore catch (mt) by gear** ("Other" is primarily catch by the driftnet fishery.)

In the post-driftnet era, **longline** has accounted for most of the South Pacific Albacore catch (> 75% in the 1990s, but > 90% in recent years), while the **troll** catch, for a season spanning November – April has generally been in the range of 3,000–8,000 mt (Figure 65), but has averaged <3,000 mt in recent years. The **WCP–CA** albacore catch includes catches from fisheries in the North Pacific Ocean west of 150°W (longline, pole-and-line and troll fisheries) and typically contributes around 80–90% of the Pacific catch of albacore. The WCP–CA albacore catch for 2016 (97,903 mt) was the lowest since 1996 and nearly 50,000 mt lower that the record (147,793 mt in 2002).

The longline catch of albacore is distributed over a large area of the south Pacific (Figure 66), but concentrated in the west. The Chinese-Taipei distant-water longline fleet catch is taken in all four regions, while the Pacific Island domestic longline fleet catch is restricted to the latitudes 10°–25°S. Troll catches are distributed in New Zealand's coastal waters, mainly off the South Island, and along the SCTZ**.** Less than 20% of the overall south Pacific albacore catch is usually taken east of 150°W.

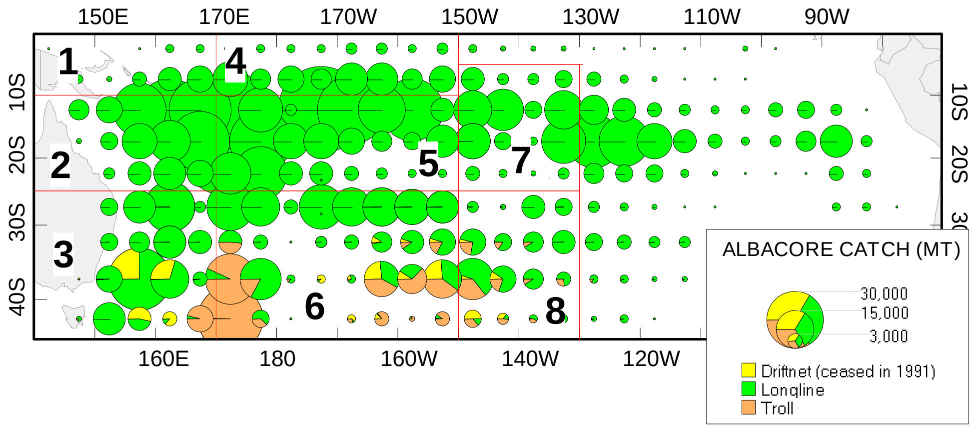


**Figure 66. Distribution of South Pacific albacore tuna catch, 1988–2016.**
**The eight-region spatial stratification used in stock assessment is shown.**

The longline fishery take adult albacore in the narrow size range of 90–105cm and the troll fishery takes juvenile fish in the range of 45–80cm (Figure 67 and Figure 68). Juvenile albacore also appear in the longline catch from time to time (e.g. fish in the range 60–70cm sampled from the longline catch). The size distribution of the longline catch in 2016 is very similar to that of 2015, which is slightly narrower in size class range than most other years shown here.

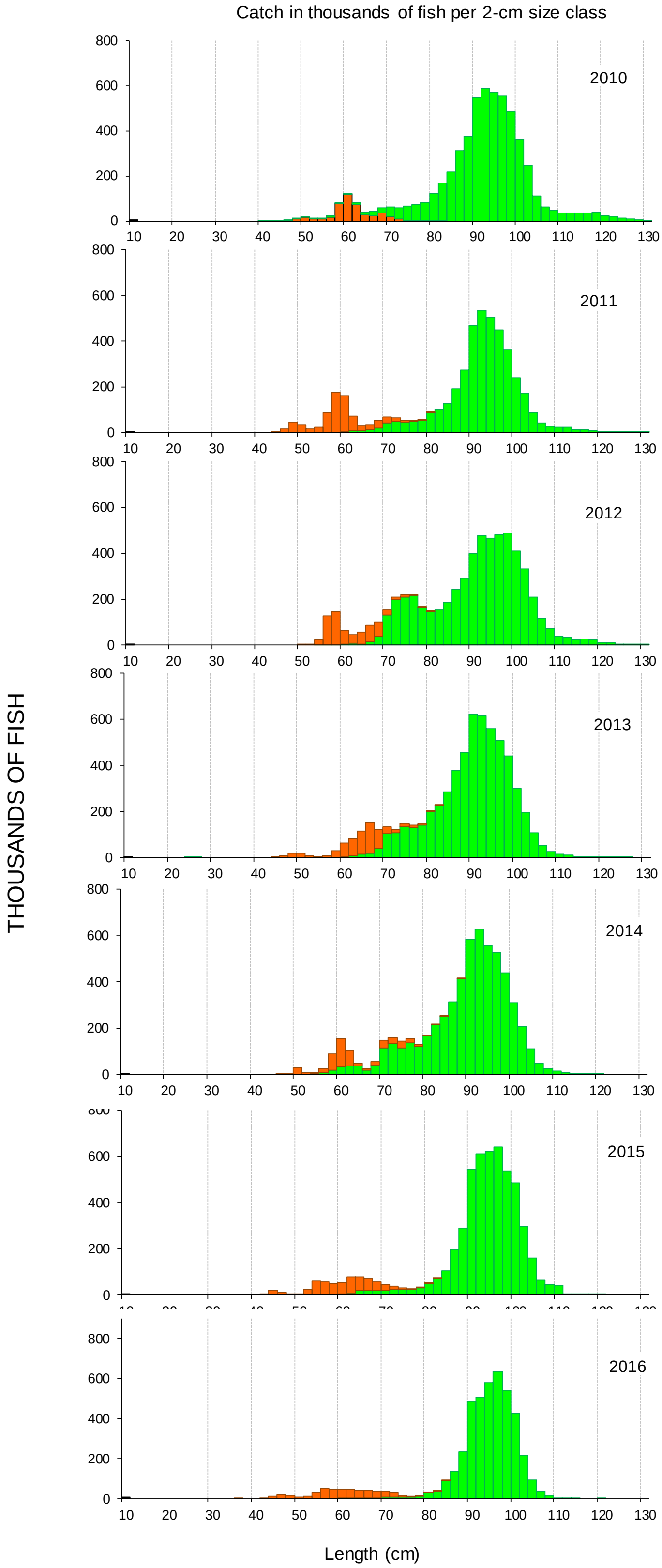


**Figure 67. Annual catches (no. of fish) of albacore tuna in the South Pacific Ocean by size and gear type, 2010–2016.** **(green–longline; orange–troll)**

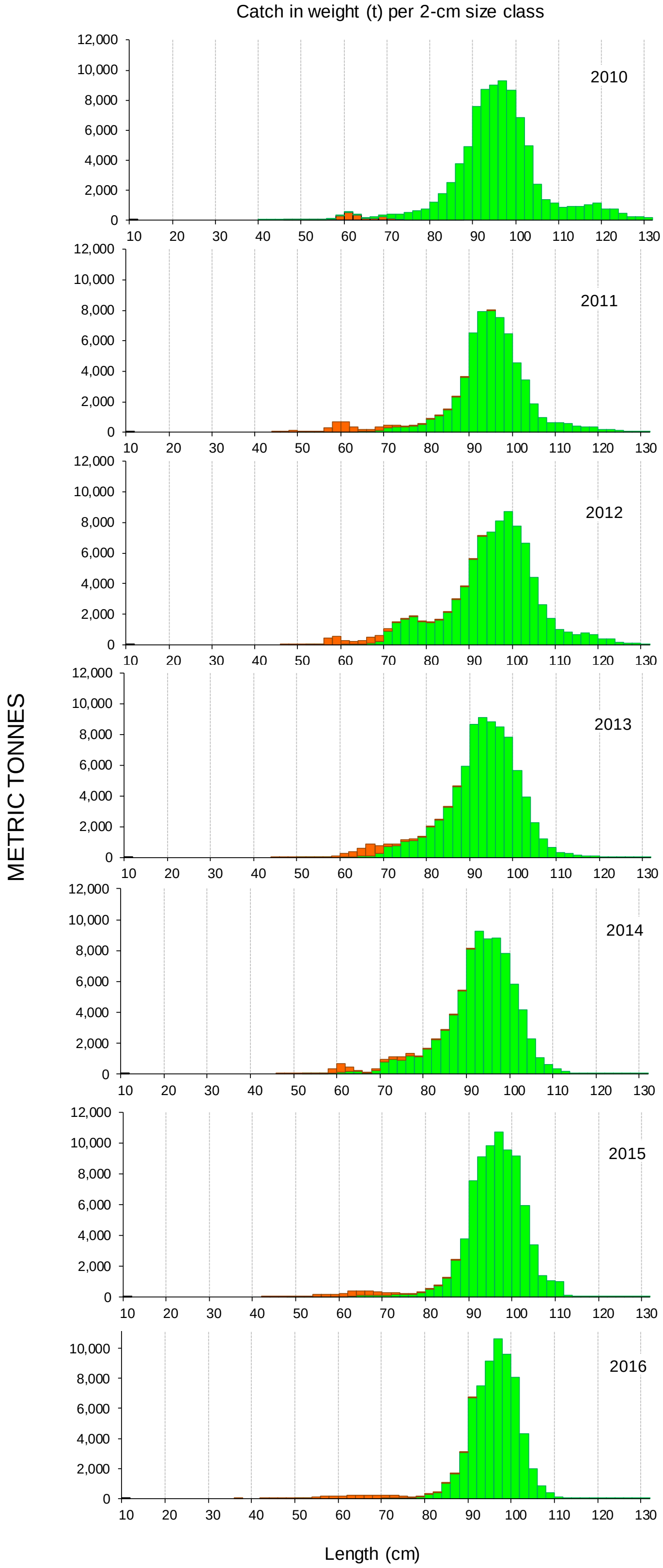


**Figure 68. Annual catches (MT) of albacore tuna in the South Pacific Ocean by size and gear type, 2010–2016.** **(green–longline; orange–troll);**

## 7.5 SOUTH PACIFIC SWORDFISH

The distant-water Asian fleets (Japan, Chinese Taipei and Korea) accounted for most of the south Pacific swordfish catch from 1972 to the mid-1990s (Figure 69), with catches slowly increasing from 2,500 mt to about 5,000 mt. The development of target (domestic) fisheries in Australia and New Zealand accounted for most of the increase in total catch to around 10,000 mt in early 2000s, with burgeoning Pacific Island domestic fleets also contributing. The Spanish longline fleet targeting swordfish entered the fishery in 2004 and resulted in total swordfish catches increasing significantly to a new level of around 15,000 mt, and then to more than 20,000 mt over the period 2011-2015, with contributions from the distant-water Asian fleet catches. The 2016 catch estimate declined from 2015, mainly due to a reduction in distant-water Asian fleet catches, although 2016 estimates for some fleets were provisional at the time of writing this paper.

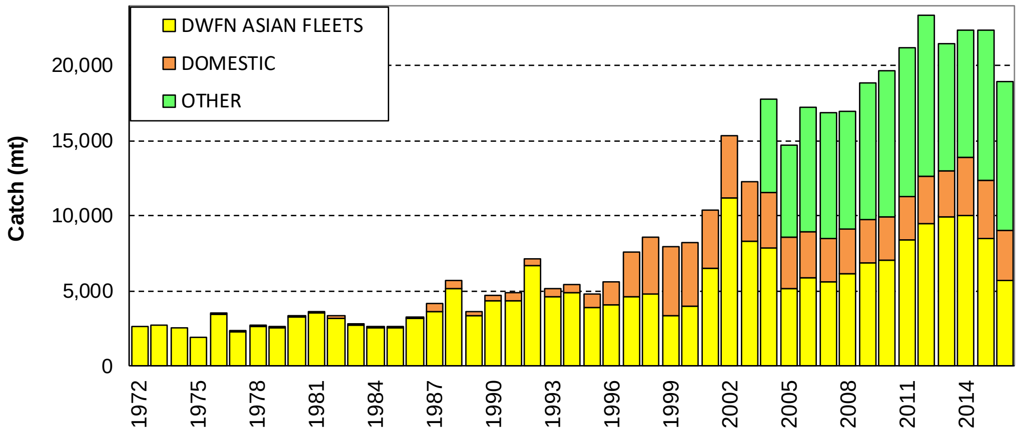


**Figure 69. South Pacific longline swordfish catch (mt) by fleet**

The longline catch of swordfish is distributed over a large area of the south Pacific (Figure 70). There are four main areas of catches (i) the far eastern Pacific Ocean off Chile and Peru, where most of the Spanish fleet catch comes from but also some of the distant-water Asian catches; (ii) the south central Pacific Ocean region south of the Cook Islands and French Polynesia, predominantly covered by the Spanish fleet; (iii) the coastal waters of New Zealand, Australia and adjacent Pacific Island countries (domestic fleets); and (iii) the equatorial Pacific Ocean between 130–160°W, covered by the distant-water Asian fleets.

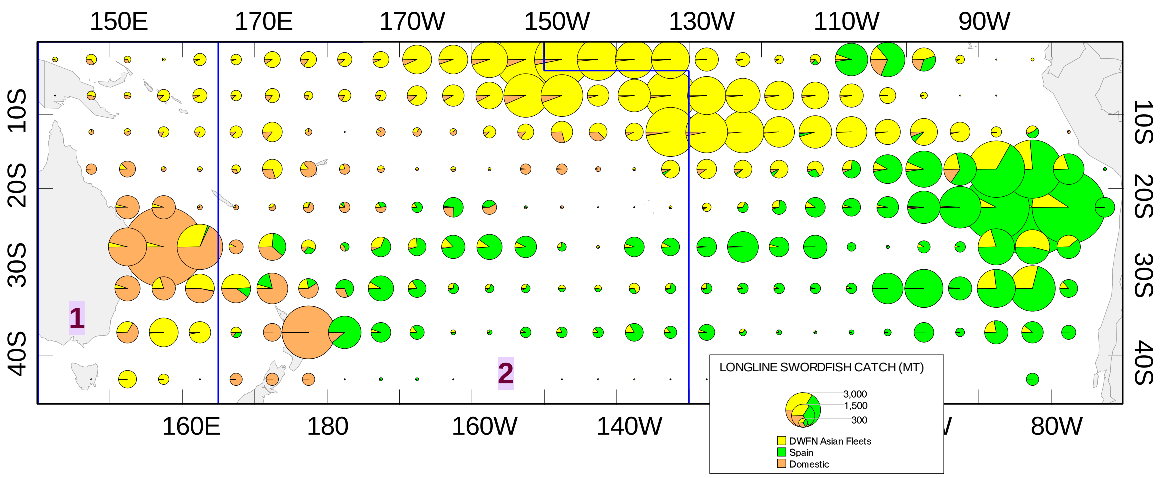


**Figure 70. Distribution of South Pacific longline swordfish catch, 1995–2016.**

The swordfish catch throughout the South Pacific Ocean are generally in the range of 110–170cm (lower jaw-fork length – Figures 71 and 72). There is evidence of inter-annual variation in the size of swordfish taken by fleet and variation in the size of fish by fleet, for example, the distant-water Asian fleets generally catch larger swordfish than the Spanish fleet, which could be related to area fished.

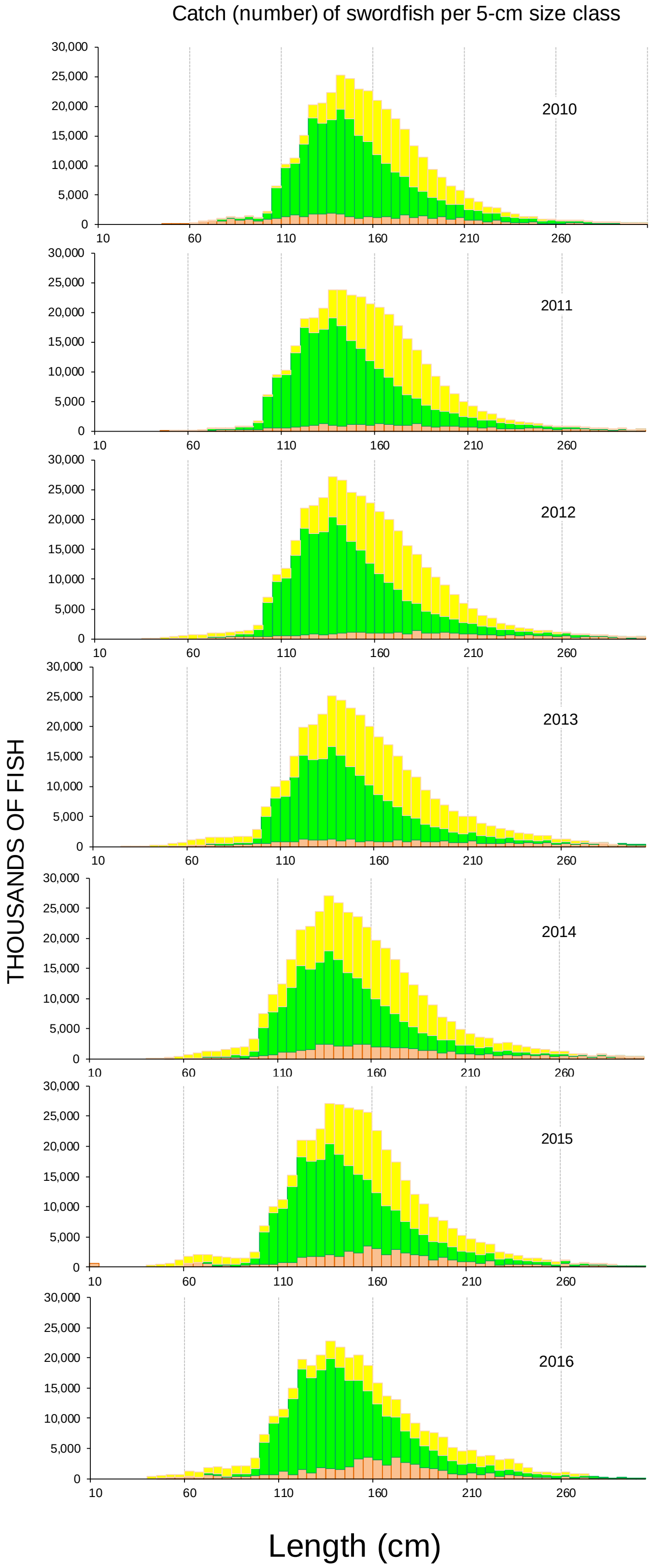


**Figure 71. Annual catches (number of fish) of swordfish in the South Pacific Ocean by size and fleet, 2010–2016.** **(green–Spanish fleet catch; yellow–distant-water Asian fleet catch; orange– Domestic fleets)**
Spanish fleet size data not available for 2012-2016, so 2011 data have been carried over.

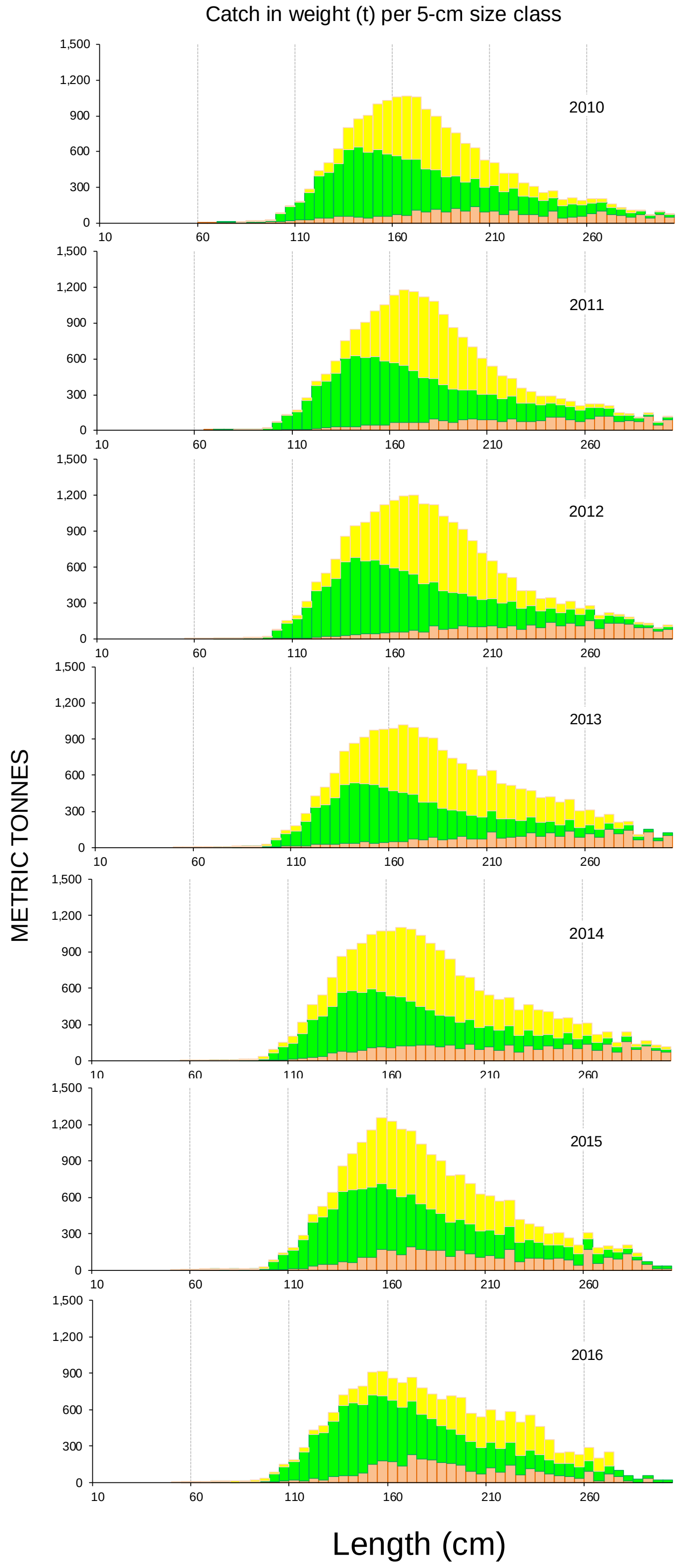


**Figure 72. Annual catches (metric tonnes) of swordfish in the South Pacific Ocean by size and fleet, 2010–2016. (green–Spanish fleet catch; yellow–distant-water Asian fleet catch; orange–Domestic fleets)**
Spanish fleet size data not available for 2012-2016, so 2011 data have been carried over.

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OFP (2017). Estimates of annual catches in the WCPFC Statistical Area. Information Paper ST–IP–1. Thirteenth Regular Session of the Scientific Committee of the WCPFC (SC13). Rarotonga, Cook Islands, 9–17 August 2017.

G. Pilling, R. Scott, P. Williams, S. & John Hampton (2017) A compendium of fisheries indicators for tuna stocks Working Paper SA-WP-6. Thirteenth Regular Session of the Scientific Committee of the WCPFC (SC13). Rarotonga, Cook Islands, 9–17 August 2017.

## APPENDIX - ADDITIONAL INFORMATION

**Table A1. Proportion of Longline SWORDFISH catch in the area north of 20°S in the WCPFC Convention Area south of the equator, 2000-2016**. Source of data: AGGREGATE CATCH DATABASE; Excludes the Indonesian estimated SWORDFISH catches.

| Year | WCPFC Area south of equator (MT) | North of 20°S in the WCPFC Area south of equator | |
|---|---|---|---|
| | | MT | % |
| 2000 | 5,257 | 1,918 | 36% |
| 2001 | 5,903 | 2,171 | 37% |
| 2002 | 8,620 | 3,819 | 44% |
| 2003 | 6,477 | 3,168 | 49% |
| 2004 | 7,605 | 3,640 | 48% |
| 2005 | 6,648 | 2,330 | 35% |
| 2006 | 8,859 | 3,192 | 36% |
| 2007 | 9,348 | 2,904 | 31% |
| 2008 | 9,234 | 4,129 | 45% |
| 2009 | 7,506 | 4,293 | 57% |
| 2010 | 6,227 | 3,433 | 55% |
| 2011 | 8,484 | 4,994 | 59% |
| 2012 | 8,792 | 4,899 | 56% |
| 2013 | 8,267 | 4,594 | 56% |
| 2014 | 8,476 | 4,773 | 56% |
| 2015 | 7,888 | 4,224 | 54% |
| 2016 | 6,300 | 3,279 | 52% |

**Table A2. Proportion of Longline SWORDFISH catch by 10° latitude band in the WCPFC Convention Area south of the equator, 2000-2016**. Source of data: AGGREGATE CATCH DATABASE; Excludes the Indonesian estimated SWORDFISH catches.

| Year | SWORDFISH CATCH - WCFPC Area south of equator | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | METRIC TONNES | | | | | % | | | | |
| | 0°-10°S | 10°S-20°S | 20°S-30°S | 30°S-40°S | 40°S-50°S | 0°-10°S | 10°S-20°S | 20°S-30°S | 30°S-40°S | 40°S-50°S |
| 2000 | 1,507 | 413 | 1,683 | 1,460 | 197 | 29% | 8% | 32% | 28% | 4% |
| 2001 | 1,565 | 611 | 1,957 | 1,575 | 229 | 26% | 10% | 33% | 27% | 4% |
| 2002 | 2,518 | 1,311 | 2,313 | 2,284 | 210 | 29% | 15% | 27% | 26% | 2% |
| 2003 | 2,001 | 1,180 | 1,778 | 1,335 | 209 | 31% | 18% | 27% | 21% | 3% |
| 2004 | 2,755 | 905 | 1,928 | 1,874 | 185 | 36% | 12% | 25% | 25% | 2% |
| 2005 | 1,614 | 746 | 2,609 | 1,476 | 109 | 25% | 11% | 40% | 23% | 2% |
| 2006 | 2,741 | 727 | 2,946 | 2,319 | 159 | 31% | 8% | 33% | 26% | 2% |
| 2007 | 2,575 | 470 | 2,784 | 3,272 | 35 | 28% | 5% | 30% | 36% | 0% |
| 2008 | 3,217 | 986 | 1,949 | 2,942 | 64 | 35% | 11% | 21% | 32% | 1% |
| 2009 | 2,780 | 1,473 | 1,556 | 2,038 | 24 | 35% | 19% | 20% | 26% | 0% |
| 2010 | 2,189 | 1,138 | 1,055 | 1,789 | 62 | 35% | 18% | 17% | 29% | 1% |
| 2011 | 3,568 | 1,424 | 1,442 | 1,924 | 125 | 42% | 17% | 17% | 23% | 1% |
| 2012 | 3,520 | 1,374 | 1,526 | 2,205 | 161 | 40% | 16% | 17% | 25% | 2% |
| 2013 | 3,060 | 1,534 | 1,658 | 1,803 | 211 | 37% | 19% | 20% | 22% | 3% |
| 2014 | 3,519 | 1,254 | 2,054 | 1,445 | 203 | 42% | 15% | 24% | 17% | 2% |
| 2015 | 3,200 | 1,024 | 2,225 | 1,210 | 229 | 41% | 13% | 28% | 15% | 3% |
| 2016 | 1,960 | 1,319 | 1,408 | 1,385 | 229 | 31% | 21% | 22% | 22% | 4% |

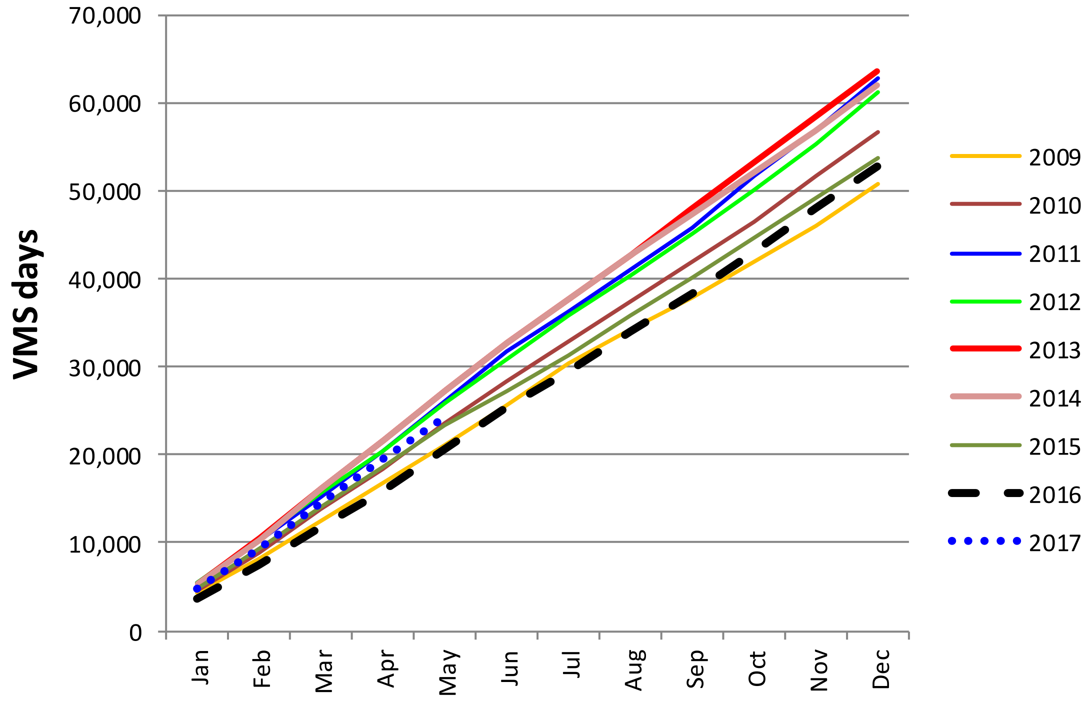



**Figure A1. Cumulative purse seine effort by month, 2009-2016, as measured by VMS (days in port and transit days omitted).**

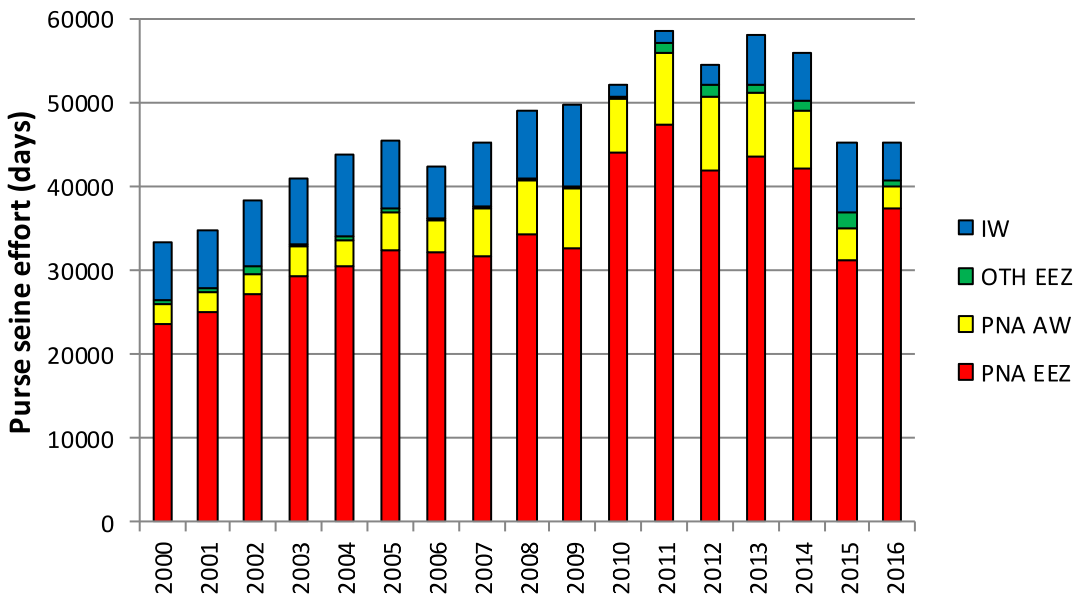



**Figure A2. Purse seine effort (days fishing and searching) in the WCPFC Convention Area between 20°N and 20°S, excluding domestic purse seine effort in Philippines and Indonesia.** Estimates are based on raised logsheet data.

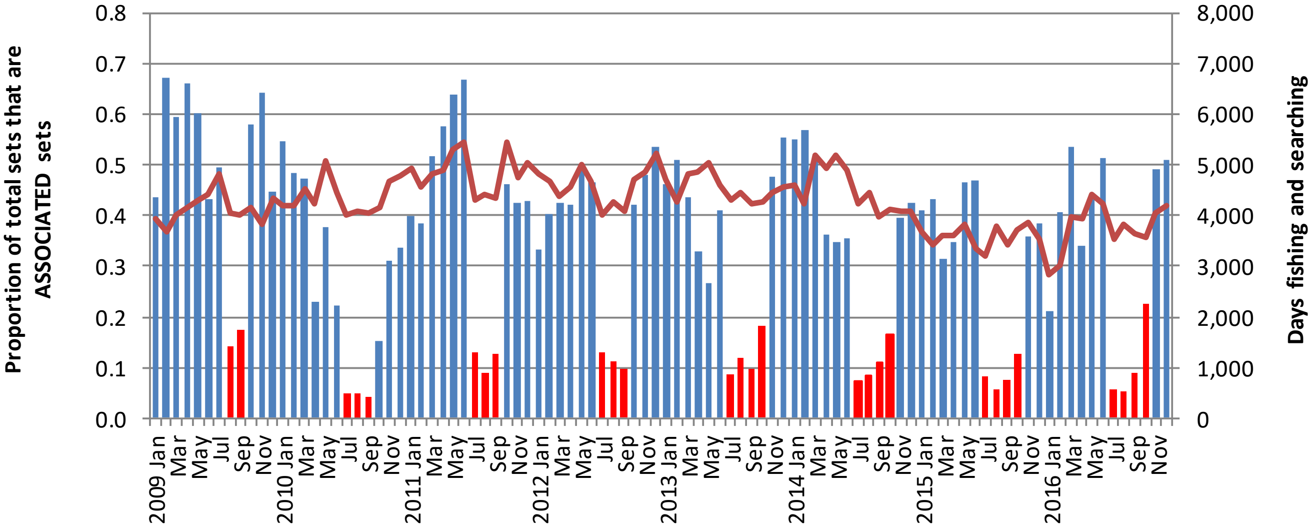



**Figure A3. Proportion of the total purse seine fishing activity comprising associated sets, as indicated by logsheet data.** Red bars indicate the FAD closure months. Total effort in days is shown by the plotted line. Activities in the domestic purse seine fisheries of Indonesia and Philippines are excluded**.**

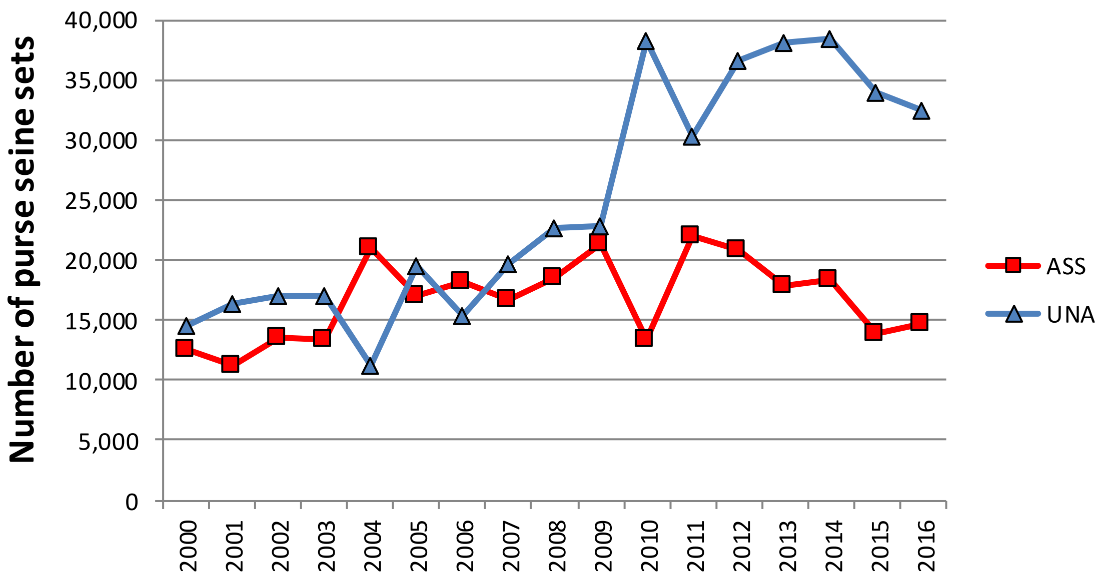
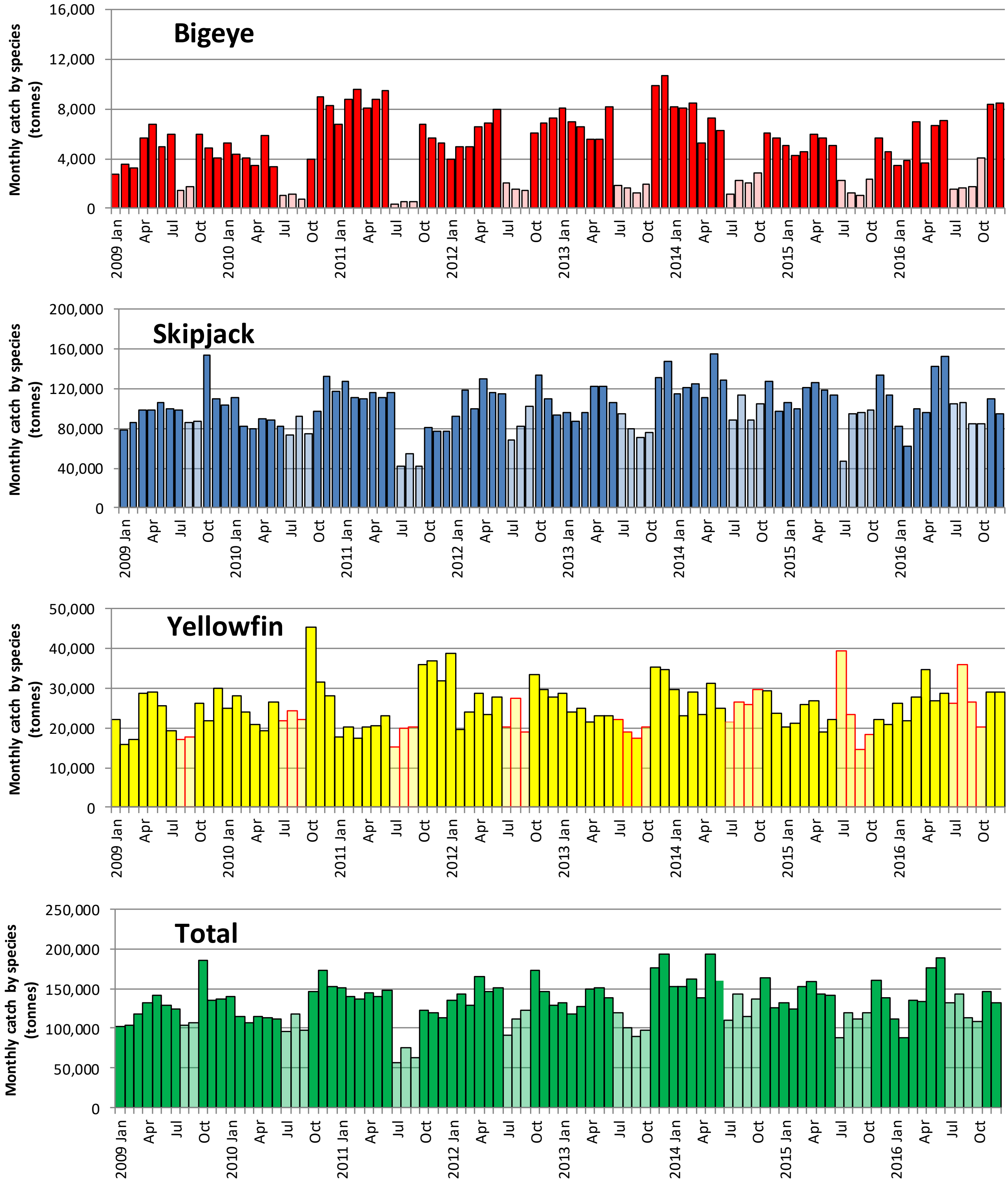



**Figure A4. Number of associated (ASS) and unassociated (UNA) sets made in the WCPO tropical purse seine fishery, 2000 – 2016.** Activities in the domestic purse seine fisheries of Indonesia and Philippines are excluded. Associated sets include animal-associated sets.




**FigureA5. Monthly catch by species (raised logsheet data with species composition adjusted using observer sampling with grab sample bias correction).** FAD closure months are shaded in lighter colour. Data excludes the domestic fisheries of Indonesia and Philippines.

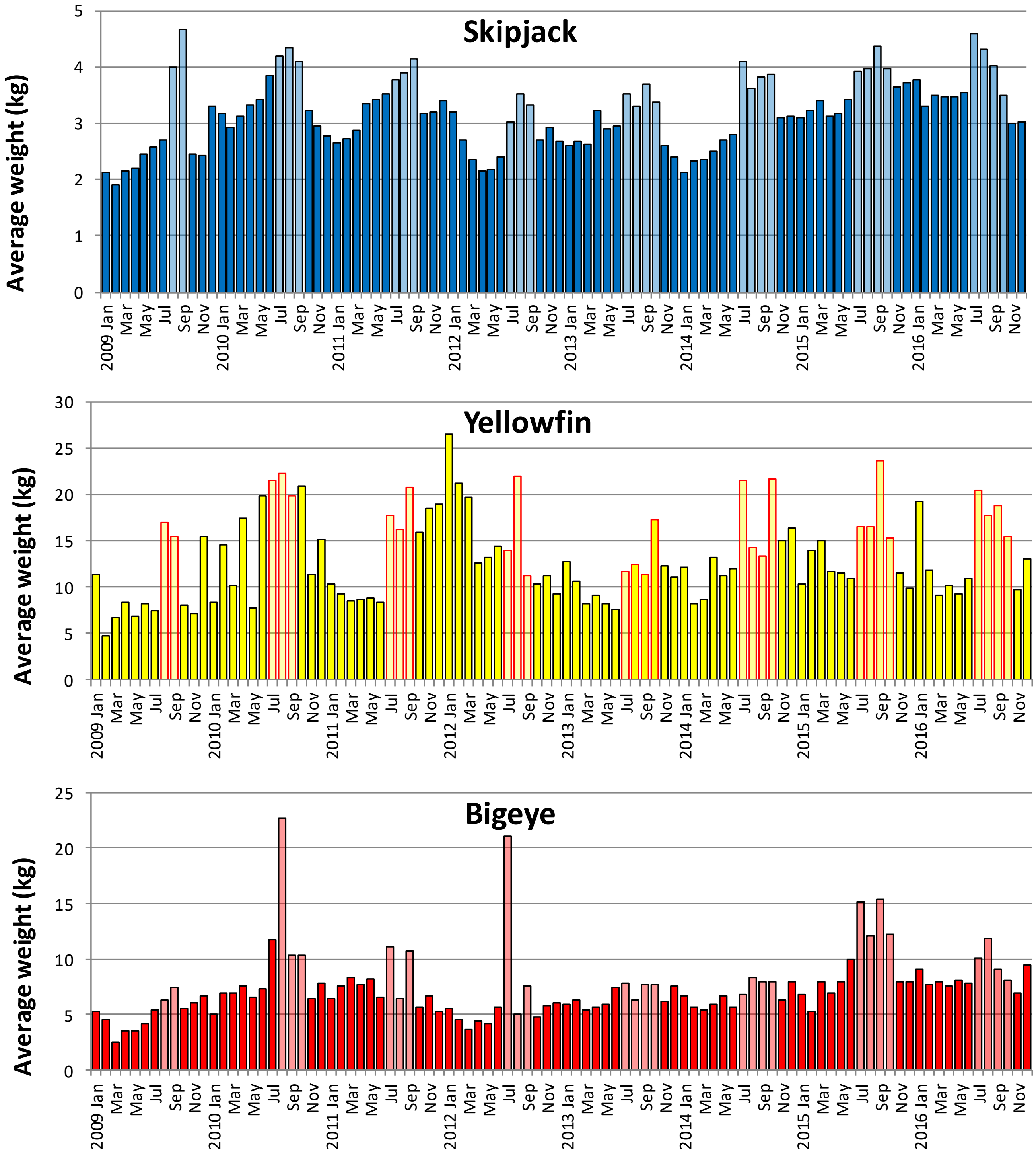



**Figure A6. Monthly average weight of bigeye, skipjack and yellowfin tuna, estimated from observer sampling data, 2009-2016.**

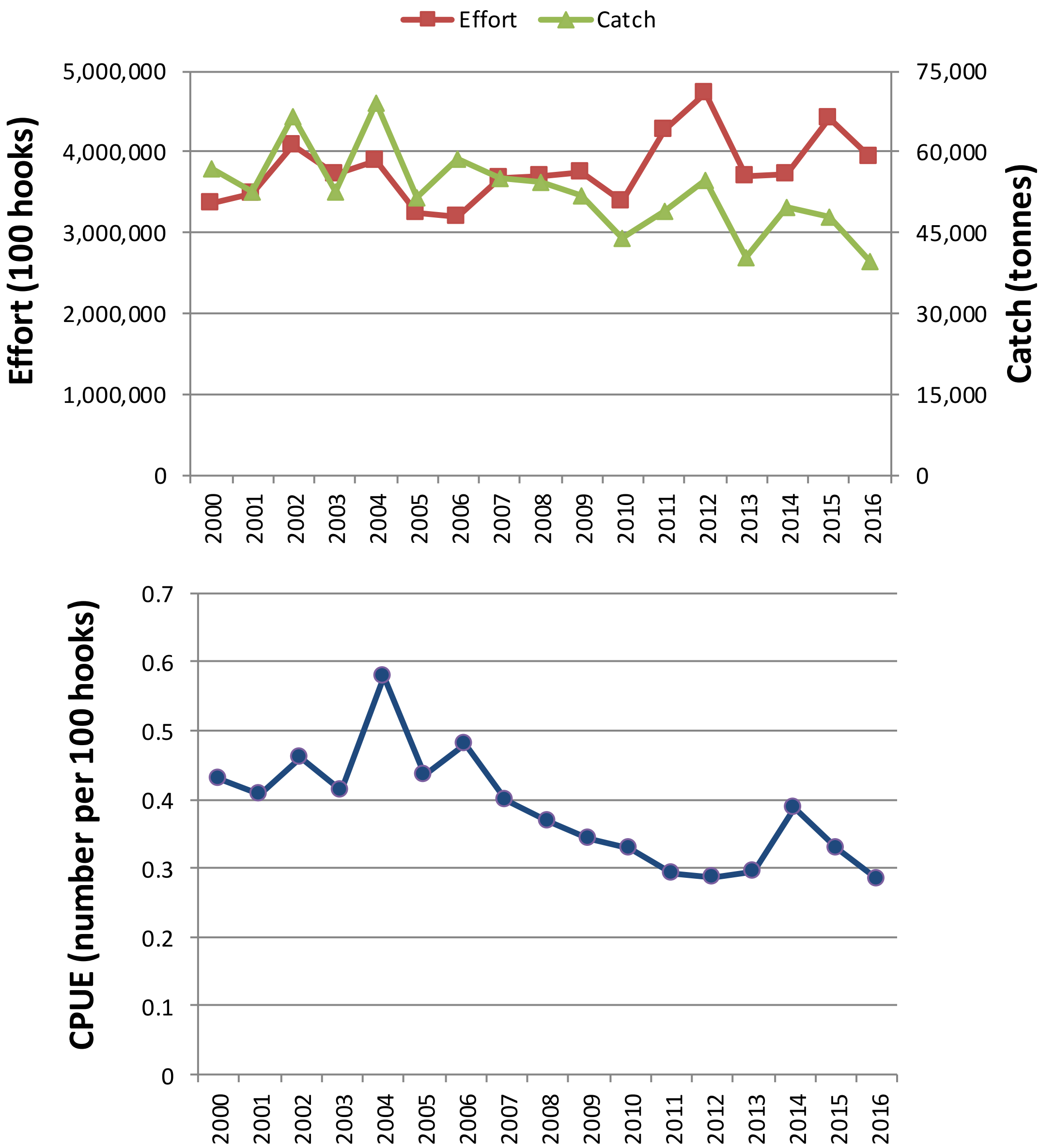



**Figure A7. Estimates of longline effort and bigeye catch (upper panel) and bigeye CPUE (lower panel) for the CORE area of the tropical WCPFC longline fishery (130°E - 150°W, 20°N - 10°S).**
2016 data are provisional.

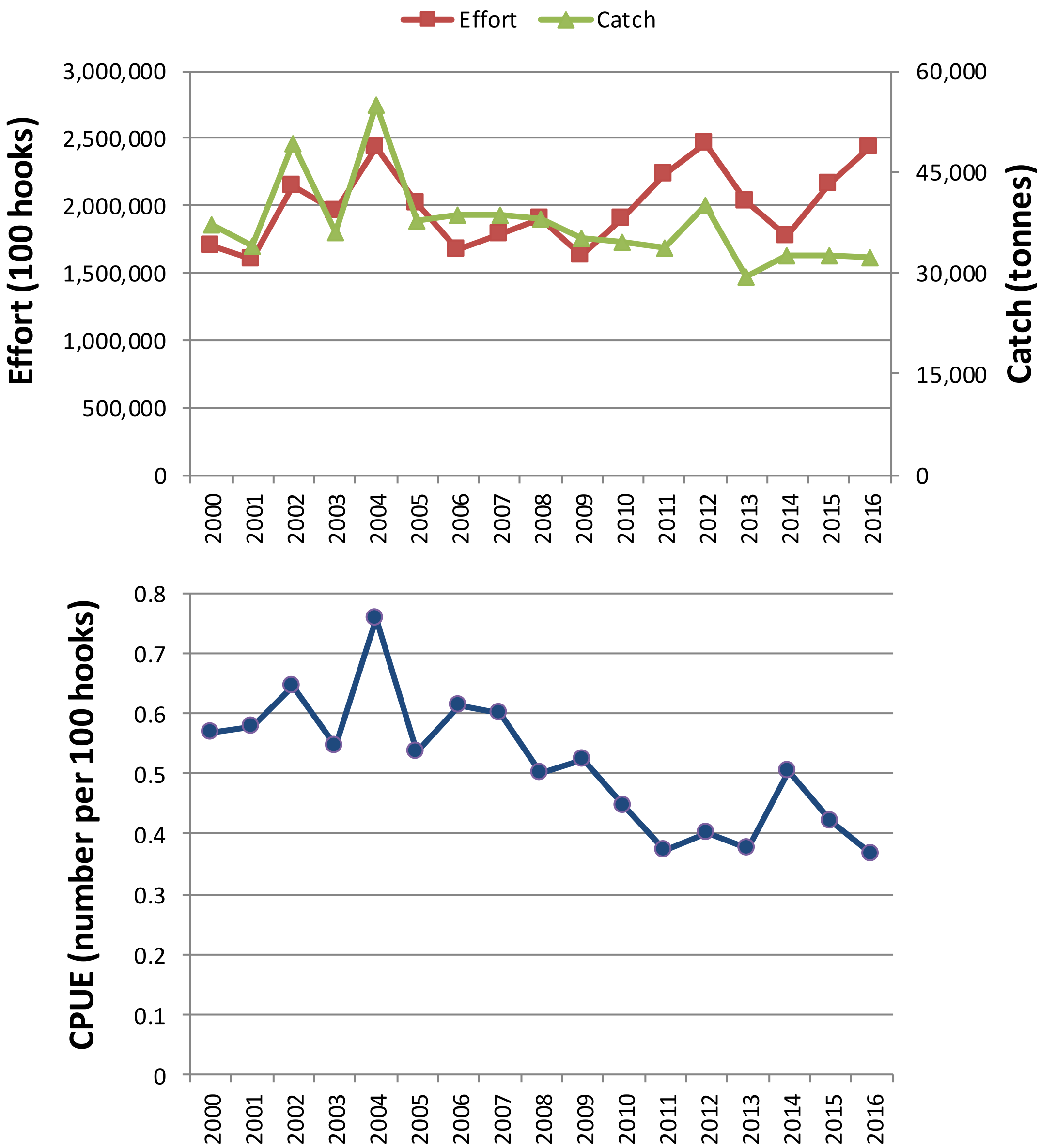



**Figure A8. Estimates of longline effort and bigeye catch (upper panel) and bigeye CPUE (lower panel) for the EASTERN area of the tropical WCPFC longline fishery (170°E - 150°W, 20°N - 10°S).**
2016 data are provisional.

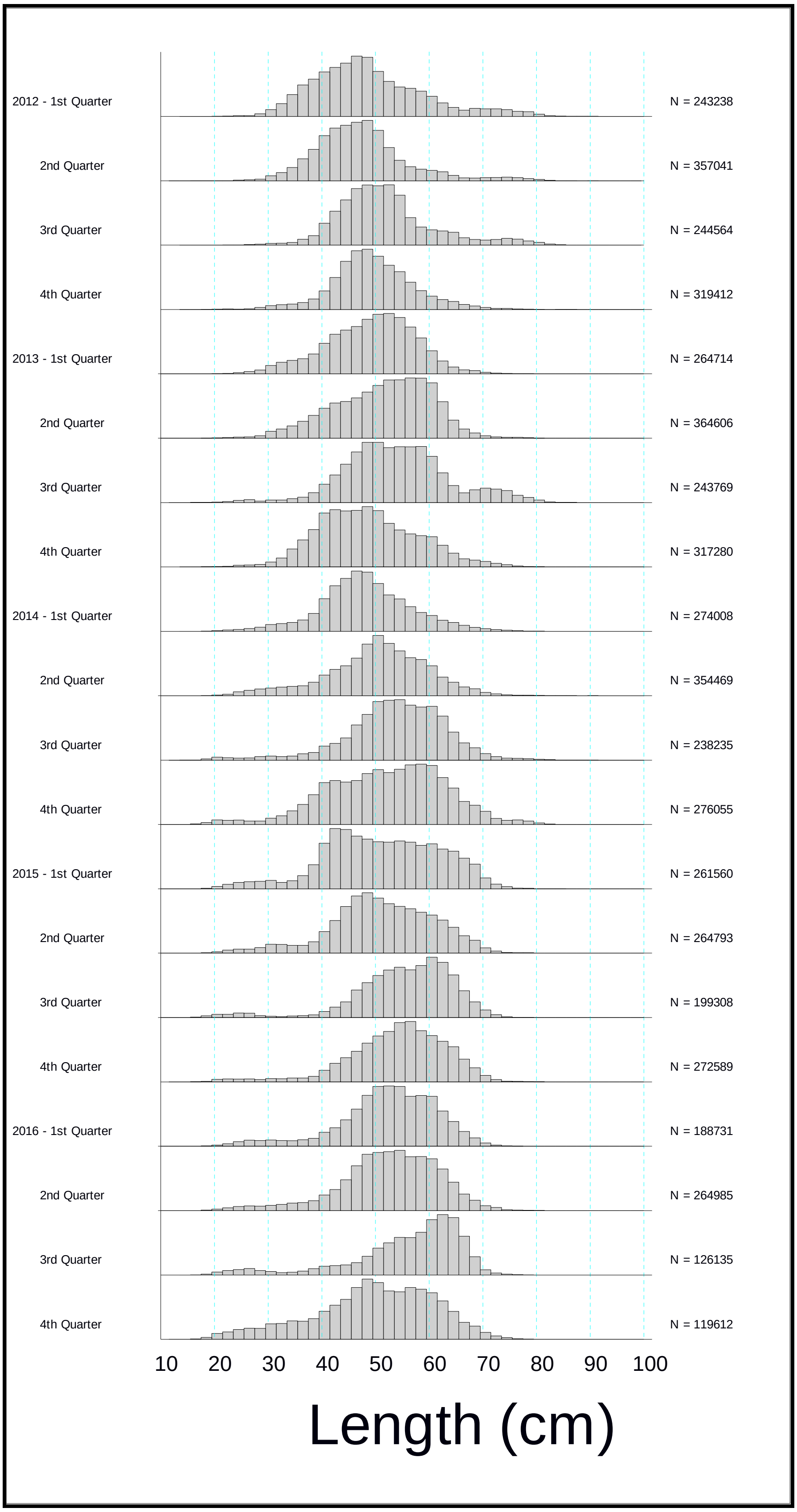



**Figure A9. Quarterly purse seine SKIPJACK length frequency histograms for the tropical WCPFC area, 2012-2016.**

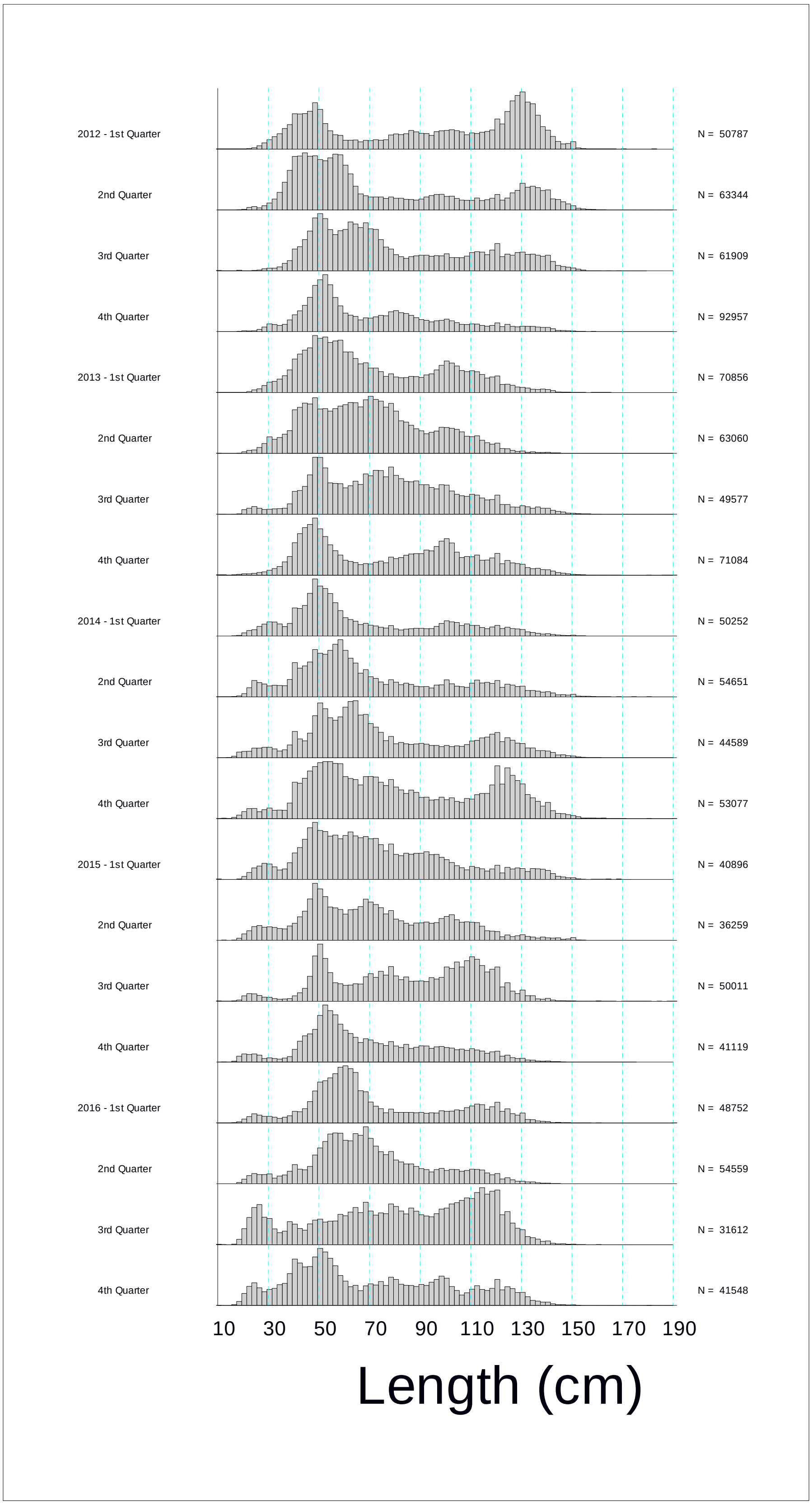



**Figure A10. Quarerly purse seine YELLOWFIN TUNA length frequency histograms for the tropical WCPFC area, 2012-2016.**

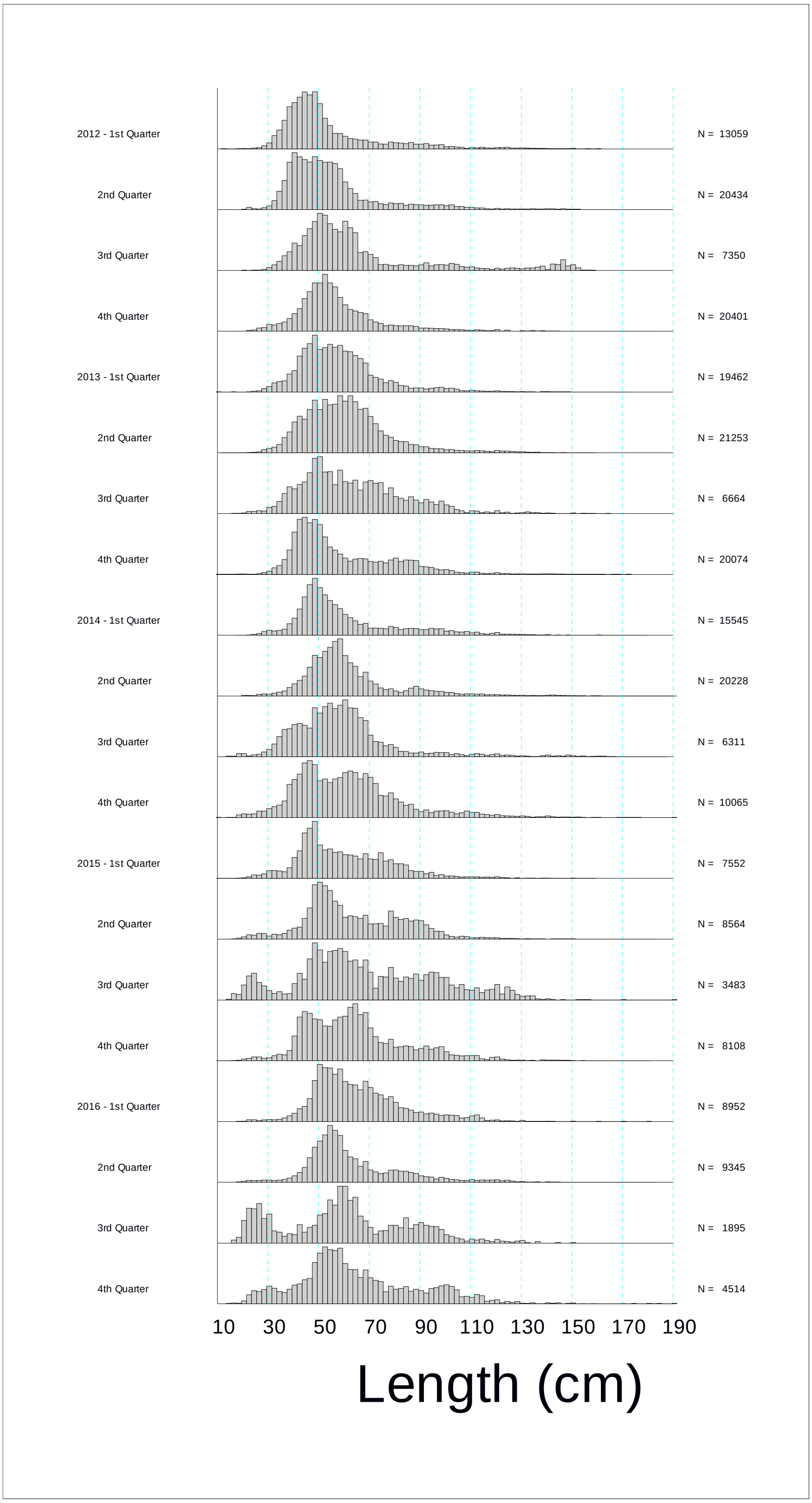



**Figure A11. Quarterly purse seine BIGEYE TUNA length frequency histograms for the tropical WCPFC area, 2012-2016.**

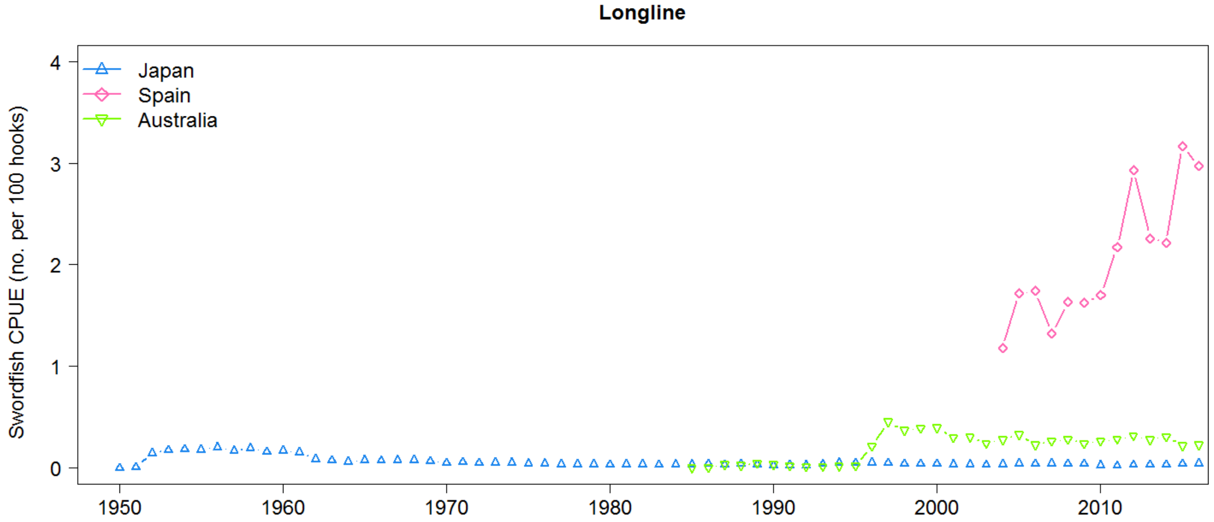



**Figure A12. Trends in SWORDFISH nominal CPUE (number of fish per 100 hooks) over time for key LONGLINE fleets in the south Pacific Ocean.**

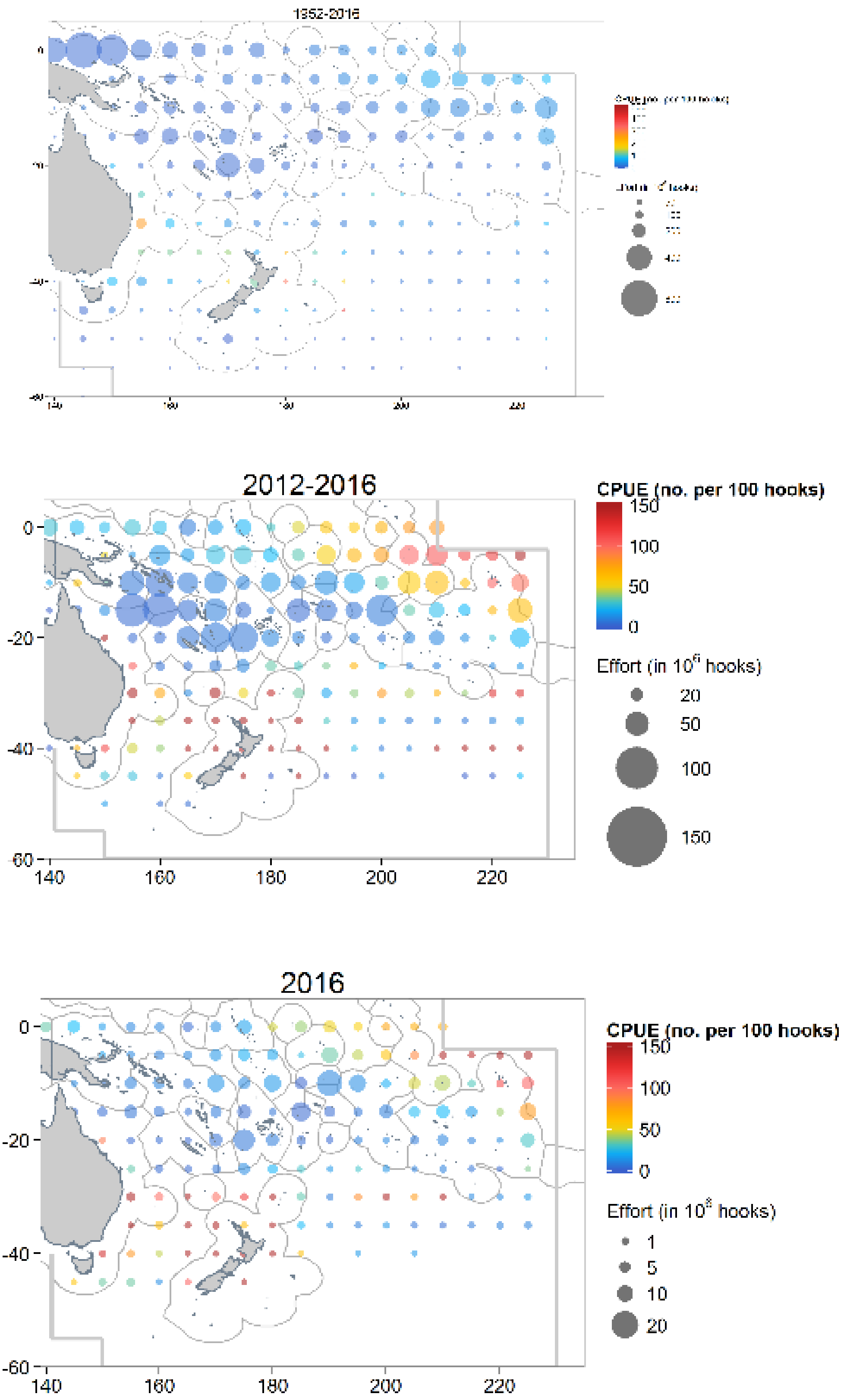



**Figure A13. Distribution of South Pacific SWORDFISH longline CPUE and effort for the period 1952-2016 (top), 2012-2016 (middle) and 2016 (bottom).**

**Table A3. Purse seine tuna catch and effort by set type and species in the WCPFC Convention Area between 20°N and 20°S, excluding domestic purse seine effort in Philippines, Indonesia and Vietnam.**

| YEAR | VESSELS | | DAYS | UNASSOCIATED SCHOOLS | | | | | | | | ASSOCIATED SCHOOLS | | | | | | | | TOTAL | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | YB | LOG | | | SKIPJACK | | YELLOWFIN | | BIGEYE | | TOTAL | | SKIPJACK | | YELLOWFIN | | BIGEYE | | TOTAL | | SKJ | YFT | BET | TOTAL |
| | | | | SETS | MT | % | MT | % | MT | % | MT | SETS | MT | % | MT | % | MT | % | MT | SETS | MT | MT | MT | MT |
| 2000 | 210 | 200 | 33,483 | 14,462 | 277,662 | 69% | 121,979 | 30% | 1,784 | 0% | 401,425 | 12,563 | 303,613 | 59% | 167,846 | 33% | 41,813 | 8% | 513,273 | 27,025 | 581,276 | 289,825 | 43,597 | 914,697 |
| 2001 | 195 | 192 | 34,738 | 16,347 | 327,545 | 67% | 157,193 | 32% | 5,882 | 1% | 490,619 | 11,246 | 257,345 | 62% | 116,711 | 28% | 43,759 | 11% | 417,815 | 27,594 | 584,890 | 273,904 | 49,641 | 908,434 |
| 2002 | 199 | 204 | 38,317 | 16,977 | 380,050 | 79% | 95,051 | 20% | 6,858 | 1% | 481,959 | 13,612 | 385,002 | 67% | 136,722 | 24% | 50,244 | 9% | 571,968 | 30,590 | 765,051 | 231,773 | 57,103 | 1,053,927 |
| 2003 | 200 | 208 | 40,938 | 17,013 | 373,482 | 71% | 147,106 | 28% | 3,935 | 1% | 524,523 | 13,318 | 312,463 | 66% | 125,149 | 27% | 32,812 | 7% | 470,424 | 30,332 | 685,945 | 272,255 | 36,747 | 994,947 |
| 2004 | 215 | 210 | 43,792 | 11,134 | 197,870 | 76% | 59,839 | 23% | 2,838 | 1% | 260,546 | 20,998 | 531,621 | 66% | 210,423 | 26% | 61,426 | 8% | 803,470 | 32,133 | 729,491 | 270,262 | 64,263 | 1,064,016 |
| 2005 | 221 | 198 | 45,583 | 19,494 | 406,916 | 75% | 133,898 | 25% | 5,478 | 1% | 546,292 | 17,091 | 427,265 | 66% | 173,502 | 27% | 44,864 | 7% | 645,631 | 36,585 | 834,181 | 307,401 | 50,342 | 1,191,924 |
| 2006 | 214 | 199 | 42,364 | 15,305 | 327,079 | 77% | 93,580 | 22% | 3,655 | 1% | 424,314 | 18,153 | 605,051 | 76% | 149,899 | 19% | 45,857 | 6% | 800,807 | 33,459 | 932,130 | 243,480 | 49,512 | 1,225,121 |
| 2007 | 237 | 229 | 45,328 | 19,648 | 429,210 | 77% | 127,236 | 23% | 3,262 | 1% | 559,709 | 16,703 | 610,073 | 77% | 147,198 | 19% | 40,352 | 5% | 797,623 | 36,351 | 1,039,283 | 274,434 | 43,614 | 1,357,332 |
| 2008 | 248 | 240 | 48,996 | 22,718 | 424,168 | 67% | 202,407 | 32% | 3,458 | 1% | 630,032 | 18,474 | 558,367 | 73% | 164,033 | 21% | 48,266 | 6% | 770,666 | 41,192 | 982,535 | 366,440 | 51,724 | 1,400,699 |
| 2009 | 261 | 251 | 49,695 | 22,803 | 484,673 | 82% | 103,167 | 17% | 3,895 | 1% | 591,735 | 21,305 | 710,251 | 76% | 175,193 | 19% | 49,902 | 5% | 935,347 | 44,108 | 1,194,924 | 278,361 | 53,797 | 1,527,082 |
| 2010 | 276 | 263 | 52,501 | 38,275 | 690,331 | 76% | 212,219 | 23% | 8,314 | 1% | 910,863 | 13,311 | 426,006 | 74% | 109,098 | 19% | 43,810 | 8% | 578,915 | 51,587 | 1,116,337 | 321,317 | 52,125 | 1,489,778 |
| 2011 | 279 | 264 | 58,993 | 30,306 | 430,247 | 76% | 132,946 | 24% | 3,316 | 1% | 566,509 | 21,968 | 625,561 | 74% | 149,889 | 18% | 67,298 | 8% | 842,748 | 52,274 | 1,055,808 | 282,834 | 70,615 | 1,409,257 |
| 2012 | 285 | 280 | 55,129 | 36,614 | 631,786 | 75% | 207,509 | 25% | 8,478 | 1% | 847,773 | 20,753 | 615,448 | 77% | 132,660 | 17% | 53,286 | 7% | 801,394 | 57,368 | 1,247,234 | 340,170 | 61,763 | 1,649,167 |
| 2013 | 297 | 285 | 54,669 | 38,014 | 651,764 | 81% | 148,464 | 18% | 8,878 | 1% | 809,106 | 17,889 | 563,268 | 73% | 150,099 | 19% | 61,058 | 8% | 774,424 | 55,904 | 1,215,032 | 298,563 | 69,936 | 1,583,531 |
| 2014 | 307 | 295 | 53,807 | 38,454 | 752,036 | 79% | 190,891 | 20% | 9,438 | 1% | 952,365 | 18,291 | 641,611 | 78% | 128,025 | 16% | 54,531 | 7% | 824,167 | 56,745 | 1,393,647 | 318,916 | 63,970 | 1,776,532 |
| 2015 | 303 | 279 | 42,959 | 34,000 | 701,488 | 80% | 170,348 | 19% | 10,392 | 1% | 882,229 | 13,852 | 566,656 | 80% | 103,377 | 15% | 37,289 | 5% | 707,322 | 47,851 | 1,268,145 | 273,725 | 47,681 | 1,589,551 |
| 2016 | 291 | 275 | 45,283 | 32,472 | 651,602 | 74% | 218,289 | 25% | 11,674 | 1% | 881,564 | 14,692 | 567,247 | 78% | 113,569 | 16% | 46,078 | 6% | 726,894 | 47,164 | 1,218,848 | 331,858 | 57,752 | 1,608,458 |

**Notes**:

1. Estimates are based on aggregate data and raised logsheet data with species composition adjusted using observer sampling with grab sample bias correction. Note that these estimates may differ from the annual catch estimates provided by CCMs.
2. Estimates exclude domestic purse seine catch/effort in Philippines, Indonesia and Vietnam.
3. Two sources of estimates of vessel numbers are provided (i) those provided by CCMs with their annual catch estimates (and therefore appear in the WCPFC Yearbook) and (ii) estimates of vessel numbers from unraised operational data available to SPC.
4. The estimate of Japanese purse seine vessels fishing in the tropical fishery (20°N-20°S) has been determined by only considering vessel numbers in the categories >200 GRT.
5. There are several instances where vessel numbers from unraised logbook data are higher than the vessel numbers provided by the CCM. The reasons for these occurrences include: (i) situations where one vessel became inactive during the calendar year and was replaced by a new vessel – the vessel number from the operational data is based on a count of the total distinct vessels fishing throughout the year; (ii) instances where there are inconsistencies in the charter/flag assignment between the vessel numbers provided by CCMs and the operational logsheet data (e.g. Philippine-flagged vessels chartered to PNG – this will require follow-up and clarification with relevant CCMs).
6. ASSOCIATED covers sets on Drifting FAD, Log and Anchored FAD. Catch/effort for sets on ANIMALS is not shown separately but are included in the TOTAL.
7. Includes Catch and Effort in Archipelagic Waters.

**Figure A14. Trends in purse seine vessel numbers, aggregated Gross Registered Tonnage (GRT) and storage capacity (cubic metres).**

(Source : FFA Regional Vessel History database; Regional Logsheet database)