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OVERVIEW OF TUNA FISHERIES IN THE WESTERN AND CENTRAL PACIFIC OCEAN, INCLUDING ECONOMIC CONDITIONS – 2015

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Revision 1 – 29th July 2016
- Revision of the value of the longline yellowfin catch in Section 5.5.2

Revision 2 – 5th August 2016
- Revision of Figure A5

Revision 3 – 30th August 2016
- Relabelled and updated Table A14 as Table A3
- Relabelled and updated Figure A15 as Figure A14

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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 (2015) and covering the most recent version of catch estimates by gear and species.

The provisional **total WCP–CA tuna catch for 2015** was estimated at **2,687,840 mt**, the third highest on record and nearly 200,000 mt below the previous record catch in 2014 (2,882,511 mt); this catch represented 80% of the total Pacific Ocean catch of 3,379,789 mt, and 56% of the global tuna catch (the provisional estimate for 2015 is 4,799,697 mt, and when finalised is expected to be the second highest on record).

The **2015 WCP–CA catch of skipjack** (**1,827,750 mt** – 68% of the total catch) was the third highest recorded, nearly 180,000 mt less than the record in 2014 (2,005,647 mt). The **WCP–CA yellowfin catch** for 2015 (**605,963 mt** – 23%) was the second highest recorded (less than 1,000 mt lower than the record catch of 2008 – 606,868 mt); the increase in yellowfin tuna catch from 2014 levels was mainly due to increased catches in the Indonesia and Philippines domestic fisheries. The **WCP–CA bigeye catch** for 2015 (**134,084** mt – 5%) was the lowest since 1996 due to relatively low catches in the longline and purse seine fisheries. The **2015 WCP–CA albacore catch** (**120,043 mt** - 4%) was the lowest since 2011 and nearly 28,000 mt lower than the record catch in 2002 at 147,793 mt. The WCP–CA albacore catch includes catches of north and south Pacific albacore in the WCP–CA, which comprised 81% of the total Pacific Ocean albacore catch of 149,289 mt in 2015. The **south Pacific** albacore catch in 2015 (68,594 mt) was about 12,000 mt lower than in 2014 and nearly 20,000 mt lower than the record catch in 2010 of 87,292 mt.

The provisional **2015 purse-seine catch of 1,766,070 mt** was the fifth highest catch on record and more than 280,000 mt lower than the record in 2014 (2,051,970 mt); the main reason for this decline in catch appears to be reduced effort more than any other factor. The 2015 purse-seine skipjack catch (1,416,453 mt; 80% of total catch) was about 210,000 mt lower than the record in 2014. The 2015 purse-seine catch estimate for yellowfin tuna (298,847 mt) contributed only 17% of the total catch, continuing the recent trend of a diminishing contribution in the overall catch and amongst the lowest for the past decade. The provisional catch estimate for bigeye tuna for 2015 (48,772 mt) was the lowest catch since 2007 and appears to be related to a combination of lower effort, and possibly environmental conditions which resulted in bigeye tuna being less available to the purse seine gear.

In line with the prevailing ENSO conditions, fishing activity during 2014 and 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 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). With the ENSO forecast for late 2016 predicting a weakening of El Nino conditions, there should be a switch back to more effort in the western tropical areas.

The **2015 pole-and-line catch (228,129 mt)** was a slight increase on the 2014 catch but remains amongst the lowest annual catch since the late-1960s. Japanese distant-water and offshore fleets (110,433 mt in 2015), and the Indonesian fleets (116,179 mt in 2015), account for nearly all of the WCP–CA pole-and-line catch (99% in 2015).

The **provisional WCP–CA longline catch (243,547 mt) for 2015** was lower than the average for the past five years. The WCP–CA albacore longline catch (80,596 mt – 33%) for 2015 was the lowest for three years, 21,000 mt. lower that the record of 101,816 mt attained in 2010. The provisional bigeye catch (63,986 mt – 26%) for 2015 was the lowest since 1996, mainly due to continued reduction in effort in the main bigeye tuna fishery. The yellowfin catch for 2015 (97,289 mt – 40%) was amongst the highest over the past decade ten years.

The **2015 South Pacific troll albacore catch (2,576 mt)** was around the average over the past decade. The New Zealand troll fleet (131 vessels catching 2,425 mt in 2015) and the United States troll fleet (6 vessels catching 151 mt in 2015) accounted for all of the 2015 albacore troll catch.

Market conditions for the tuna raw materials of the WCP-CA during 2015 saw further deteriorations in the prices for canning lightmeat raw material and sashimi grade products but improvement in the price for albacore for canning.

Prices in the major markets for WCP-CA skipjack were lower in 2015 compared with 2014, underpinned by an oversupply of raw material and lower demand at end markets. The Bangkok benchmark (4-7.5lbs) and Thai import prices were lower by 15% and 17% respectively. Similar trends occurred in other markets with prices in Europe and Spain 6% and 15% lower respectively; General Santos prices were 12% lower while the Ecuador price declined by 25%. Prices on markets in Japan increased (in JPY) but driven by the 14% depreciation of the Yen against the USD, prices in USD terms fell. USD prices for Japan selected ports, Japan Customs imports and Yaizu port declined 1%, 3% and 6% respectively.

Yellowfin prices on canning markets were mostly down but by varying magnitude; the Bangkok market price (20lbs+, c&f) and Thai import prices both declined 14%, Yaizu declined 13% (in USD terms) and General Santos (20lbs+, fob) down 10% while Ecuador saw a 28% decline. Albacore prices rose during 2015 across markets following on from significant increases in 2014; the Bangkok benchmark (10kg and up) increased 7% (following a 15% rise in 2014), Thai frozen imports increased 5% while Japan selected ports fresh (ex-vessel) and US imports fresh (f.a.s.) increased 6% and 7% respectively. USD prices on the main markets for longline caught sashimi products (yellowfin and bigeye) in Japan declined in 2015. The 2015 average price for the Japan fresh yellowfin imports from all sources averaged $8.44/Kg, down 13% on 2014. The Yaizu Port 2015 longline caught yellowfin fresh/frozen price decreased by 18% to $5.31/Kg. Similar trends occurred on US markets with the US fresh yellowfin import price averaging $9.45 in 2015, 2% down on 2014.

Japanese fresh bigeye imports from all sources weakened by 8% to $8.68/Kg while Japan selected ports frozen price in 2015 declined by 14% to $7.74/Kg. In the US market the fresh bigeye import price in 2015 declined by 4%.

The total estimated delivered value of catch in the WCP-CA declined by 18% to $4.8 billion during 2015. This is the third consecutive year of a decline in catch values since the peak of $7.5 billion in 2012. The value of the purse seine fishery declined by 28% from the previous year to $2.3 billion with its contribution to the total catch value falling to 49% (56% in 2014). The value of the longline fishery also declined, down 11%, to $1.5 billion but its contribution to the total catch value increased to 31%. In terms of value by species, all species declined in value except albacore which remained steady at $357 million result in its contribution to the total catch value rising to 7%. The value of the bigeye catch declined by 20% to $605 million (13% of the total catch value). The value of the skipjack catch declined the most, falling by 24% to $2.3 billion or 49% of the total catch value. The yellowfin catch value declined by 11% to $1.5 billion (32%).

Economic conditions in the purse seine, tropical longline and southern longline fisheries of the WCP-CA – improved, albeit marginally in some cases, in 2015 compared with 2014. The purse seine fishery saw increases in catch rates and declines in costs which more than offset declines in prices. In the tropical longline fishery conditions improved only marginally compared with 2014 despite a significant fall in fuel prices as the effect of the resulting decline in costs was largely offset by declines in the catch rate and fish prices. For the southern longline fishery economic conditions improved significantly in 2015 primarily driven by falling fuel costs with the fish price remaining around its 2014 level. However, persistent low catch rates continue to impact on economic conditions in the southern longline fishery and if they continue the likelihood of economic conditions returning to higher historical average levels remains low.

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 – 2015. The review draws on the latest catch estimates compiled for the WCP–CA, which can be found in Information Paper WCPFC–SC12 ST IP–1 *(Estimates of annual catches in the WCPFC Statistical Area – OFP, 2016)*. Where relevant, comparisons with previous years' activities have been included, although it should be noted that data for 2015, 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 2015 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.

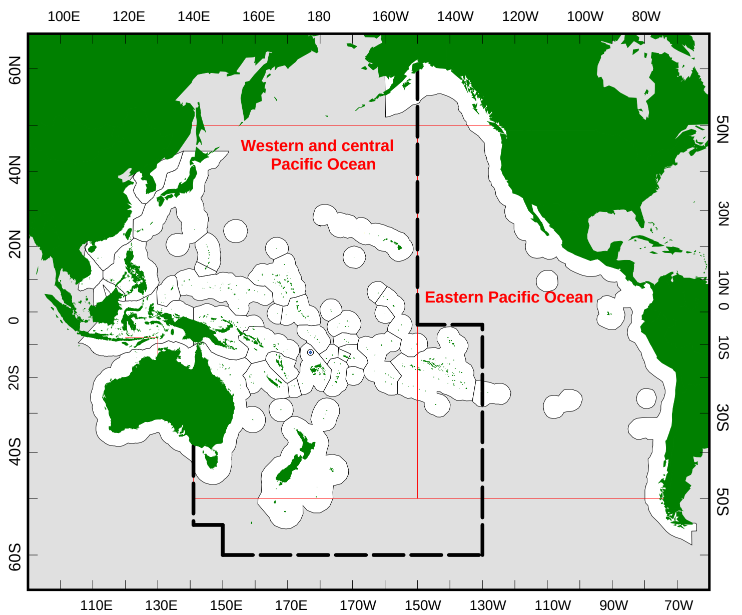

Figure 1. The western and central Pacific Ocean (WCPO), the eastern Pacific Ocean (EPO) and the WCPFC Convention Area (WCP–CA in dashed lines)

2. TOTAL TUNA CATCH FOR 2015

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 2012, 2013 and again in 2014 (Figure 2 and Figure 3).

The provisional total WCP–CA tuna catch for 2015 was estimated at **2,687,840 mt**, the third highest on record and nearly 200,000 mt below the previous record catch in 2014 (2,882,511 mt). During 2015, the purse seine fishery accounted for a catch of 1,766,070 mt (66% of the total catch), with pole-and-line taking an estimated 228,129 mt (8%), the longline fishery an estimated 243,547 mt (9%), and the remainder (17%) taken by troll gear and a variety of artisanal gears, mostly in eastern Indonesia and the Philippines. The WCP–CA tuna catch (2,687,840 mt) for 2015 represented 80% of the total Pacific Ocean catch of 3,379,789 mt, and 56% of the global tuna catch (the provisional estimate for 2015 is 4,799,697 mt, and when finalised is expected to be the second highest on record).

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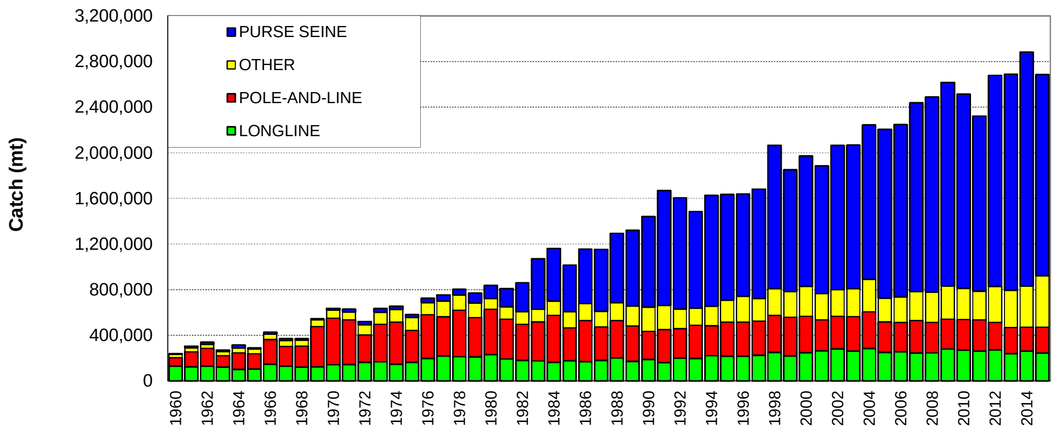


Figure 2. Catch (mt) of albacore, bigeye, skipjack and yellowfin in the WCP–CA, by longline, pole-and-line, purse seine and other gear types

The contribution to the **total estimated delivered value of the WCP-CA catch** of the different gears and species has changed dramatically over recent years, largely a consequence of the rise in importance of the purse seine fishery and changes in relative prices. Prior to 2007 the relative contribution of the purse seine fisheries fluctuated between 30%-45% and averaged 39%. Since 2007, however, the contribution of the purse seine fishery has grown significantly reaching a high of 61% in 2013 although lower at 55% and 49% in 2014 and 2015 respectively as a result of declines in the price of purse seine caught fish. The longline fishery values contribution, on the other hand, averaged 41% (higher than the purse seine) over the period prior 2007 despite the longline catch being only 13% of the total catch. In 2014, the value of the purse seine and longline fisheries represented 56% and 28% of the total WPC-CA catch value while for 2015 49% and 31% respectively (Figures

[1] includes catches of north and south Pacific albacore in the WCP–CA, which comprised 81% of the total Pacific Ocean albacore catch of 149,289 mt in 2015; the section 7.4 "Summary of Catch by Species - Albacore" is concerned only with catches of south Pacific albacore (68,694 mt in 2015), which made up approximately 46% of the Pacific albacore catch in 2015.

4a and 4b). Similarly, the value of skipjack has also risen significantly over time, prior to 2006 the value of the skipjack catch was around the range 30-40% of the total catch value whereas between 2012 and 2014 it represented between 50 and 58% but then dropped to 48% in 2015 owing to declines in both catch and price (Figures 5a and 5b).

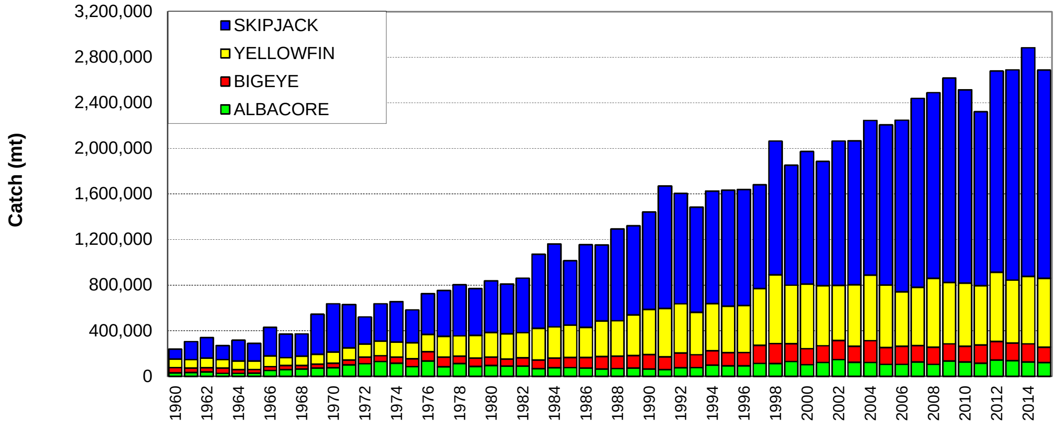
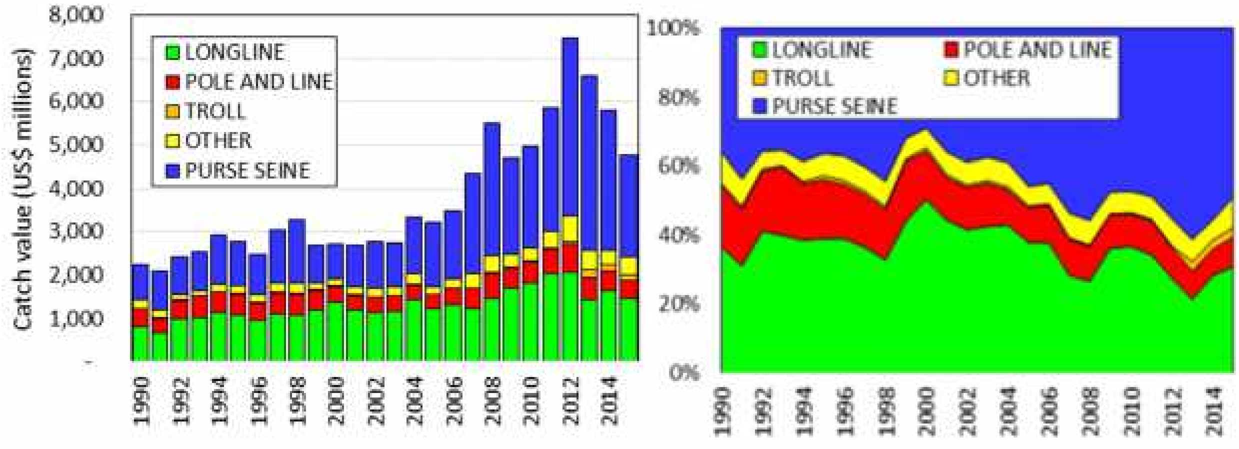
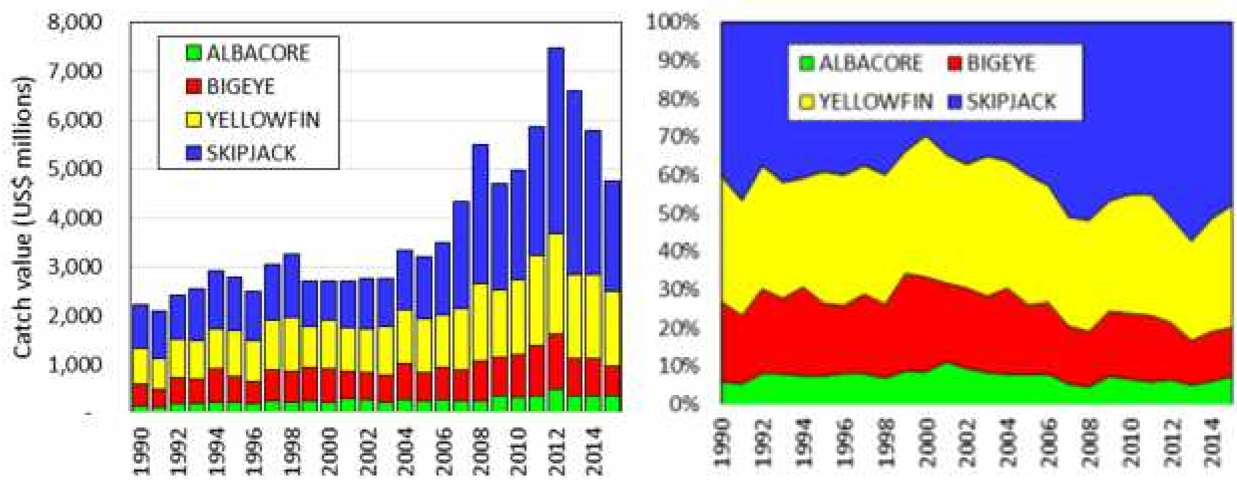


Figure 3. Catch (mt) of albacore, bigeye, skipjack and yellowfin in the WCP–CA.



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, 1990–2015.



Figures 5a and 5b: Catch value by species and Relative share of species type in the estimated delivered values of WCP-CA catch, 1990–2015.

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 (138 vessels in 2015[2]). The Pacific Islands fleets have gradually increased in numbers over the past two decades to a level of 105 vessels in 2015 (Figure). The remainder of the purse seine fishery includes several fleets which entered the WCPFC tropical fishery in the 2000s (e.g. China, Ecuador, El Salvador, New Zealand and Spain). The total number of purse seine vessels was relatively stable over the period 1990-2006 (in the range of around 180–220 vessels), but over the last seven years, the number of vessels has gradually increased, attaining a record level of 313 vessels[3] in 2014, with 308 vessels listed for 2015. Figure A14 in the APPENDIX provides more information on vessel numbers and capacity.

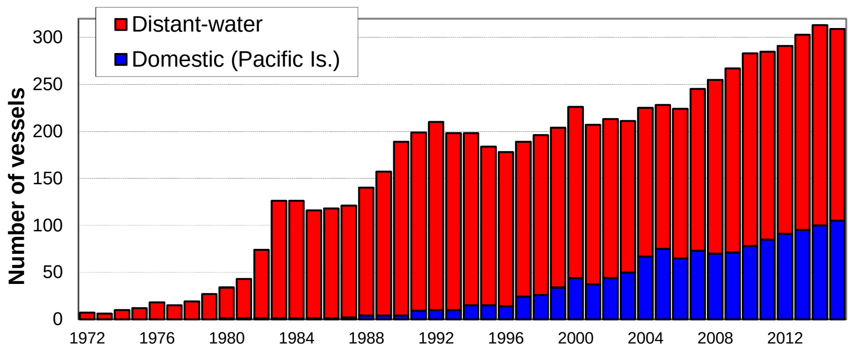


Figure 6. Number of purse seine vessels operating in the WCP–CA
(this does not include the Japanese Coastal purse seine fleet and the Indonesian, Philippine and Vietnamese domestic purse-seine/ringnet fleets which account for over 1,000 vessels)

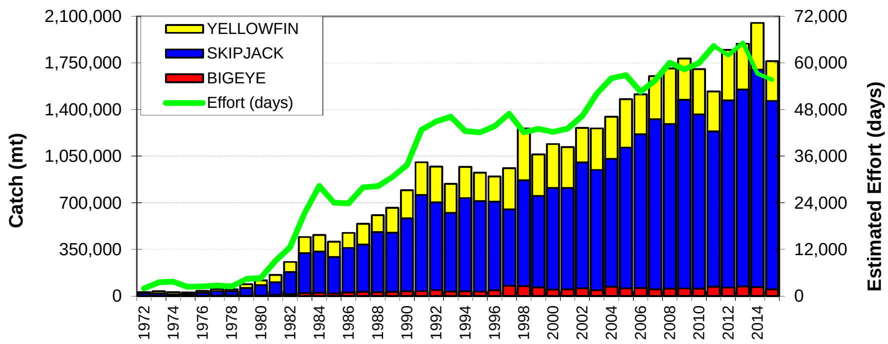


Figure 7. Purse seine catch (mt) of bigeye, skipjack and yellowfin and estimated fishing effort (days fishing and searching) in the WCP–CA

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;
- 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;

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[2] The number of vessels by fleet in 1992 was Japan (38), Korea (36), Chinese-Taipei (45) and USA (44) and in 2015 the number of active vessels by fleet was Japan (40), Korea (25), Chinese Taipei (34) and USA (39). In 2015, 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.

[3] The vessel numbers presented here are based on the annual provisions of data to the WCFPC from each CCM. There are a large number of ringnet and small purse seine vessels in the Indonesian, Japanese Coastal and Philippines domestic fisheries which are not included in this total.

- Increased bigeye tuna purse seine catch estimates, coinciding with the introduction of drifting FADs (since 1997). Significant bigeye catch years have been 1997 (77,105 mt), 1998 (73,778 mt), 2004 (70,174 mt), 2011 (70,120 mt) and 2013 (71,575 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), 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 and 2015). The total estimated purse seine effort and catch in 2015 was clearly lower than in recent years.

3.2 Provisional catch estimates, fleet size and effort (2015)

The provisional **2015 purse-seine catch of 1,766,070 mt** was the fifth highest catch on record and more than 280,000 mt lower than the record in 2014 (2,051,970 mt); the main reason for this decline in catch appears to be reduced effort more than any other factor. The 2015 purse-seine skipjack catch (1,416,453 mt; 80% of total catch) was about 210,000 mt lower than the record in 2014. The 2015 purse-seine catch estimate for yellowfin tuna (298,847 mt) contributed only 17% of the total catch, continuing the recent trend of a diminishing contribution in the overall catch and amongst the lowest for the past decade. The provisional catch estimate for bigeye tuna for 2015 (48,772 mt) was the lowest catch since 2007 and appears to be related to a combination of lower effort, and possibly environmental conditions which resulted in bigeye tuna being less available to the purse seine gear; more details are provided in Pilling et al. (2016).

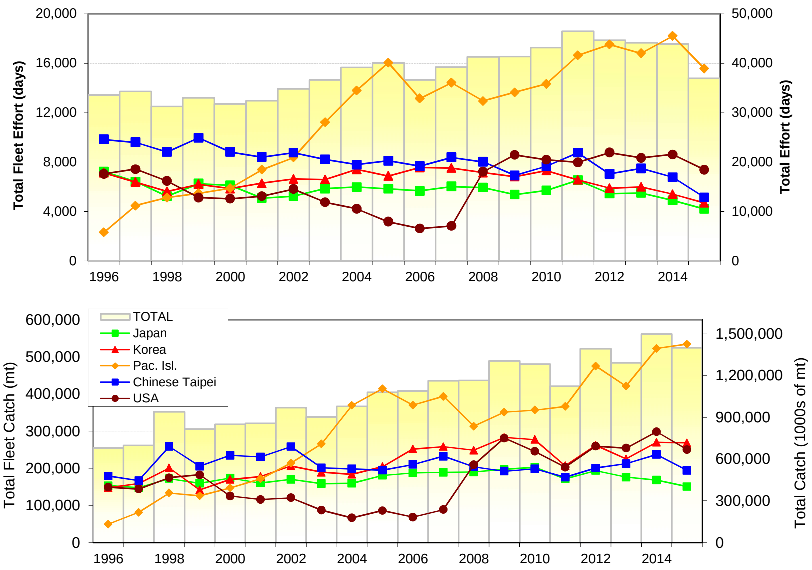

Figure 8. Trends in annual effort (top) and catch (bottom) estimates for the top five purse seine fleets operating in the tropical WCP–CA, 1996–2015.

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. 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 during 2015 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. 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 2014 and 2015. 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 2015 (105 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; 12 vessels), the Kiribati (21 vessels), Marshall Islands (12 vessels), PNG (Papua New Guinea; 51 vessels including their chartered vessels), Solomon Islands (5 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 between 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 three years have been reported in the SC10, SC11 and SC12 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 2014 and 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). Prior to 2009, the domestic fleets of Indonesia and Philippines accounted for about 13-16% of the WCP-CA total purse seine catch, although in recent years it has dropped to below 10% and in 2015, only 6%.

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 (72% of all sets for these fleets in 2015). The proportion of sets on drifting FADs in 2015 (21%) remains consistent with recent years (in the range of 21–24% since 2012). The number and proportion (4%) of sets on natural logs continues to decline 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 2015 = 40%: Figure 9–right) will be higher than the percentage of sets for drifting FADs (for 2015 = 21%: Figure 9–left). In contrast, the catch from unassociated schools in 2015 was 59% of the total catch, but taken from 72% of the total sets. The APPENDIX provides a more detailed breakdown of catch and effort by set type in 2009-2015 using available logsheet and observer data.

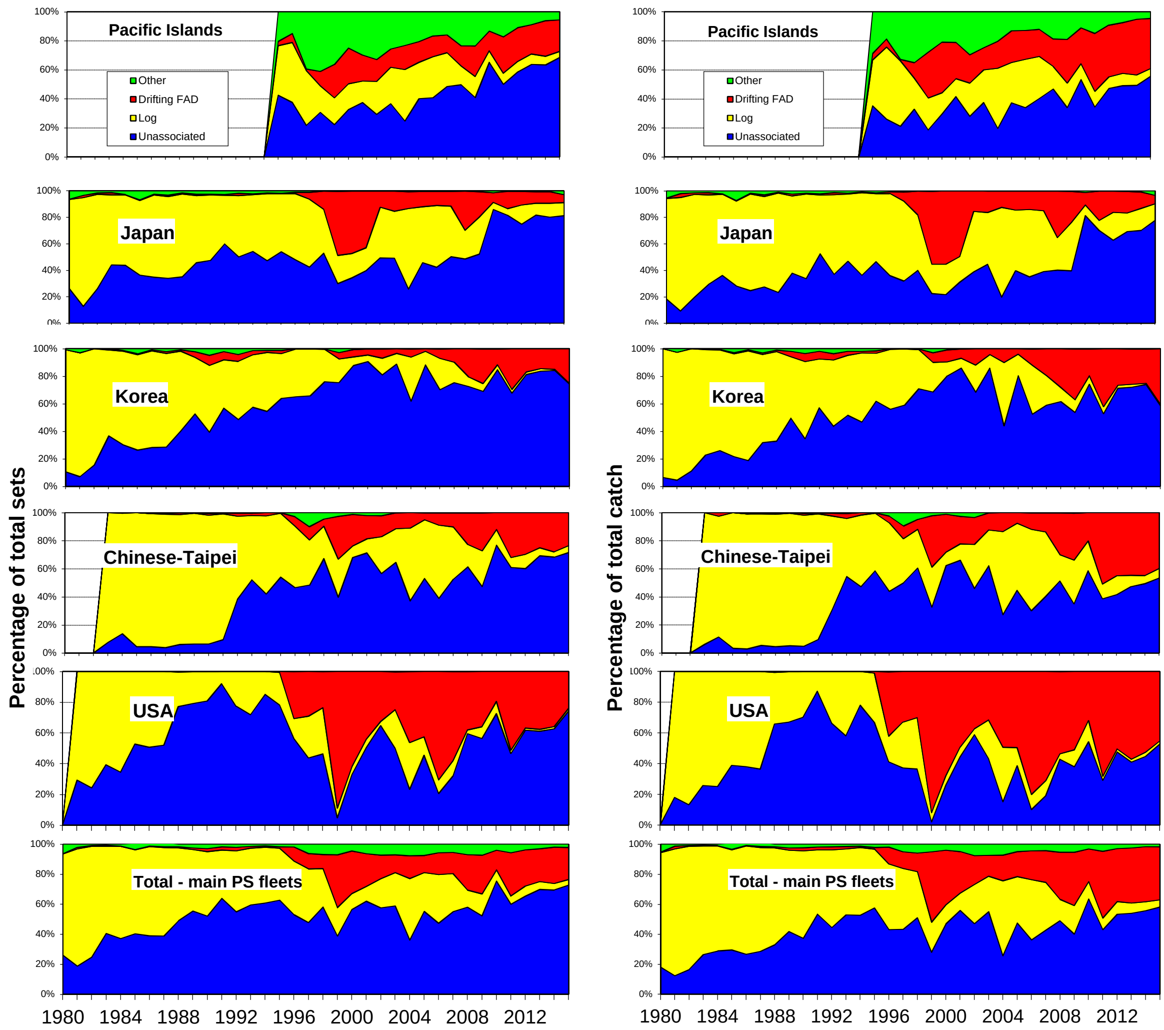

Figure 9. Time series showing the percentage of total sets (left) and total catch (right), by school type for the major purse-seine fleets operating in the WCP–CA.

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 was in a prolonged La Niña state in early 2009 and then transitioned to an El Niño period which then presided into the first quarter of 2010. Conditions in the WCP-CA then switched back 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 early 2016 and the forecasted weakening has begun with a move towards La Nina by the end of 2016 into 2017.

In line with the prevailing ENSO conditions, fishing activity during 2014 and 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). With the ENSO forecast for late 2016 predicting a weakening of El Nino conditions, there should be a switch back to more effort in the western tropical areas.

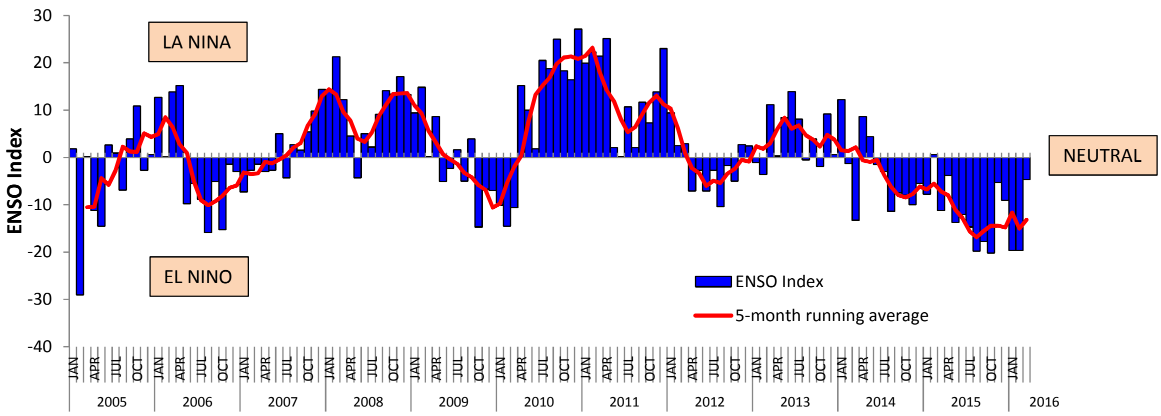

Figure 10. Trends in El Nino Southern Oscillation Index (ENSO), 2005-2016

3.4 Distribution of fishing effort and catch

Despite the FAD closure for certain periods in each year since 2010, drifting FAD set 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 2015. The relatively high proportion of unassociated sets in the eastern areas (e.g. Gilbert Islands) was a feature of the fishery in 2014 and 2015 (during El Nino conditions). The FAD closure periods (since 2010) have clearly contributed to an increase in unassociated sets, although in some years (e.g. 2014 and 2015), 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 2014 and 2015. The move to El Nino-like conditions in 2014 resulted in effort by most fleets extending eastwards into Nauru, Gilbert/Phoenix groups of Kiribati and Tuvalu waters from the previous year. The US fleet typically fishes in the more eastern areas and this was again the case during 2014/2015, 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 2014/2015 (Figures 13, 14 and 15) is in some way 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 2015, 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).

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 2012, 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 2015 (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 60). 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 distribution of catch by species and set type during 2014 and 2015 are similar but in contrast to 2013 (a La Nina year) which had a concentration of catch/effort in the western tropical areas (e.g. PNG, FSM and Solomon Islands). 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, and tends to be dominated by drifting FAD sets in the area to the east of 160°E (Figure 19). During 2015, unassociated sets appear to have accounted for a considerable proportion of the bigeye tuna catch in the area bounded by 160°–170°E, possibly due to environmental conditions related to the strong El Nino in that area (see Pilling et al., 2016).

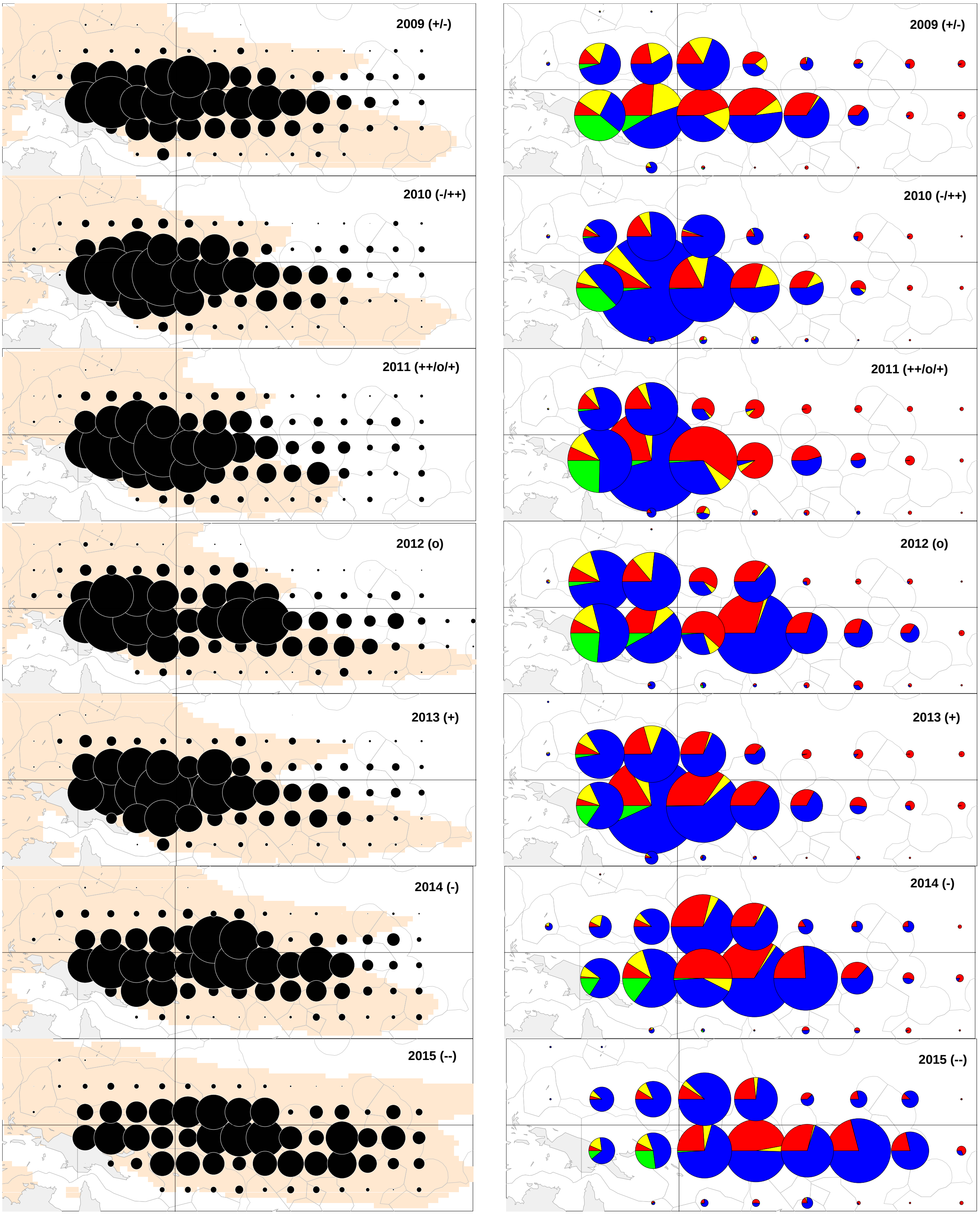

Figure 11. Distribution of purse-seine effort (days fishing – left; sets by set type – right), 2009–2015. (Blue–Unassociated; Yellow–Log; Red–Drifting FAD; Green–Anchored FAD).

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.

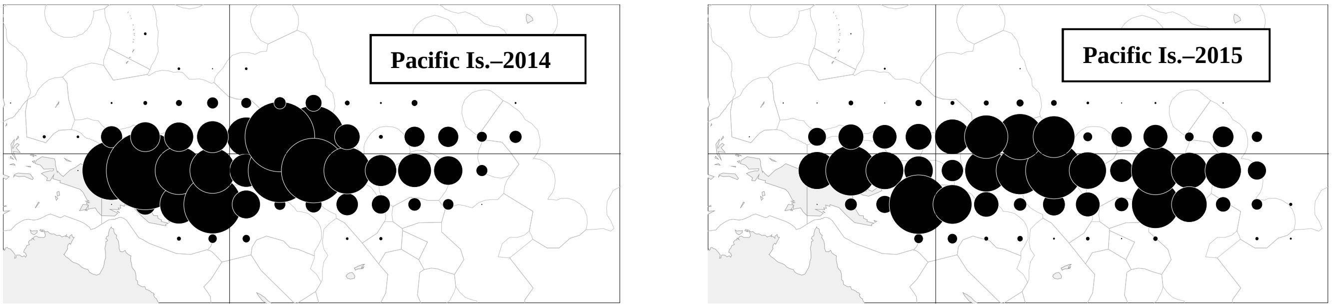

Figure 12. Distribution of effort by Pacific Islands fleets during 2014 and 2015
lines for the equator (0° latitude) and 160°E longitude included.

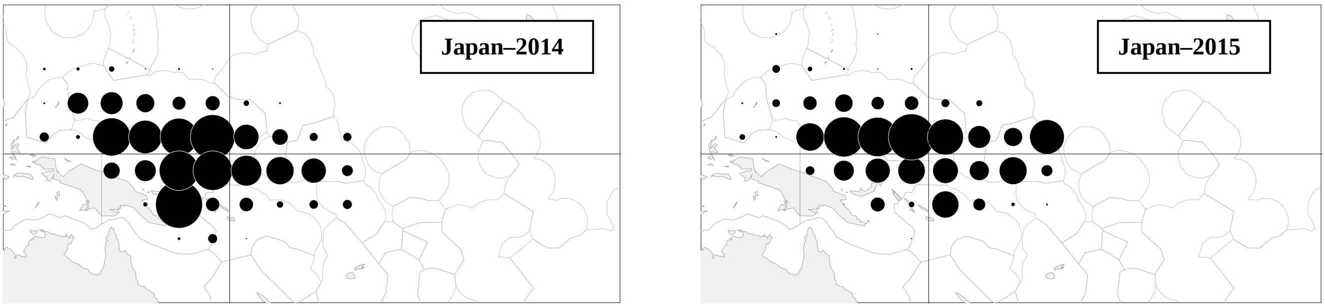

Figure 13. Distribution of effort by the Japanese purse seine fleet during 2014 and 2015
lines for the equator (0° latitude) and 160°E longitude included.

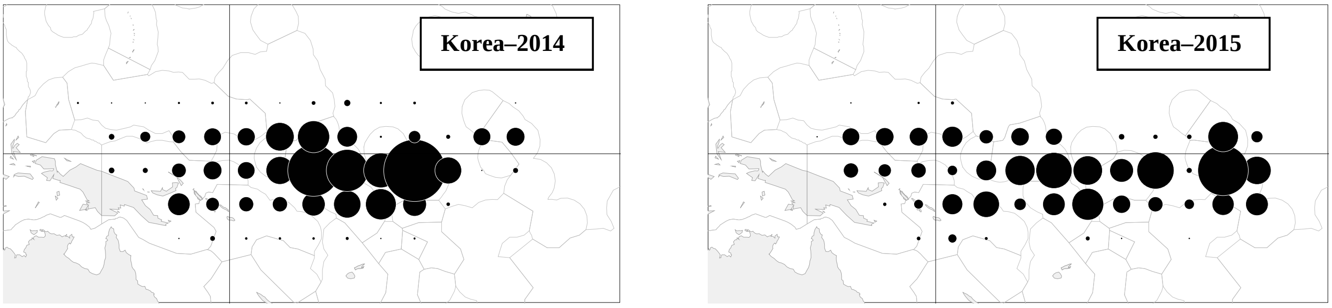

Figure 14. Distribution of effort by the Korean purse seine fleet during 2014 and 2015
lines for the equator (0° latitude) and 160°E longitude included.

Figure 15. Distribution of effort by the Chinese-Taipei purse seine fleet during 2014 and 2015
lines for the equator (0° latitude) and 160°E longitude included.

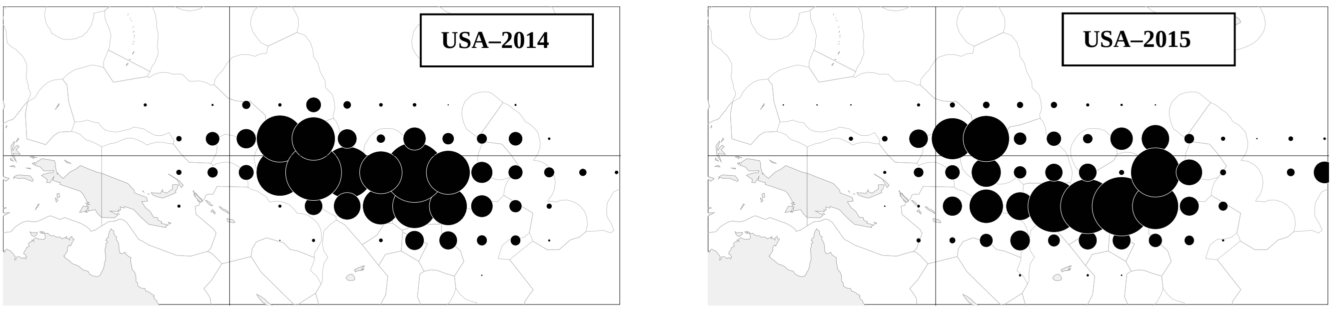

Figure 16. Distribution of effort by the US purse seine fleet during 2014 and 2015
lines for the equator (0° latitude) and 160°E longitude included.

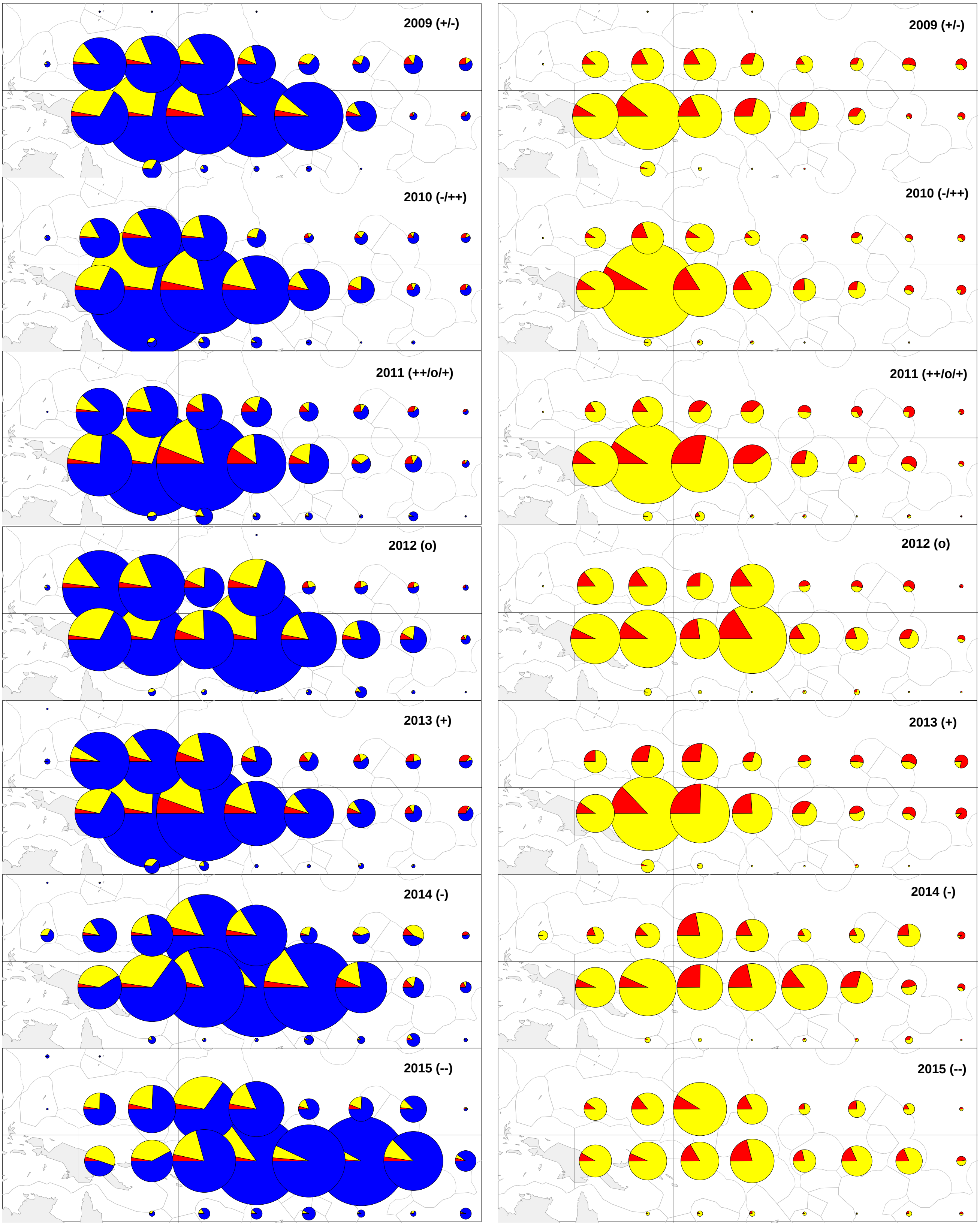

Figure 17. Distribution of purse-seine skipjack/yellowfin/bigeye tuna catch (left) and purse-seine yellowfin/bigeye tuna catch only (right), 2009–2015 (Blue–Skipjack; Yellow–Yellowfin; Red–Bigeye).
ENSO periods are denoted by "+": La Niña; "-": El Niño; "o": transitional period.

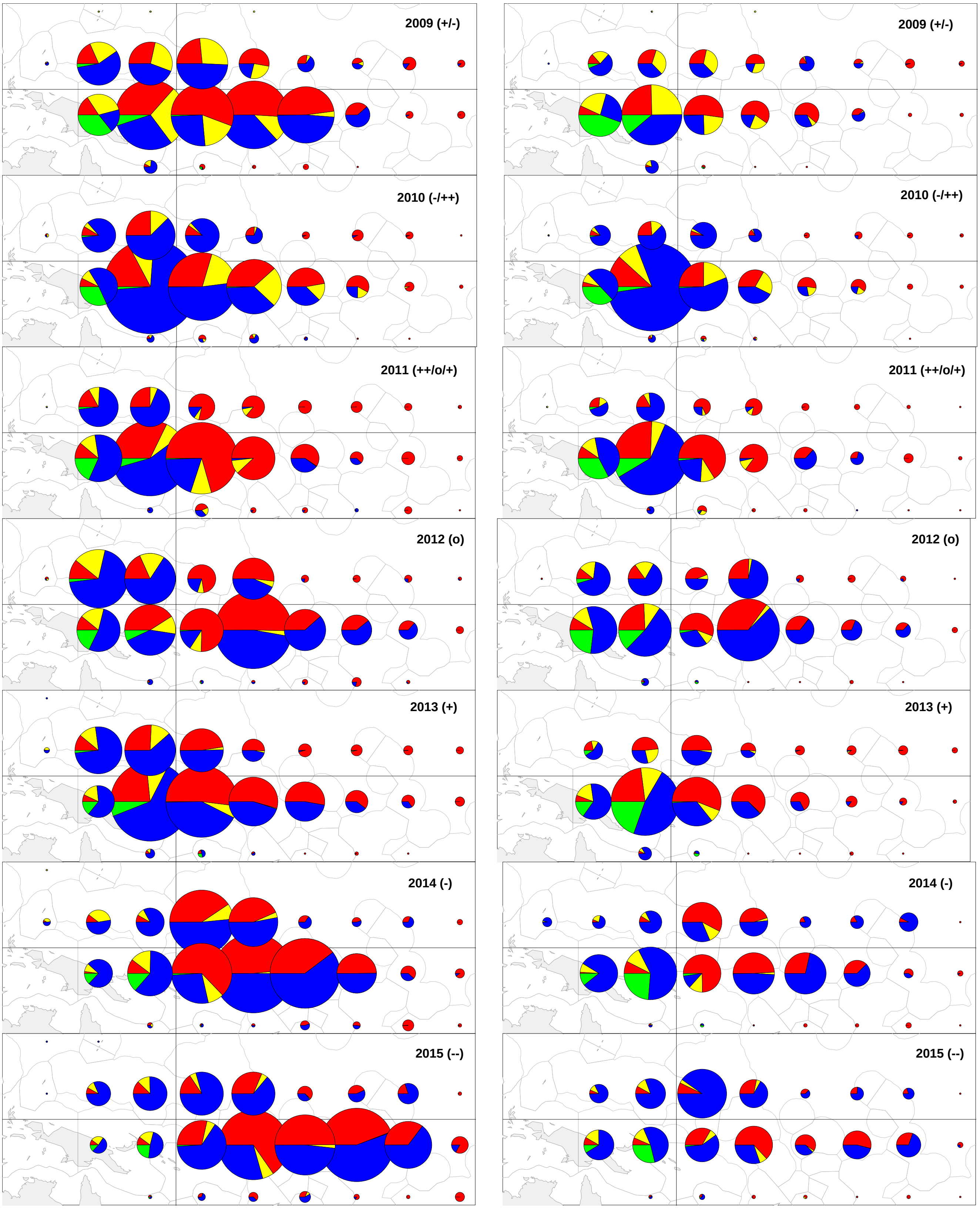

Figure 18. Distribution of skipjack (left) and yellowfin (right) tuna catch by set type, 2009–2015 (Blue–Unassociated; Yellow–Log; Red–Drifting FAD; Green–Anchored FAD).

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

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

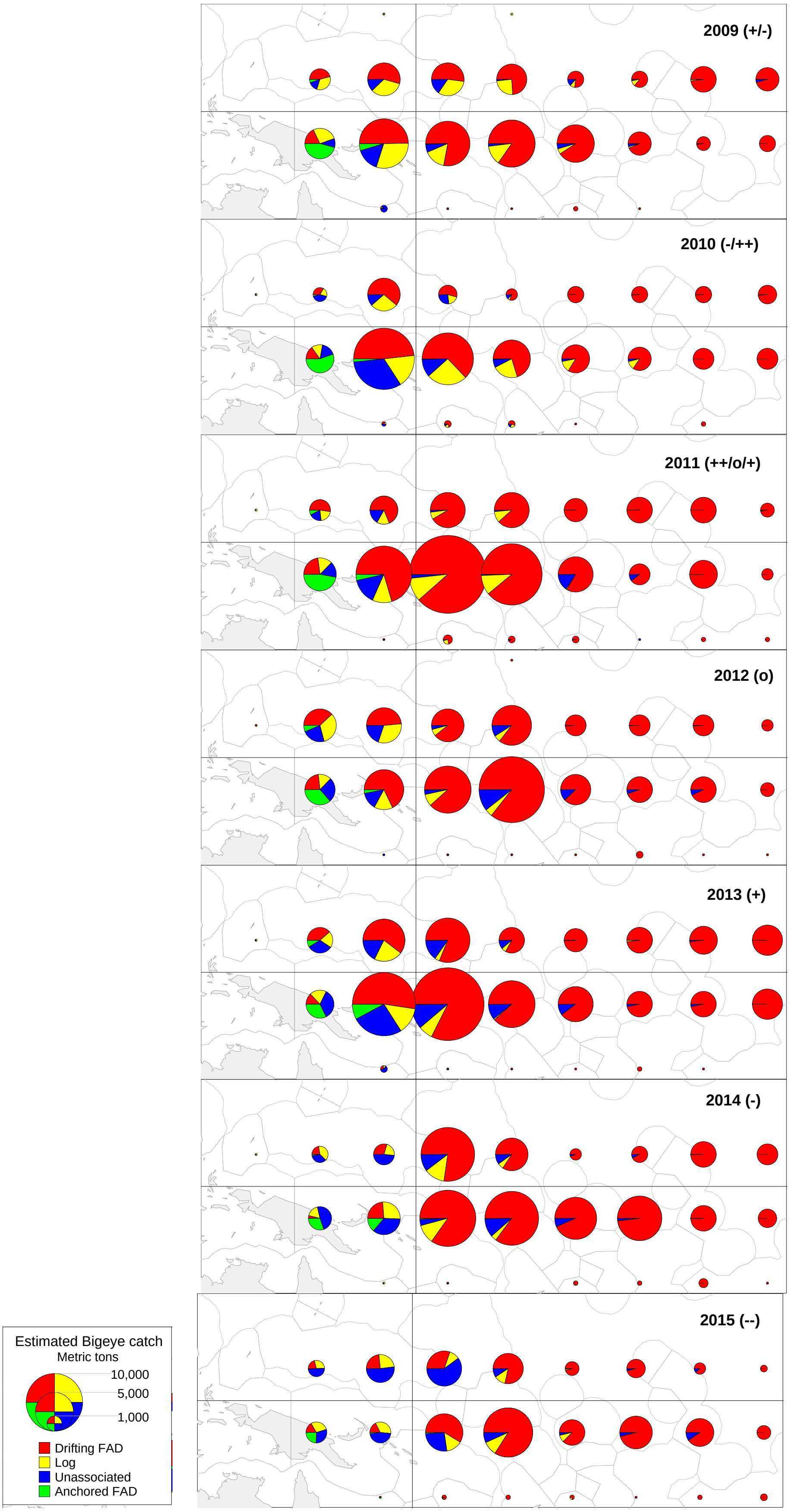

Figure 19. Distribution of estimated bigeye tuna catch by set type, 2009–2015 (Blue–Unassociated; Yellow–Log; Red–Drifting FAD; Green–Anchored FAD).
ENSO periods are denoted by "+": La Niña; "-": El Niño; "o": transitional period.

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 (see APPENDIX 1 in Tidd et al., 2015) 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 at record levels in 2015 (the Korean fleet in particular. The overall 2015 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 level of purse seine yellowfin CPUE for free-schools was generally maintained from 2014 into 2015, and was in part related to the prevailing El Nino conditions with large yellowfin more available to vessels fishing in the eastern tropical areas (see Figure 17–right). In contrast, the yellowfin catch rates on drifting FADs continued to decline for most fleets in 2015 (compared to 2013), but are still 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; the recent change in reporting behaviour (Tidd et al., 2015) would suggest the yellowfin CPUE trend is declining, if this was taken into consideration. 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.

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 2016), 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. In November 2013 (just after the FAD closure period of 2013), the total tuna CPUE rebounded strongly with high catch rates which were maintained through 2014 into 2015. The main reason for the strong rebound appears to be related to a strong skipjack recruitment pulse in the last quarter which provided better catches from drifting FAD sets. During the 2014 FAD-closure months (and unlike previous years), the relatively high total tuna CPUE was maintained which suggests free-swimming schools were more available; the FAD-closure months of 2015 did show some decline in tuna CPUE, but the CPUE returned to relatively high levels from November 2015 thereafter into 2016. It appears that the CPUE has now shifted to higher average level since late 2013.

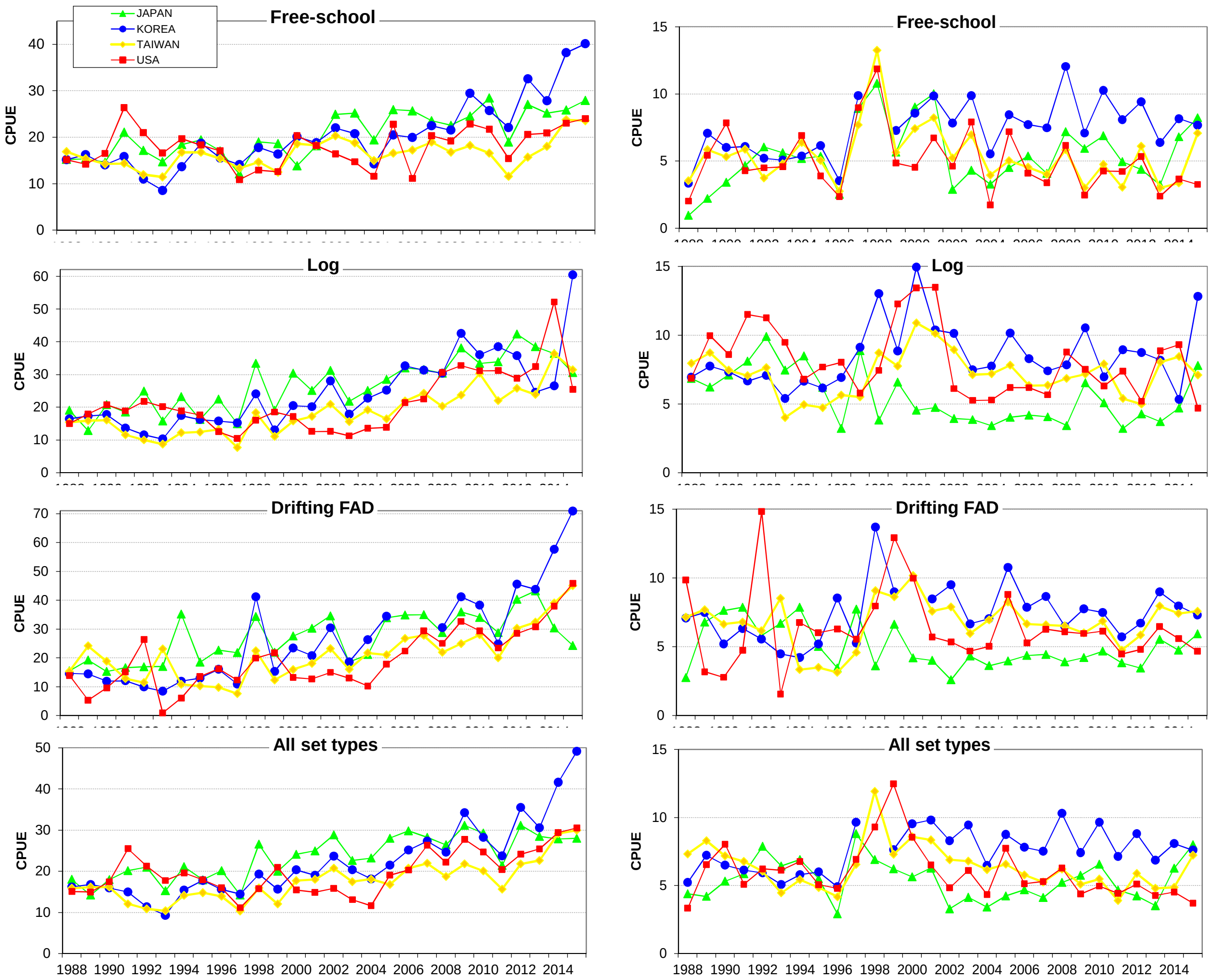

Figure 20. Skipjack tuna CPUE (mt per day–left) and yellowfin tuna CPUE (mt per day–right) by set-type, and all set types combined, for selected purse-seine fleets fishing in the tropical WCP–CA.
Effort and CPUE were partitioned by set type according to the proportions of total sets attributed to each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

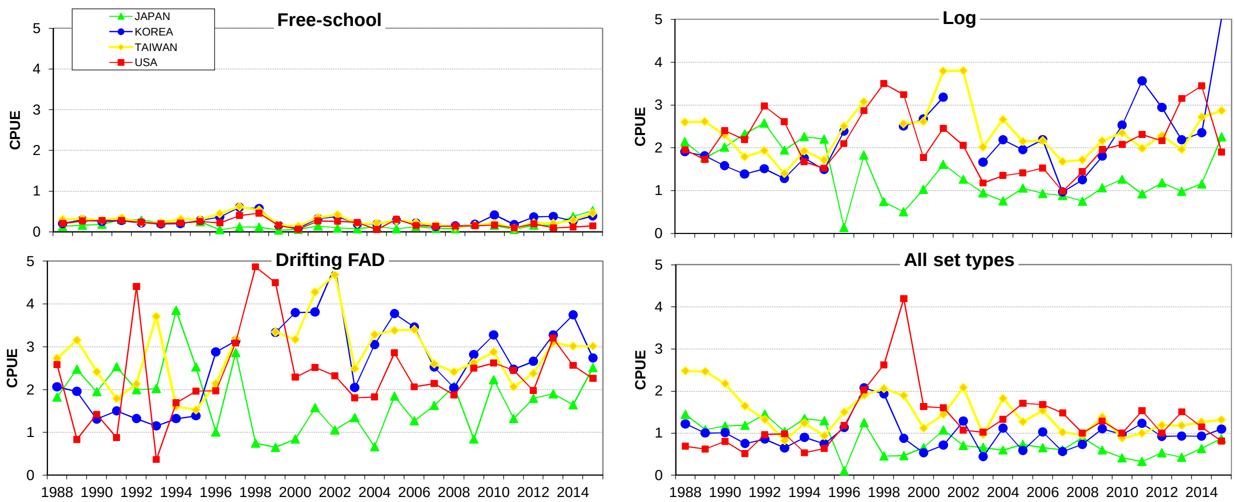

Figure 21. Estimated bigeye tuna CPUE (mt per day) by major set-type categories (free-school, log and drifting FAD sets) and all set types combined for Japanese, Korean, Chinese-Taipei and US purse seiners fishing in the tropical WCP–CA.
Effort and CPUE were partitioned by set type according to the proportions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

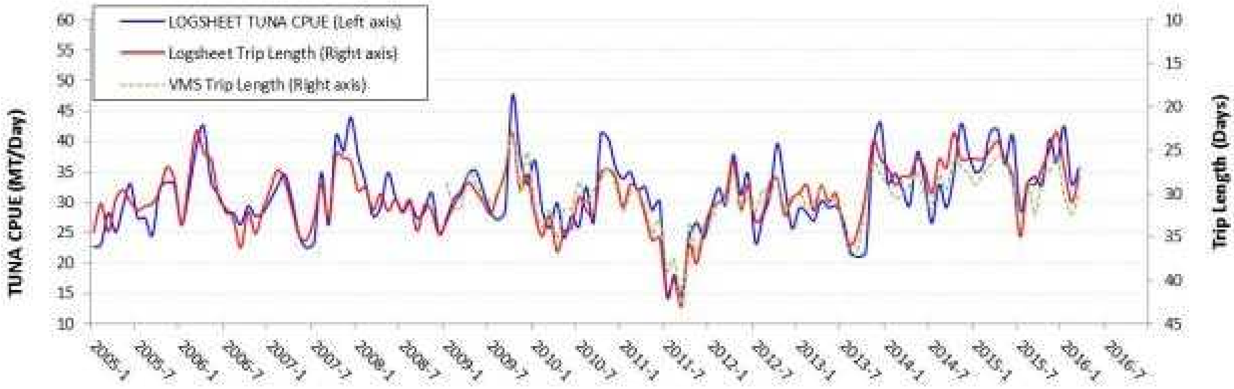

Figure 22. Monthly purse-seine tuna CPUE (mt/day) and average trip length (Logsheet days and VMS days, excluding port visits and transit), 2005–2015.

3.6 Seasonality

Figure 23 shows the seasonal average CPUE for skipjack (left) and yellowfin (right) in the purse seine fishery for the period 2000–2015, and Figure 24 shows the distribution of effort by quarter for the period 2000-2014 in comparison to effort by quarter in 2015. Over the period 2000–2014, 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 for 2000-2014, which was at its lowest during the first six months, but higher thereafter. This situation corresponds to the seasonal extension east 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 trend in monthly skipjack CPUE for 2015 was above most of the 2000-2014 monthly averages, reflecting very good conditions for skipjack catches in the fishery. In most of the previous years, there tended to be a drop in skipjack CPUE in the FAD-closure period but this only occurred for July 2015 as it quickly rebounded in August through to October; this trend suggests that, as in 2014, fleets experienced good catch rates from free-swimming schools in the absence of FAD fishing. The fishery experienced very high (record) monthly skipjack CPUE for the first six months of 2015 (Figure 23–left). In contrast, the monthly yellowfin CPUE for 2015 was mostly below the long-term monthly averages but with a very high level attained in July 2015, again in contrast to the skipjack CPUE level for this month (Figure 23 – right).

The El Nino-like conditions that developed during 2015 are evident with the more eastwards extension of the warm pool (i.e. surface water >28.5°C on average) for all quarters of 2015 when compared to the long-term average (2000-2014 – contrast the shading representing sea surface temperature in each quarter in Figure 24). By the 3rd and 4th quarters of 2015, the 'warm pool' had extended to the eastern boundary of the WCPFC tropical waters. The distribution of effort and catch in 2015 (Figure 24–right) was no doubt influenced by these conditions and resulted in most of the catch being taken in the eastern areas during ALL quarters. This situation is in contrast with the long-term average (Figure 24–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 2015 (when the FAD closure was in force) do not appear to be as constrained as in recent years for the same quarter, confirming good catch rates from free-swimming schools, although it is evident there were only small catches of bigeye tuna which is consistent with other years. Note the high proportion of yellowfin tuna in the 3rd quarter 2015 in the area 0°–5°N, 160°–165°W, which may coincide with the spike in yellowfin CPUE for July 2015, shown in Figure 23 (right).

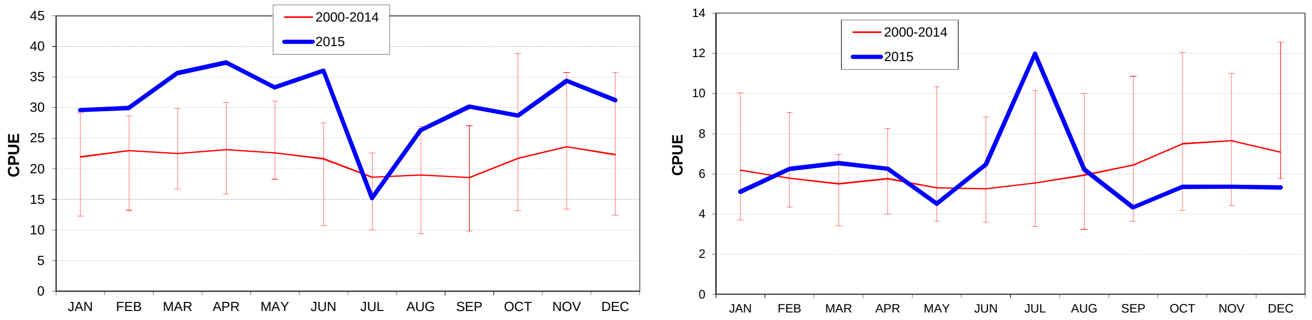

Figure 23. Average monthly skipjack (left) and yellowfin (right) tuna CPUE (mt per day) for purse seiners fishing in the tropical WCP–CA, 2000–2015.

Red line represents the period 2000–2014 and the blue line represents 2015.
The bars represent the range (i.e. minimum and maximum) of monthly values for the period 2000–2014.

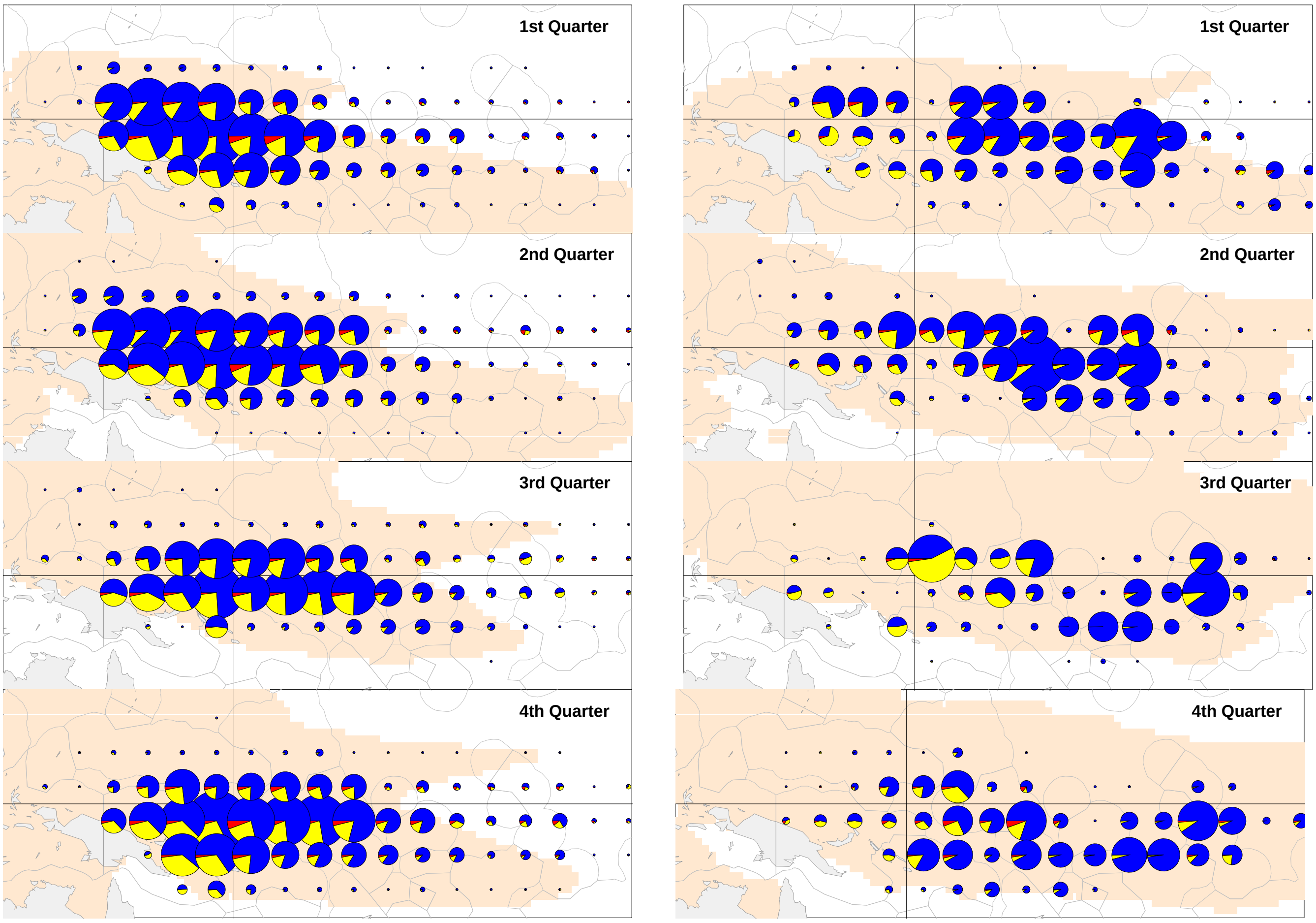

Figure 24. Quarterly distribution of purse-seine catch by species for 2000–2014 (left) and 2015 (right).

(Blue–Skipjack; Yellow–Yellowfin; Red–Bigeye)
Pink shading represents the extent of average sea surface temperature >28.5°C by quarter for the period 2000–2014 (left) and 2015 (right)

3.7 Prices, value and economic conditions

3.7.1 Prices

Skipjack

Prices in the major markets for WCPO skipjack during 2015 continued the 2014 decline, albeit at a slower rate, as a result of oversupply and lower demand at the end markets. Declines at major markets (for 4-7.5lbs) included 15% at Bangkok, 12% at General Santos, 6% at EU market and 25% at Ecuador. The average price for Thai imports declined 17% while the Yaizu Port price declined by 3% in USD terms (10% improvement in JPY terms however) and Japan selected ports average price declined only 1% (14% improvement in JPY terms).

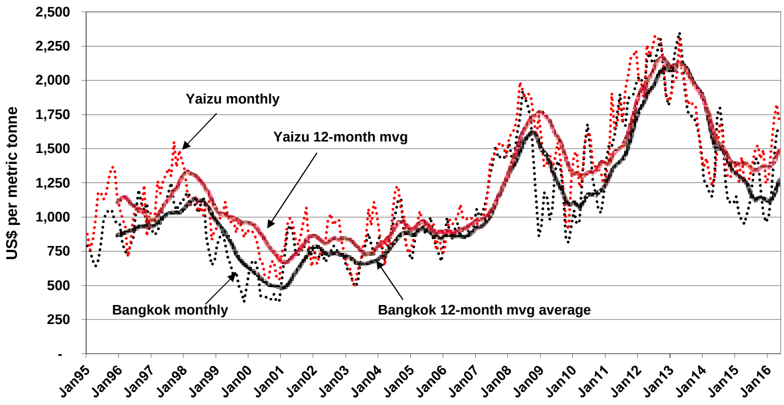

Figure 25. Skipjack prices, Bangkok (4-7.5lbs, c&f) and Yaizu (ex-vessel) monthly and 12 month moving average

The Bangkok benchmark skipjack price (4-7.5lbs) reduced from a peak of $2,350/Mt in April 2013 to a low of $1,500/Mt in December 2013 and continued to decline to the start of the second quarter of 2014 when prices bottomed out in April at $1,150/Mt, the lowest since December 2010. Over the months May to July 2014 there was a spike in prices that saw prices rise from $1,150/mt in April to $1,800/Mt in July (typical of the lead up to the FAD closure). Despite this, prices declined sharply over the following months to reach $1,100 in December and further to a new low of only $950/Mt by April 2015. Another spike in prices occurred over the period May to September 2015 with prices recovering to $1450/Mt but then declining and by December they had reached another low of $950/mt. Since this time the Bangkok market has risen sharply with skipjack prices (4-7.5lbs c&f) in May reportedly around $1,650/Mt or 74% higher than the low in December and higher (61%) against the same month in 2015. This has been in response to uncertainties about supplies as fleets, faced with uncertainty on market direction and poor fishing conditions together with the non-activity of US Treaty vessels earlier in the year, sections of other fleets operating in the WCPO, including Taiwan and South Korea fleet, also stopped fishing for periods of time. However, the recent resumption of fleet operations and improved fishing conditions has resulted in prices dropping 15% to $1,400/mt by first week of July.

Movements in Thai frozen skipjack imports show there has been a decline of 8% by February 2016 from year end 2015 prices but a strong uptrend of 37% to May has since followed. At Yaizu prices in June (USD terms) were 7% down from February peak, General Santos early July prices still up 10% on April and Europe in early July 6% down on April.

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, the price level around which these variations occur appear to be driven by global food prices trends which annual skipjack prices tracking the FAO food price index as shown in Figure 26.

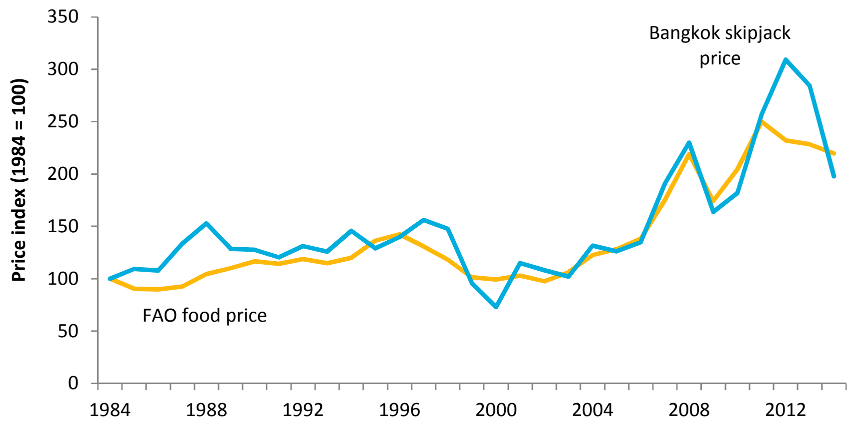

Figure 26. Annual FAO food price index and Bangkok skipjack price index

Yellowfin

Yellowfin prices on canning markets continued to decline in 2015, albeit at a slower rates than seen in 2014: the Bangkok market price (20lbs+, c&f) was down 14% (-20% in 2014), Thai import prices declined 14% (-21%), Yaizu prices in US$/Mt down 13% (-2%) and General Santos (20lbs+, fob) down 10% (-30%).

Bangkok yellowfin prices averaged $1,369/mt in 2015 compared to $1,526/Mt in 2014. Over the first six months of 2016, Bangkok prices fluctuated from a low of $1175 in December 2015 to a peak of $1,900/mt in May but dropped to $1,675/mt by June. In comparison, Thai frozen yellowfin import prices in 2015 averaged $1,568/mt against $1,822/mt in 2014. Over the first five months of 2016, prices also fluctuated, falling to a low of $1425 in March from $1,537/mt in December 2015 then increasing significantly to $1,737/mt by March and remaining relatively steady through to May.

The Bangkok yellowfin price trends were broadly reflected in other markets with the Japan Yaizu prices declining in 2015 by 13% to $2,076/Mt (in JPY terms prices remained steady). Over the first five months of 2016, however, Yaizu prices at $2,424/Mt were steady against the previous five-month period but 13% higher compared to the same period the previous year. An estimated 20%-25% of the Japanese purse seine yellowfin catch is sold as low grade sashimi product and this is factored into the price variations.

Similarly, at General Santos market, yellowfin prices (20lbs+, fob) averaged $1,934/Mt, a 10% drop from $2,149/Mt in 2014. There was a downtrend during the first half of 2015; prices reduced from $2,225/Mt in January to $1,800 in July. Prices rose to $2,000/Mt over the next three months before retreating to a low of $1,750/Mt in December.

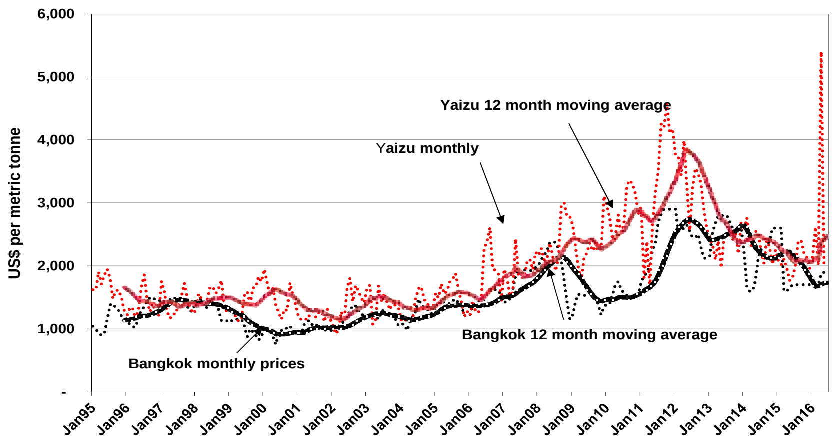

Figure 27. Yellowfin prices, Bangkok (20lbs and up, c&f) and Yaizu (ex-vessel) monthly and 12 month moving average

Over the first half of 2016, prices firmed to average $1,972/Mt having improved from $1,775/Mt in January to $2,050/Mt by mid-June. At this level prices are moderately higher, up 5%, compared to the second half of 2015 but comparable to the average price in the same period in 2015.

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 2015 were obtained (Figure 28). 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.[4]

The estimated delivered value of the purse seine tuna catch in the WCP-CA area for 2015 is $2,331 million compared with $3,225 million in 2014. This represents a decrease of $894 million (28%) from 2014. This decrease resulted from the $659 million (27%) decrease in the delivered value of the skipjack catch (worth $1,765 million in 2015) as well as the decline of $196 million (28%) in the value of the yellowfin catch. The decline in the delivered value of skipjack resulted from a 16% decline in the skipjack composite price and a 13% decrease in catch. Similarly, the decline in the delivered value for yellowfin was caused by declines in price and catch, 16% and 15% respectively[5].

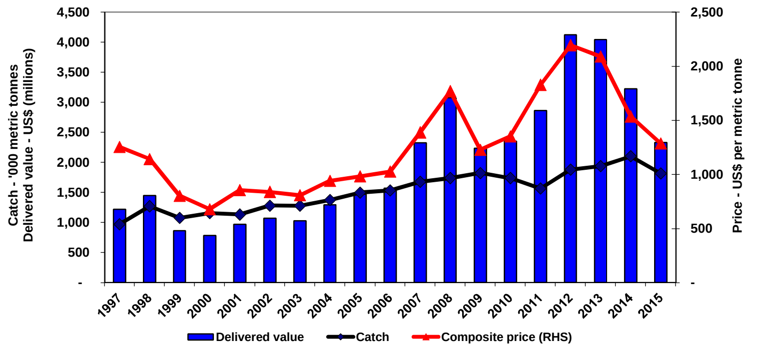

Figure 28. All tuna in the WCPFC purse seine fishery – Catch, delivered value of catch and composite price

3.7.3 Economic Conditions

The FFA purse seine fishery economic conditions index,[6] 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. Prices continued to decline in 2015, however, falls in fuel costs and increases in catch rates, saw an improvement in economic conditions in 2015 compared with 2014 and the index indicates that overall conditions were significantly above the long term average.

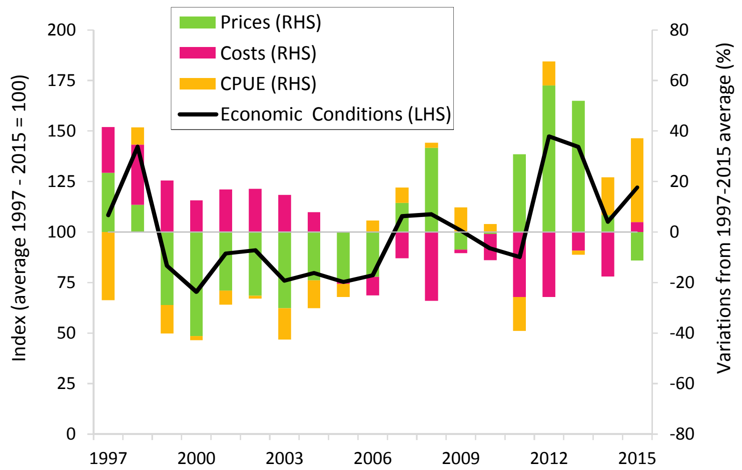

Figure 29. Economic conditions index for the purse seine fishery (LHS) and variance of component indices against average (1997-2015) conditions (RHS)

[4] 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.

[5] 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).

[6] 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).

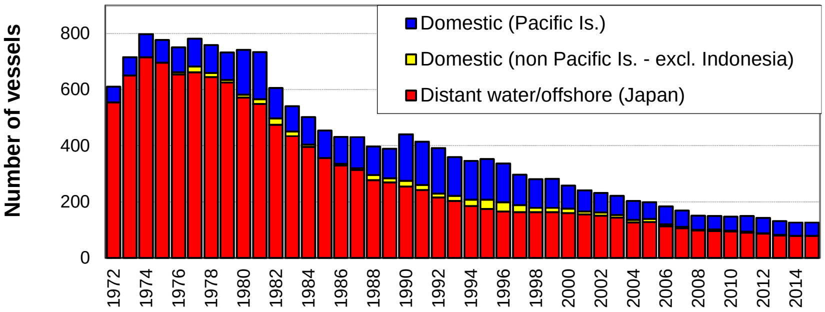

Figure 30. Pole-and-line vessels operating in the WCP–CA
(excludes pole-and-line vessels from the Japanese Coastal and Indonesian domestic fisheries)

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 30) and in the annual pole-and-line catch during the past 15–20 years (Figure 31). 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 2015), 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 (2015)

The provisional 2015 pole-and-line catch (228,129 mt) was a slight increase on the 2014 catch but remains amongst the lowest annual catch since the late-1960s.

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 (110,433 mt in 2015), and the Indonesian fleets (116,179 mt in 2015), account for nearly all of the WCP–CA pole-and-line catch (99% in 2015). The catches by the Japanese distant-water and offshore fleets in recent years have been the lowest for several decades and this is no doubt related to the continued reduction in vessel numbers (in 2015 reduced to only 79 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 (910 mt in 2015).

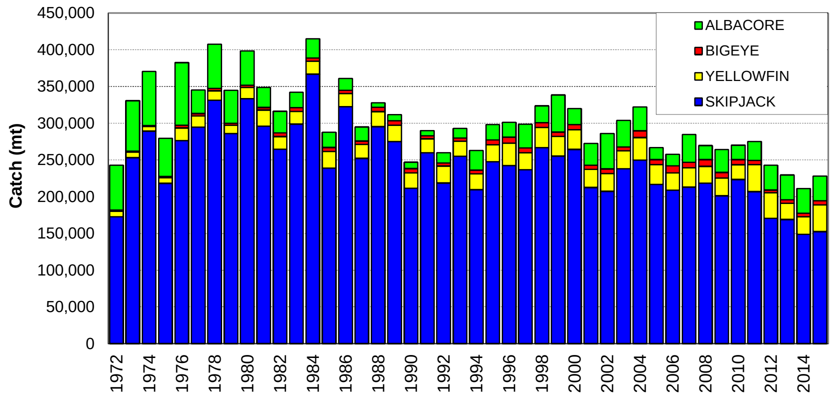

Figure 31. Pole-and-line catch in the WCP–CA

Figure 32 shows the average distribution of pole-and-line effort for the period 1995–2015. 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.

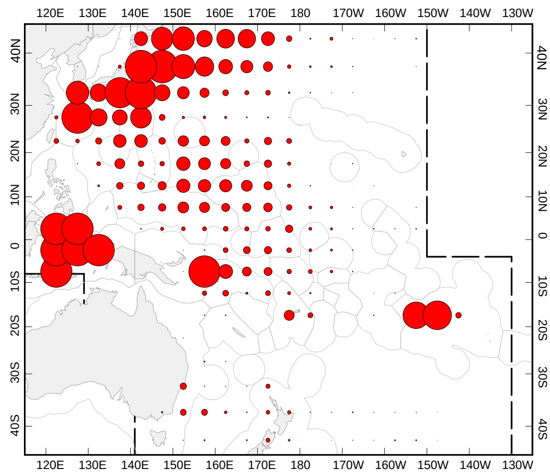

Figure 32. Average distribution of WCP–CA pole-and-line effort (1995–2015).

4.3 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 2015 averaged $2,054/Mt compared with $2,356/Mt in 2014, a decline of 13%. The price of catch in waters off Japan averaged $1,943/Mt (JPY235/Kg), a dramatic decline from $3,056/Mt (¥323/kg) in 2014. The price of skipjack caught in waters south of Japan also decreased, by 5% to $2,141/Mt (JPY259/Kg) from $2,243/Mt (+2% to ¥237).

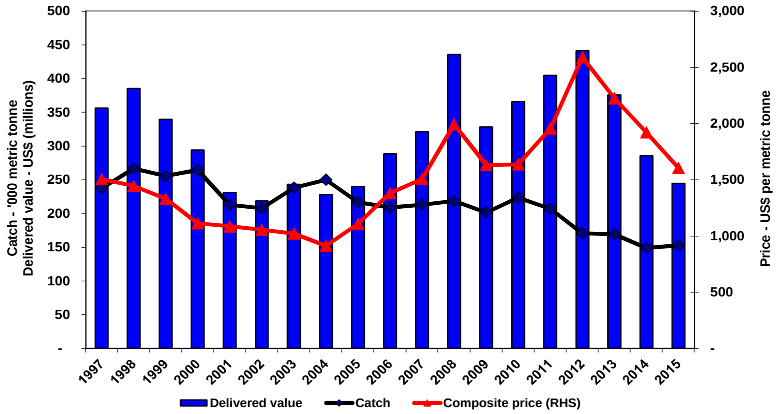

Figure 33. Skipjack in the WCPFC pole and line fishery – Catch, delivered value of catch and composite price

Over the first half of 2016 Yaizu pole and line prices have improved. The overall average at $2,285/mt is 16% higher than the previous six month period prices and 9% higher than the comparable period last year.

4.3.2 Value

As a means of examining the effect of the changes in price and catch levels over the period 1997-2015, an estimate of the annual delivered value of the tuna catch in the pole and line fishery in the WCP-CA is provided in Figures 33 and 34. The estimated delivered value of the total catch in the WCPFC pole and line fishery for 2015 is $405 million.[7] This is a decrease of $52 million (11%) on 2014 caused by the 12% decline in catch that more than offset the 1% rise in catch.

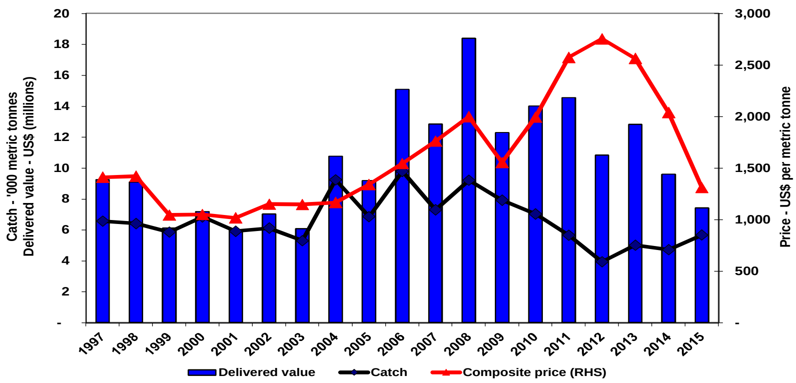

Figure 34. All tuna in the WCPFC pole and line fishery – Catch, delivered value of catch and composite price

The estimated delivered value of the skipjack catch for 2015 is $260 million. This represents a decline of 14% ($43 million) compared to 2014 and results from the decrease of 17% in price that more than offset the 3% increase in catch. The estimated delivered value for albacore comes to $101 million, a 5% ($5 million) increase on the value in 2014 and reflected the increase of 5% in price against stable catches.

7 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, 2015), 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 35), 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.

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.

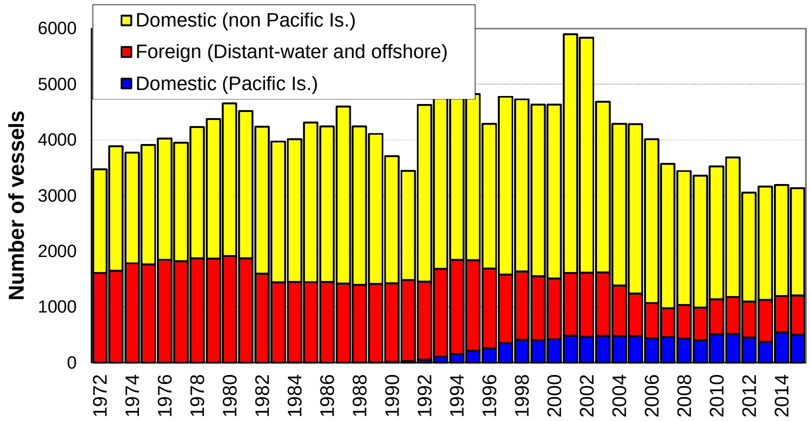

Figure 35. Longline vessels operating in the WCP–CA
(Available data does not make the distinction between foreign "distant-water" and "offshore")

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, Samoa, Solomon Islands, Tonga 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. The Portuguese fleet (one vessel) started fishing in 2011.
- **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.
- **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 35). 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 36). 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–33%; BET–26%; YFT–40% in 2015) differs from the period of the late 1970s and early 1980s, when yellowfin tuna were the main target species (e.g. ALB–18%; BET–27%; YFT–54% in 1980).

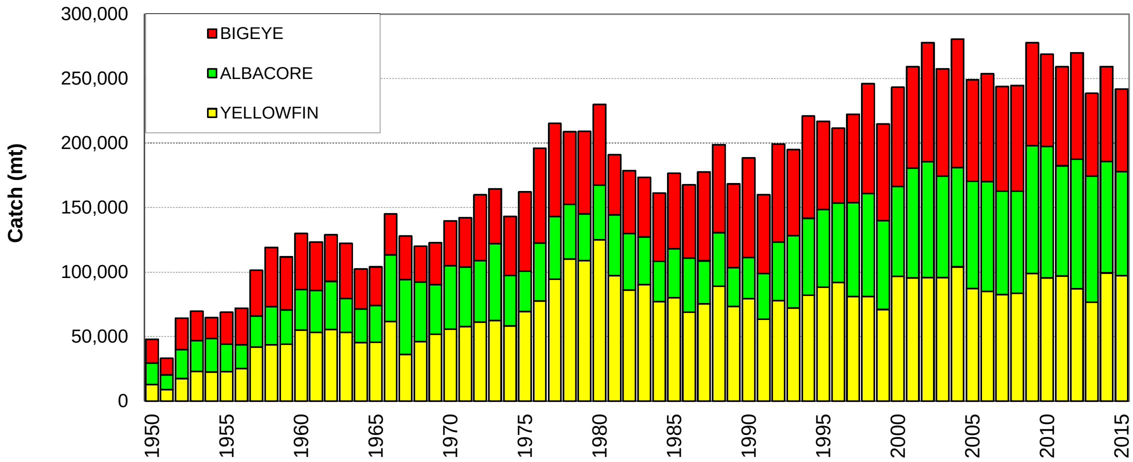

Figure 36. Longline catch (mt) of target tunas in the WCP–CA

5.2 Provisional catch estimates and fleet sizes (2015)

The provisional WCP–CA longline catch (243,547 mt) for 2015 was lower than the average for the past five years. The WCP–CA albacore longline catch (80,596 mt – 33%) for 2015 was the lowest for three years, 21,000 mt. lower that the record of 101,816 mt attained in 2010. The provisional bigeye catch (63,986 mt – 26%) for 2015 was the lowest since 1996, mainly due to continued reduction in effort in the main bigeye tuna fishery (refer to Pilling et al., 2016 for more detail). The yellowfin catch for 2015 (97,289 mt – 40%) was amongst the highest over the past decade ten 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 6,259 mt in 2015) and vessel numbers (366 in 2004 to 109 in 2015). The Chinese-Taipei distant-water longline fleet bigeye catch declined from 16,888 mt in 2004 to 3,550 mt (in 2015), mainly related to a substantial drop in vessel numbers (137 vessels in 2004 reduced to 75 vessels in 2015). The Korean distant-water longline fleet also experienced declines in bigeye and yellowfin catches over the past decade in line with a reduction in vessel numbers – from 184 vessels active in 2002 reduced to 108 vessels in 2008, back to 126 vessels in 2012, but down to 84 vessels in 2015.

With domestic fleet sizes continuing to increase as foreign-offshore and distant-water fleets decrease (Figure 35), 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–SC12 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.

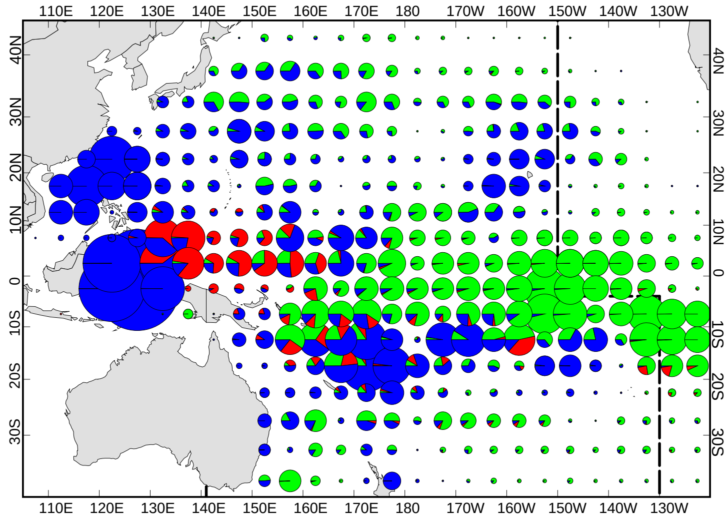

Figure 37. Distribution of longline effort for distant-water fleets (green), foreign-offshore fleets (red) and domestic fleets (blue) for the period 2000–2015.

(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

Figure 37 shows the distribution of effort by category of fleet for the period 2000–2015. 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.

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** 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 38).

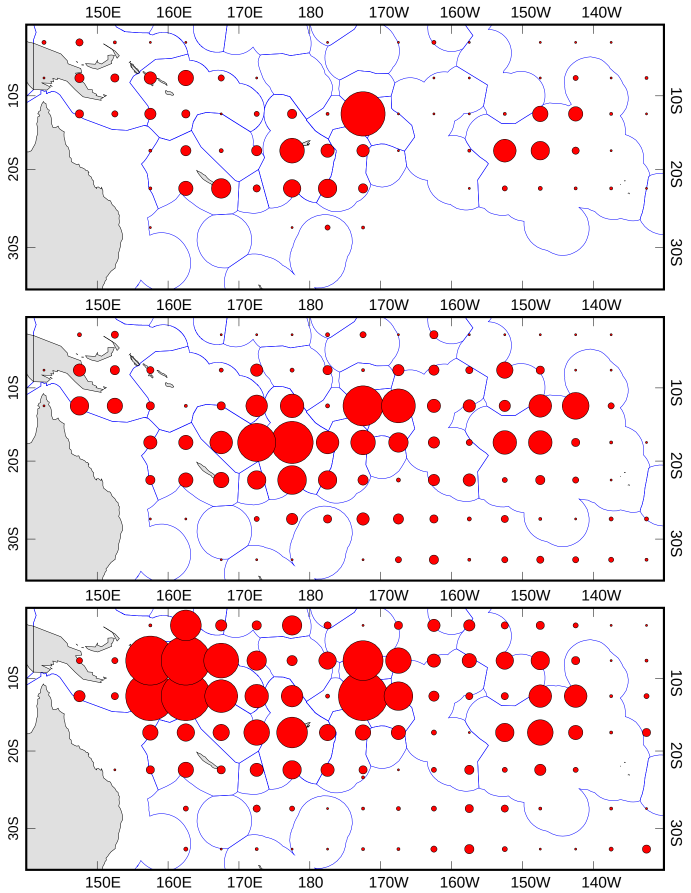

Figure 38. Distribution of south Pacific-island fleet longline effort for 1999 (top), 2004 (middle) and 2015 (bottom). Note that 2015 includes estimated effort for charter vessels assigned according to the WCPFC CMM on charter notification.

Figure 39 shows quarterly species composition by area for the period 2000–2014 and 2015. 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 2000-2014 quarterly averages (Figure 39–left) with the 2015 catches (Figure 39–right). The 2015 data are considered preliminary for some fleets, but nonetheless provide some insights into the fishery, for example, the apparent decline in the catches of south Pacific Albacore in the west, and a clear increase in the yellowfin tuna catches in the area 0°-10°S/160–170°E in the 2nd thru 4th quarters of 2015, possibly due to the prevailing El Nino conditions.

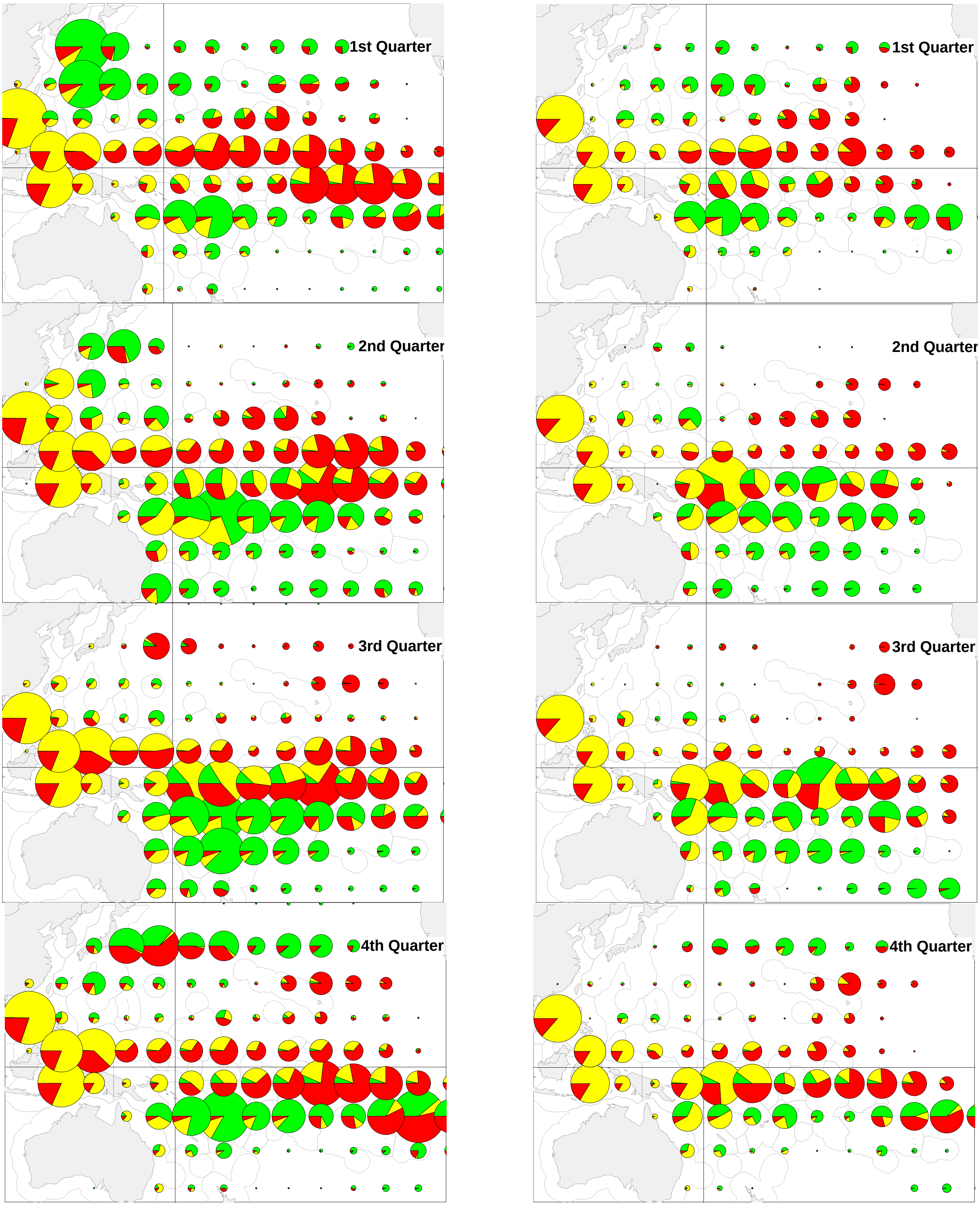

Figure 39. Quarterly distribution of longline tuna catch by species, 2000-2014 (left) and 2015 (right)
(Yellow–yellowfin; Red–bigeye; Green–albacore)
(Note that catches from some distant-water fleets targeting albacore in the North Pacific may not be fully covered)

5.5 Prices, value and economic conditions

5.5.1 Prices

Yellowfin

Japan fresh yellowfin import prices (c.i.f., USD) in 2015, from all sources, dropped 11% (+2% in JPY terms) while Yaizu port fresh & frozen prices (ex-vessel) dropped by 18% (-6%) reversing the previous year's moderate 4% rise against the then tight supply conditions as well as the substantial weakening of the Yen. US import prices (f.a.s.) in 2015 marginally declined (2%) relative to 2014.

The average price in 2015 for the Japan fresh yellowfin prices from all sources averaged $8.44/Kg, lower by 11% compared to 2014 average price. Over the first four months of 2016, however, the overall import price improved moderately by 5% to $8.87/Kg compared to the whole of 2015 although only up 3% compared to same period in 2015.

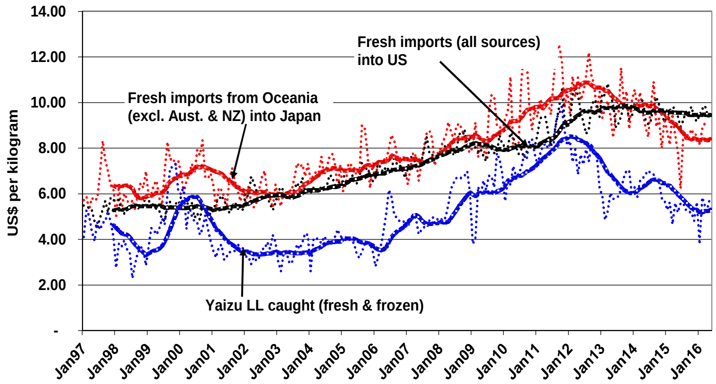

Figure 40. Yellowfin prices in US dollars: US fresh imports (f.a.s.), Japanese fresh imports from Oceania (c.i.f.) and Yaizu longline caught (ex-vessel)

The Yaizu port 2015 longline caught yellowfin fresh/frozen prices (ex-vessel) decreased by 18% to $5.31/Kg. Over the first five months of 2016, however, the prices have increased moderately over the second and first halves of 2015, by 4% and 2% respectively.

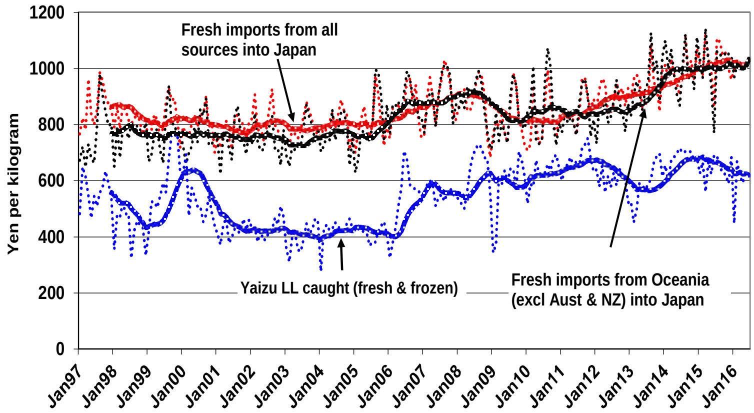

Figure 41. Yellowfin prices on Japanese markets; fresh imports from all sources (c.i.f.), fresh imports from Oceania (c.i.f.) and Yaizu longline caught (ex-vessel)

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 in 2015. The contrast in these trends is driven by exchange rate movements (Figures 40 and 41).

Broadly, there has been overall downtrend in demand in Japan for yellowfin (and bigeye) as reflected in Japan annual import trends; fresh yellowfin imports have steadily declined over the years but in 2015 at just under 5,200mt, the lowest on record, represents a decline of 35% on last year's and 86% from a high of 36,500mt in 2001.

The US fresh yellowfin import prices from all sources averaged $9.45 (f.a.s.) in 2015, marginally down on the levels in the previous three years but 17% up on 2010. Over the first four months of 2016, prices have shown continuing stability at less than 1% higher than the comparable months of 2015. 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.

Bigeye

Japan fresh bigeye import prices (c.i.f., USD) in 2015, from all sources, declined during 2015 by 8% in USD terms (up 5% in JPY terms) while Japan selected ports frozen longline prices (ex-vessel) declined 14% (-2%) reversing the previous year's moderate 3% rise as a result of the substantial weakening of the Yen. US fresh bigeye import prices (f.a.s.) in 2015 registered a moderate increase of 4% relative to 2014.

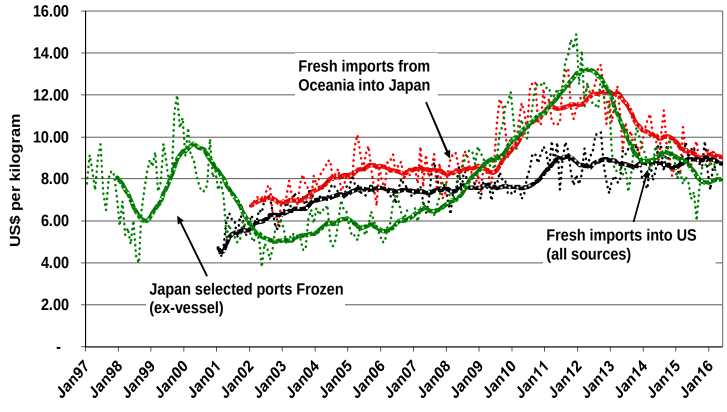

Figure 42a. Bigeye prices in US dollars: US fresh imports (f.a.s.) and Japanese markets; fresh imports from Oceania (c.i.f.) and Japan selected ports (ex-vessel)

Sources: Ministry of Finance (www.customs.go.jp), FFA Tuna Industry Advisor, and US National

The average price in 2015 for the Japan fresh bigeye prices from all sources averaged $8.68/Kg, down by 8% compared to 2014. Over the first five months of 2016, however, the overall import price improved by 10% to $9.56/Kg compared to the whole of 2015 although only up 3% compared to same period in 2015.

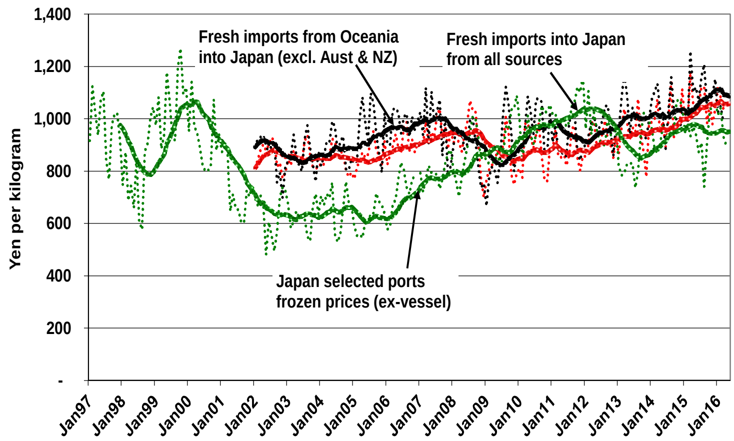

Figure 42b. Bigeye prices on Japanese markets; fresh imports all sources (c.i.f.), fresh imports from Oceania (c.i.f.) and Japan selected ports (ex-vessel)

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

2015 Japan selected ports longline caught bigeye frozen prices (ex-vessel) decreased by 14% to $7.74/Kg. Over the first five months of 2016, however, prices have increased 8% over the comparable period for last year.

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 2015 at 7,000mt being the lowest on record that represents a decline of 29% on last year's and 68% from a high of 22,000mt in 2002.

The price of fresh bigeye imports into the US was $8.99/Kg an improvement of 8% on 2014. Over the first five months of 2016, however, prices declined 7% relative to the same period last year. Import volumes for fresh bigeye into the US have also been on a long-term declining trend. Imports in 2015 came to more than 5,000mt, an increase of almost 22% on 2014 but substantially down by 28% on the past peak of more than 7,000 Mt in 2003.

Albacore

Albacore prices experienced improvements during 2015 across markets; the Bangkok benchmark (10kg and up) increased 7% (following a 15% rise the previous year), Thai frozen imports 5% (14%), Japan selected ports fresh (ex-vessel) 10% (12%) and US imports fresh (f.a.s.) 7% (same). The price increase across markets were in response to supply shortages and saw the Bangkok benchmark price average around $2,900/mt.

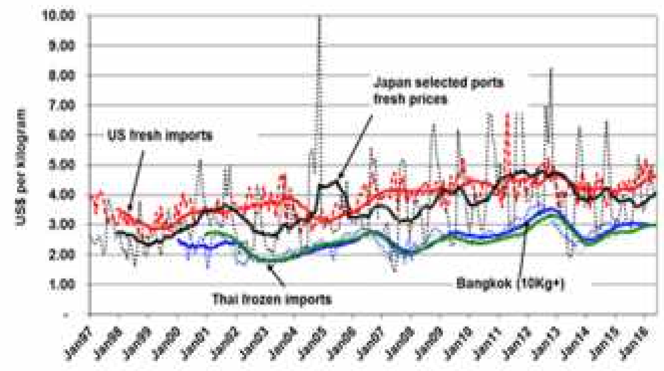

Figure 43. Albacore prices in $: Thai frozen imports, Japan fresh / frozen selected ports (ex-vessel) and US fresh imports (f.a.s.)

There has continued to be a marked recovery in albacore prices recently with the Bangkok price trending up from $2,900/mt at the end of 2015 to US$3,200 in the first week of July 2016.

Swordfish

The US swordfish market weighted average price (fresh and frozen, f.a.s.) averaged $7.90/Kg in 2015, lower by 8% compared to 2014. Against the moderate price decrease, the volume of imports rose by 9% to more than 7,800mt while in value terms the increase was marginal to $62 million. The weighted ex-vessel average price for swordfish at Japan selected ports in 2015 was $7.36 (¥891/Kg), a 10% decrease (+12% in JPY terms) from the previous year's while the landed volume rose by 12% to 4,500 Mt.

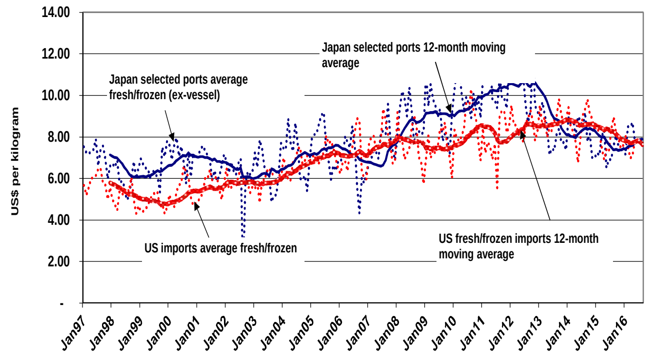

Figure 44. Swordfish prices in $: Japan selected ports fresh/frozen (ex-vessel) and US fresh/frozen import prices (f.a.s.)

In the first half of 2015, the US fresh import prices averaged $6.45/Kg, a decrease of 2% and imports rose 15% in volume and 13% in value compared to the same period last year. The Japan market prices, based on landings at Japan major ports, averaged $8.10/Kg (¥915/Kg), 9% (3% up in JPY terms) against the corresponding period last year while landings rose 16%.

For purposes of estimating the annual value of swordfish taken in the WCP-CA, 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.[8] The estimated delivered value of the longline swordfish catch in the WCP-CA for 2015 is $118 million, down by 11% on the estimated value of the catch in 2014 resulting from the price decrease of 10% and the 1% decrease in catch.

[8] 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 2015 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. [9]

The estimated delivered value of the longline tuna catch in the WCPFC area for 2015 is $1.5 billion. This represents a decrease of $176 million (11%) on the estimated value of the catch in 2014. The value of all target species declined – the albacore catch value declined modestly by only $6 million (2%), while bigeye and yellowfin saw significant declines of $107 million (17%) and $63 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 $243 million in 2015 with the 2% decrease on 2014 resulting from a 7% decrease in catch that more than offset a 5% increase in the albacore composite price. The longline bigeye catch was estimated to be worth $514 million in 2015, a decrease of 17% compared to 2014 accounted for by the 10% decrease in catch and the decline of 8% in price. The estimated delivered value of the yellowfin catch was $707 million in 2015, a decrease of 8% from 2014 resulting from 11% decrease in price and a 3% increase in catch.

Tropical longline[10]

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[11].

The estimated delivered value of the tropical tuna longline tuna catch in the WCP-CA for 2015 is $494 million (Figure 46). This represents a decrease of $96 million (-16%) on the estimated value of the catch in 2014. The value of albacore catch increased by $4

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[9] 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.

[10] 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.

[11] 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.

million (26%) but this was more than offset by the decline in the values of the main target species of bigeye and yellowfin which declined by $91 million (-24%) and $8 million (4%) respectively. The bigeye catch value, estimated to be worth $285 million in 2015 represented a decrease of 24% driven by reductions in catch (16%) and price (9%). The estimated delivered value of the yellowfin catch was $189 million in 2015, a decrease of 4% accounted for by a reduction in price (11%) that more than offset the rise in catch (6%). The albacore catch was estimated to be worth $20 million in 2015, a 26% increase on 2014 resulting from the increase in catch (20%) and the increase in price (5%).

Southern longline fisheries catch[12]

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[13].

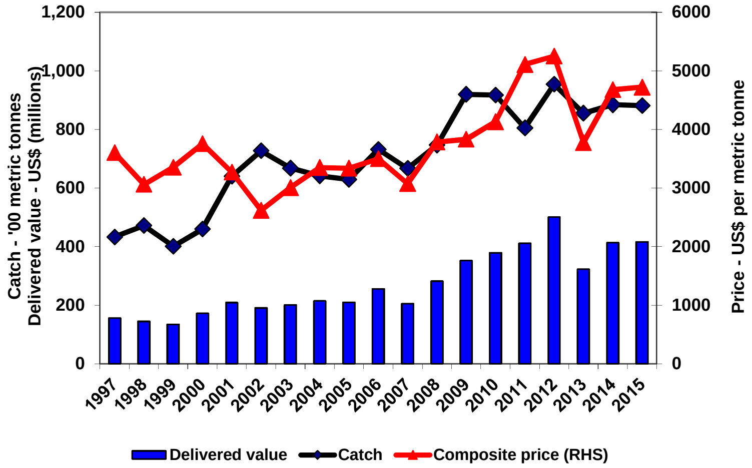

Figure 47. All tuna in the WCPFC Southern longline fishery – Catch, delivered value of catch and composite price

The estimated delivered value of the tuna catch in the southern longline fishery within the WCP-CA for 2015 is $416 million (Figure 47). This represents a slight increase of almost $3 million (1%) on the estimated value of the catch in 2014. The marginal increase was despite the $10 million increase in the value of bigeye as this was almost offset by the combined decreases in the values of albacore and yellowfin of $6 million (4%) and $1 million (1%) respectively. The albacore catch was estimated to be worth $154 million in 2015, a 4% decrease on 2014 resulting from the decrease in catch (-9%) that more than offset the increase in price (5%). The bigeye catch value, estimated to be worth $63 million in 2015 represented an increase of 19% driven by the increase in catch (26%) that more than offset the decrease in price (-5%). The estimated delivered value of the yellowfin catch was $197 million in 2015, a marginal decrease of less than 1% accounted for by a reduction in price (-9%) that more than offset the rise in catch (10%).

5.5.3 Economic conditions

Tropical longline

Economic conditions in the fishery appear to have gone through two phases since 1997. The first phase between 1997 and 2008 saw a continuous and rapid decline as costs increased and prices and catch rates fell. This was followed by a significant improvement in economic conditions in 2009 as costs fell as a result of falls in the global fuel price and catch rates rose. The second phase, of persistent but stable below average conditions, commenced in 2011 and continued in 2015. While overall conditions have been relatively stable since 2011 the components of the index have seen significant annual variations. In 2015 conditions improved marginally compared with 2014 despite a significant fall in fuel prices as the effect of the resulting decline in costs was largely offset by declines in the catch rate and fish price.

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[12] 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.

[13] 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.

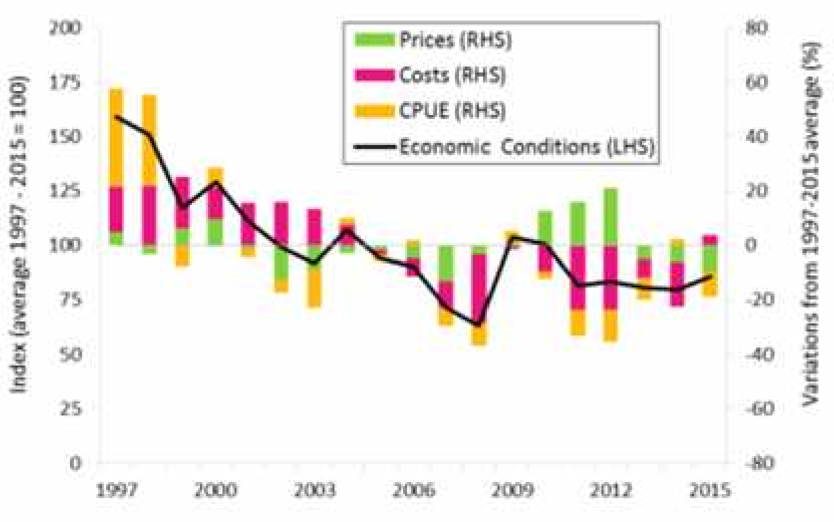

Figure 48. Economic conditions index for the tropical longline fishery (LHS) and variance of component indices against average (1997-2015) conditions

Southern Longline

Economic conditions for the southern longline fishery were particularly poor in the period from 2010 to 2014, as a result of low catch rates and high real fuel prices (Figure 49). Despite the fact that real fish prices were at their second highest and highest levels over the period in 2011 and 2012, respectively, conditions have continued the declining trend that is evident from the beginning of the assessment period, 1997. Economic conditions improved significantly in 2015. This improvement was primarily driven by falling fuel costs with the fish price remaining around its 2014 level. However, persistent low catch rates continue to impact on economic conditions and if they continue the likelihood of economic conditions returning to higher historical average levels remains low.

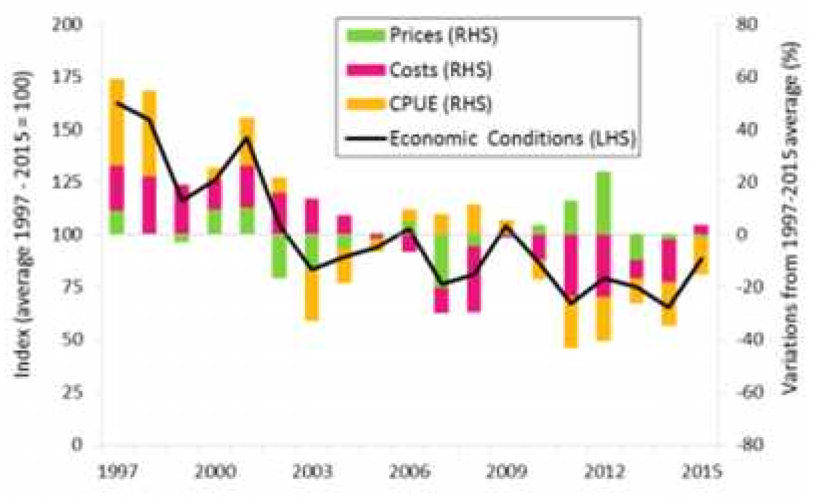

Figure 49. Economic conditions index for the southern longline fishery (LHS) and variance of component indices against average (1997-2015) conditions

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.

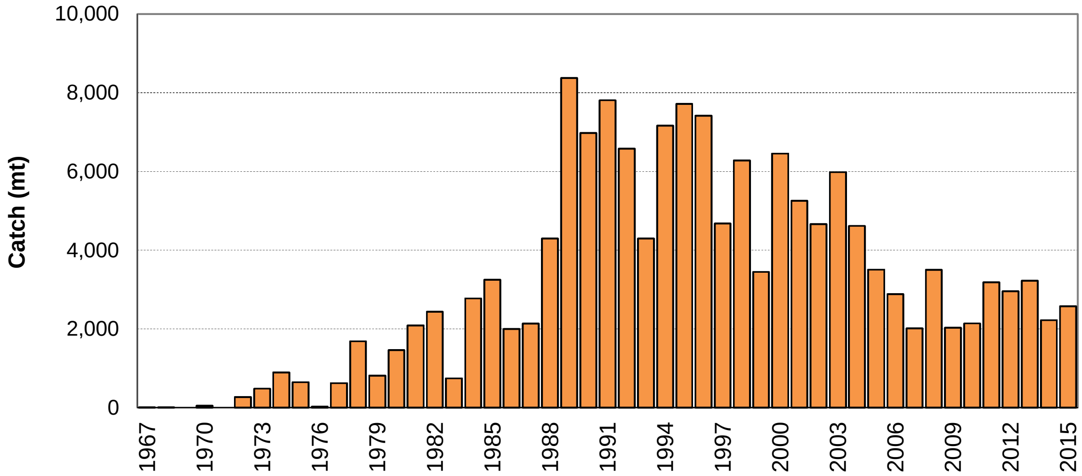

Figure 50. Troll catch (mt) of albacore in the south Pacific Ocean

6.2 Provisional catch estimates (2015)

The 2015 South Pacific troll albacore catch (2,576 mt) was around the average over the past decade. The New Zealand troll fleet (131 vessels catching 2,425 mt in 2015) and the United States troll fleet (6 vessels catching 151 mt in 2015) accounted for all of the 2015 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.

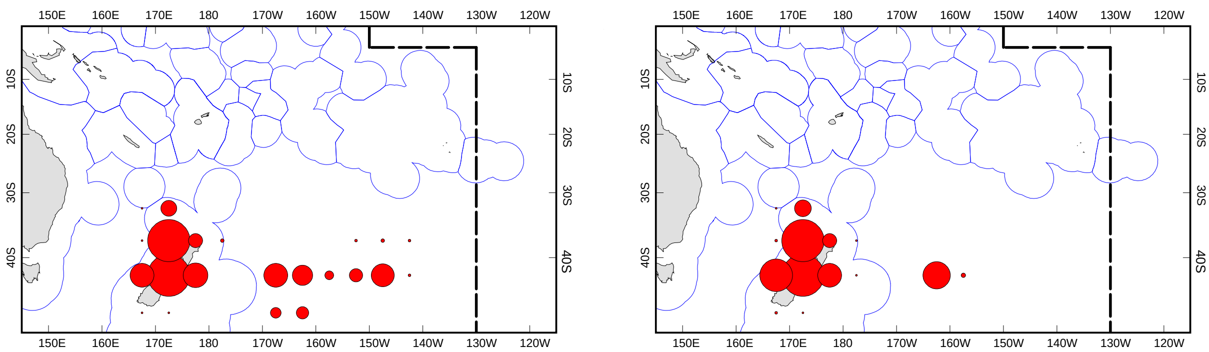

Figure 51. Distribution of South Pacific troll effort during 2013 (left) and 2014 (right)

7. SUMMARY OF CATCH BY SPECIES

7.1 SKIPJACK

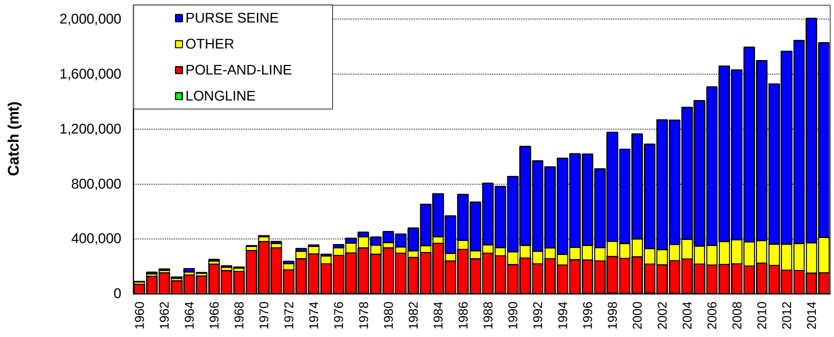

Figure 52. WCP–CA skipjack catch (mt) by gear

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 2015 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 2015 WCP–CA skipjack catch of 1,827,750 mt was the third highest catch recorded and around 180,000 mt lower than the previous record in 2014 (2,005,647 mt). The **pole-and-line** catch (152,600 mt – 7%) was relatively stable, and the "**artisanal**" gears in the domestic fisheries including Indonesia, Philippines and Japan (215,040 mt – 12%). The **longline** fishery accounted for less than 1% of the total catch.

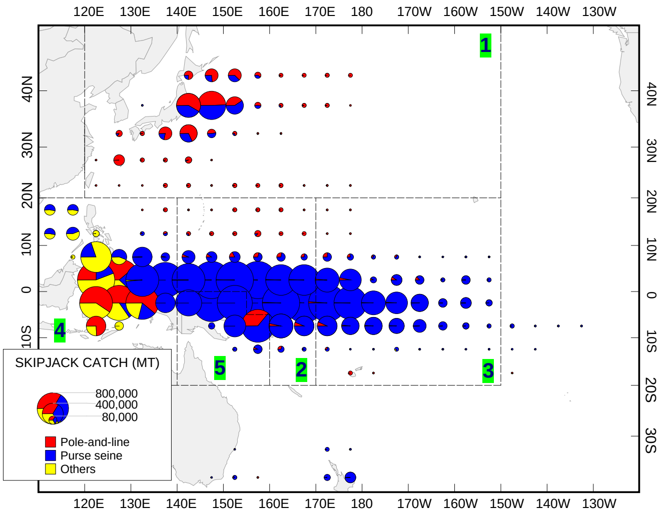

Figure 53. Distribution of skipjack tuna catch, 1990J2015.

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 (unassociated, free swimming school sets account for most of the large skipjack). In contrast, the WCP–CA skipjack purse-seine catch in 2009 comprised of younger fish from associated schools. The overall purse-seine skipjack size distribution has been very similar for the last three years (2013–2015); most of the catch by weight in 2015 was from unassociated, with a clear mode of relatively large fish (60–65 cm) from unassociated schools dominant. Another feature of the 2015 skipjack catch was the relatively large number of small fish (20-30 cm) in the Indonesia/Philippines domestic fisheries (Figure 54).

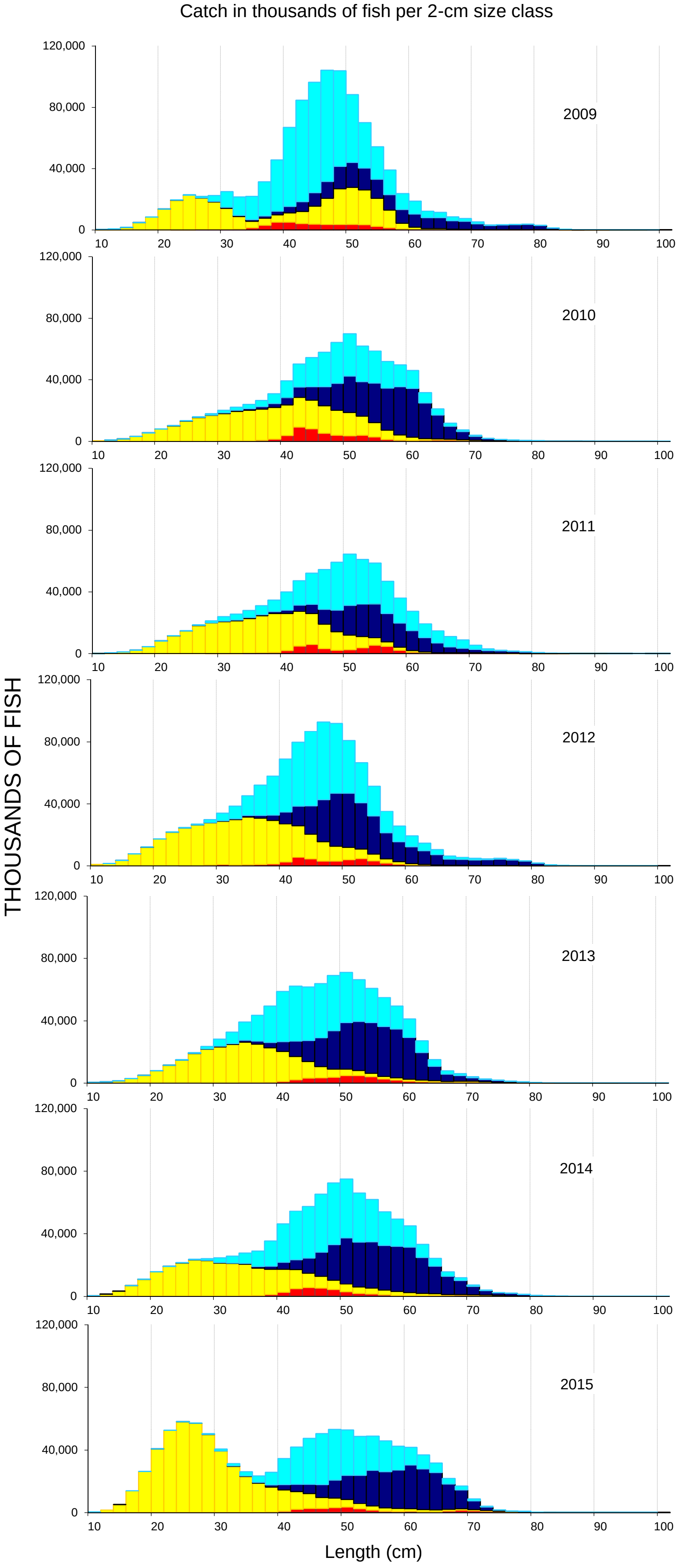

Figure 54. Annual catches (no. of fish) of skipjack tuna in the WCPO by size and gear type, 2009–2015.
(red–pole-and-line; yellow–Phil-Indo archipelagic fisheries; light blue–purse seine associated; dark blue–purse seine unassociated)

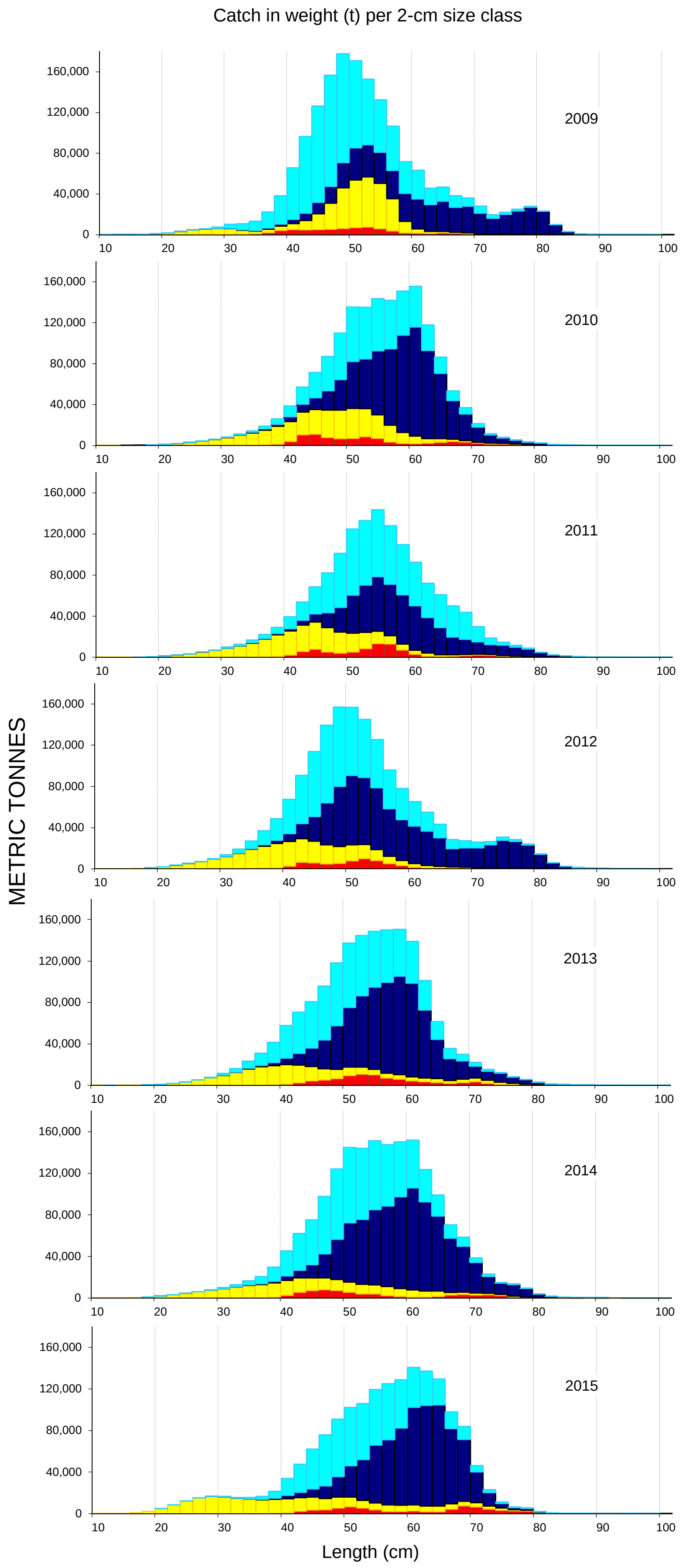

Figure 55. Annual catches (MT) of skipjack tuna in the WCPO by size and gear type, 2009–2015.
(red–pole-and-line; yellow–Phil-Indo archipelagic fisheries; light blue–purse seine associated; dark blue–purse seine unassociated)

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 2015 yellowfin catch (**605,963 mt**) was only 1,000 mt lower than the record catch in 2012 (606,868 mt) and mainly due to increased catches in the domestic Indonesia and Philippines fisheries. The yellowfin catch in the **purse-seine** fishery (298,847 mt – 49% of the total yellowfin tuna catch) was amongst the lowest catches over the past decade and contributing a relatively low proportion (17%) of the total purse seine catch.

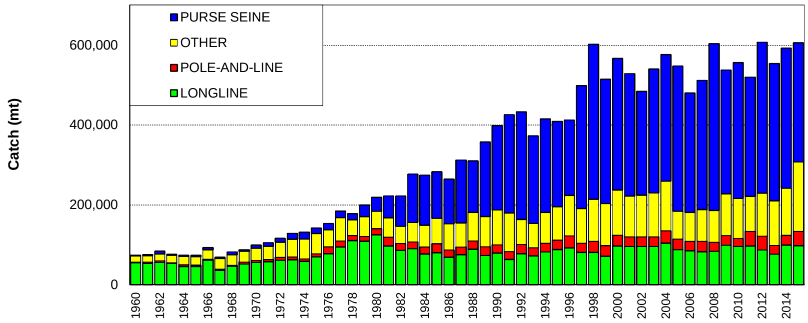

Figure 56. WCP–CA yellowfin catch (mt) by gear

The WCP–CA **longline** catch for 2015 (97,289 mt–16%) 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 36,120 mt during 2015 (6% of the total yellowfin catch) which is higher than the 10-year average for this fishery. Catches in the '**other**' category (165,000mt–27% in 2015) 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; 2015 yellowfin tuna catches in the 'other' category were about 50% higher than in 2014. Figure 57 shows the distribution of yellowfin catch by gear type for the period 1990–2015. 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.

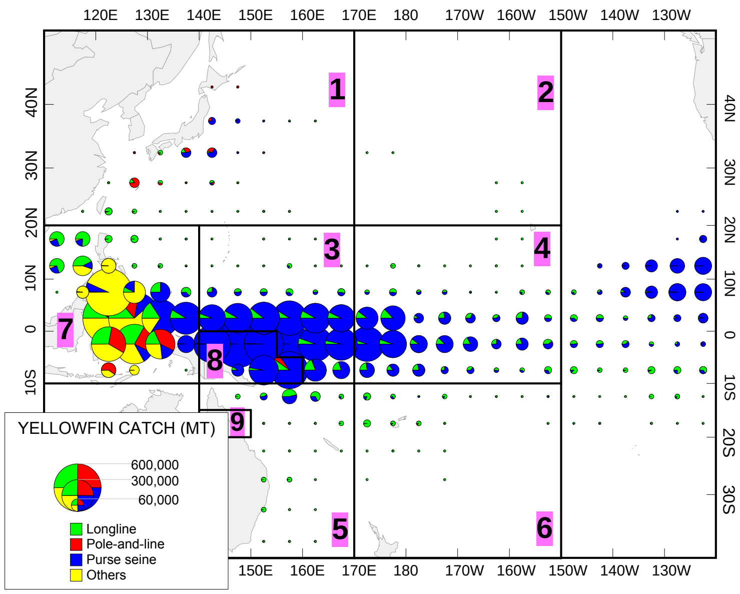

Figure 57. Distribution of yellowfin tuna catch in the WCP–CA, 1990J2015.

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 and 2014 – 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.

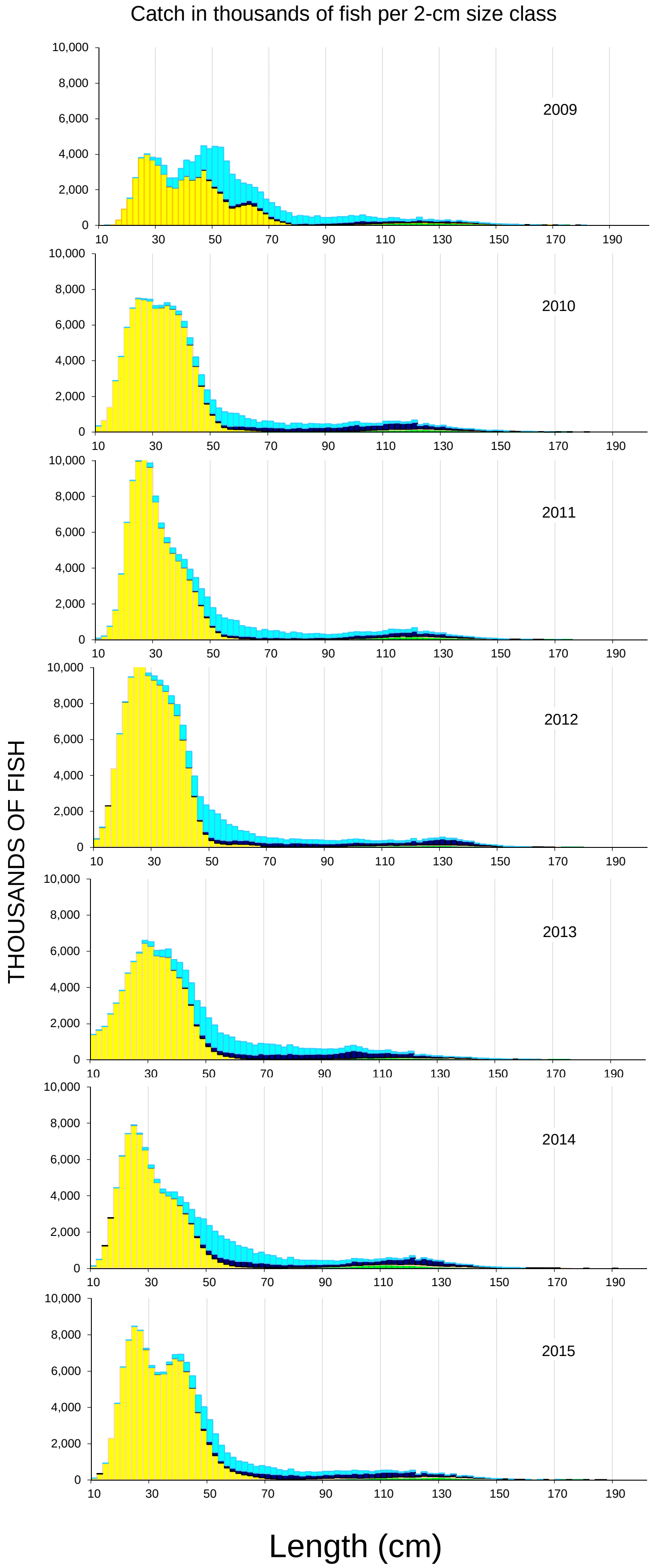

Figure 58. Annual catches (no. of fish) of yellowfin tuna in the WCPO by size and gear type, 2009–2015.
(green–longline; yellow–Phil-Indo archipelagic fisheries; light blue–purse seine associated; dark blue–purse seine unassociated)

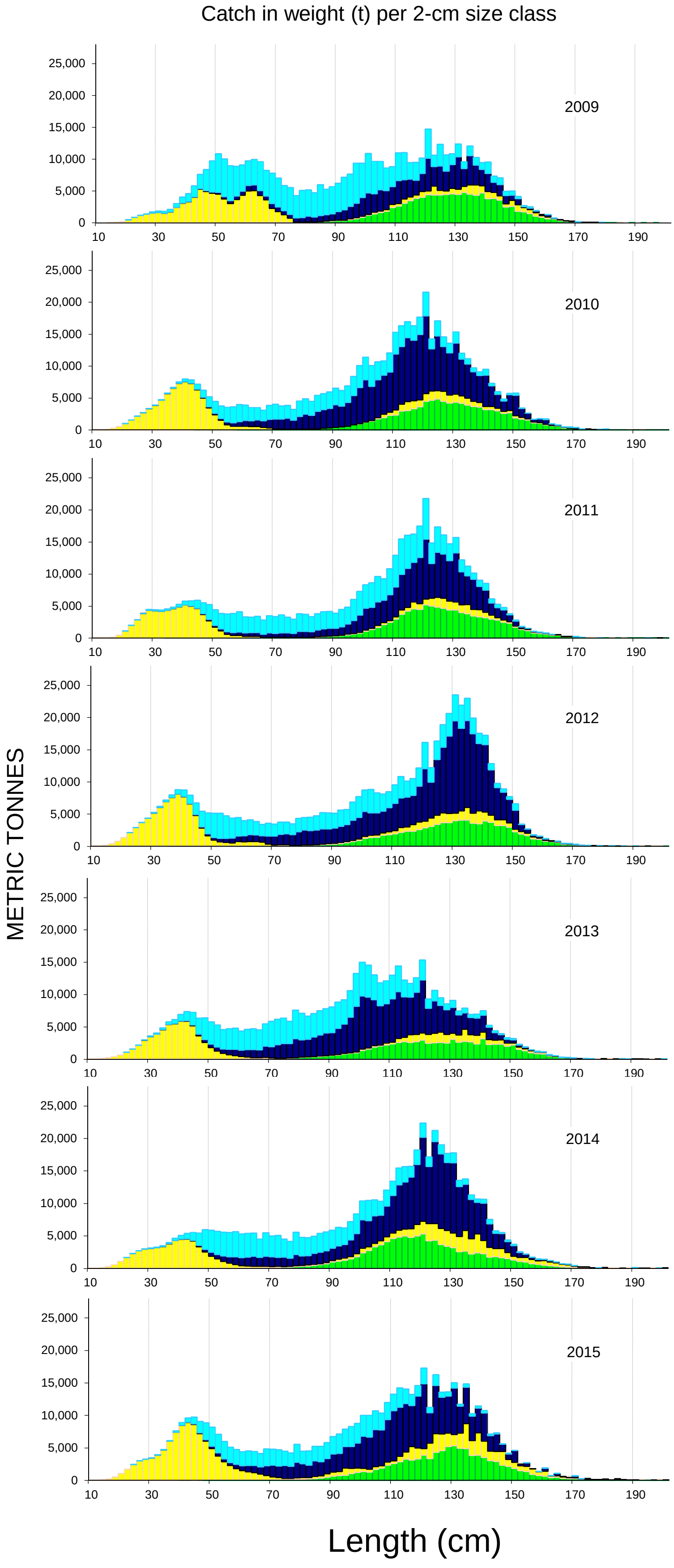

Figure 59. Annual catches (MT) of yellowfin tuna in the WCPO by size and gear type, 2009–2015.
(green–longline; yellow–Phil-Indo archipelagic fisheries; light blue–purse seine associated; dark blue–purse seine unassociated)

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 2015 bigeye catch for the **Pacific Ocean** (231,470 mt) was about 10,000 mt lower than in 2014 and slightly lower than the average for the past ten years.

The **purse-seine** catch in the **EPO** (provisionally 67,432 mt in 2015; the highest since 2009) continues to account for a significant proportion (66%) of the total EPO bigeye catch. The provisional 2014 EPO longline bigeye catch estimate (35,087 mt; 2015 estimate not yet available) is around the average for the last seven years but below the catches prior to 2006, when effort by the Asian fleets was higher. However, the EPO catch estimates are acknowledged to be preliminary[14] and may increase when more data become available.

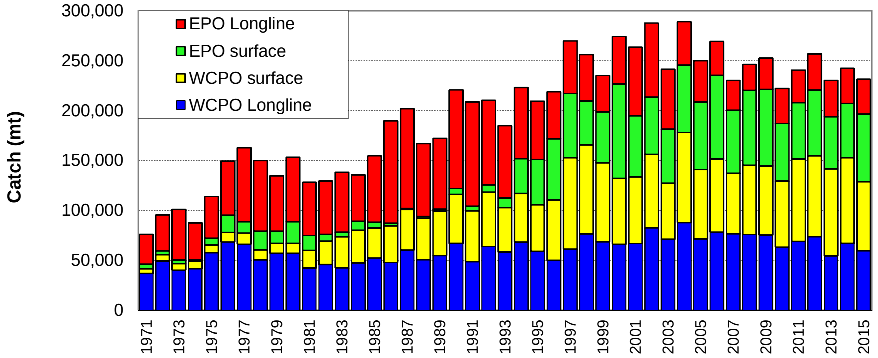

Figure 60. Pacific bigeye catch (mt) by gear
(excludes catches by "other" gears)

The provisional **WCP-CA longline** bigeye catch for 2015, at 63,986 mt is the lowest catch since 1991 (slightly higher than in 2013 – 64,420 mt – also a low catch year). The provisional **WCP–CA purse seine** bigeye catch for 2015 was estimated to be 48,772 mt was also amongst the lowest catch levels for this fishery over the past twenty years (Figure 61). In 2013, the WCP-CA purse-seine bigeye catch exceeded the longline catch for the first time, although this proved to be the exception and the prior long-term trend of a higher longline catch returned in 2014 and again in 2015.

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 in the Philippine, Indonesian[15] and Japanese domestic fisheries, has accounted for an estimated 12,000–16,000 mt (3–7% of the total WCP–CA bigeye catch) in recent years.

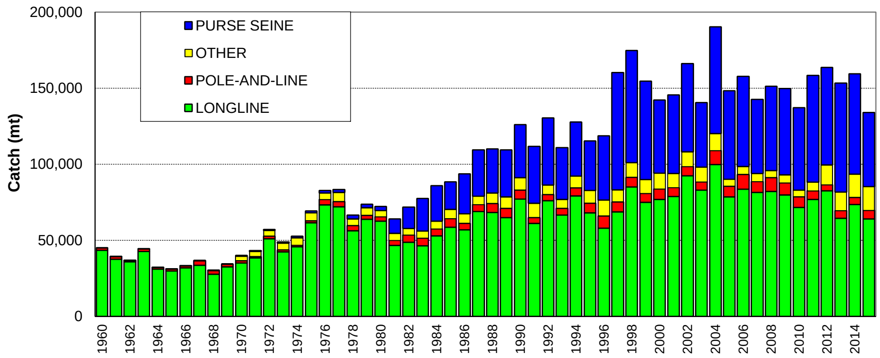

Figure 61. WCP–CA bigeye catch (mt) by gear

Figure 62 shows the spatial distribution of bigeye catch in the Pacific for the period 1990–2015. 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

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[14] Catch estimates for the EPO longline fishery for 2014-2015 and the EPO purse seine fishery for 2014-2015 are preliminary

[15] Indonesia has recently 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.

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.

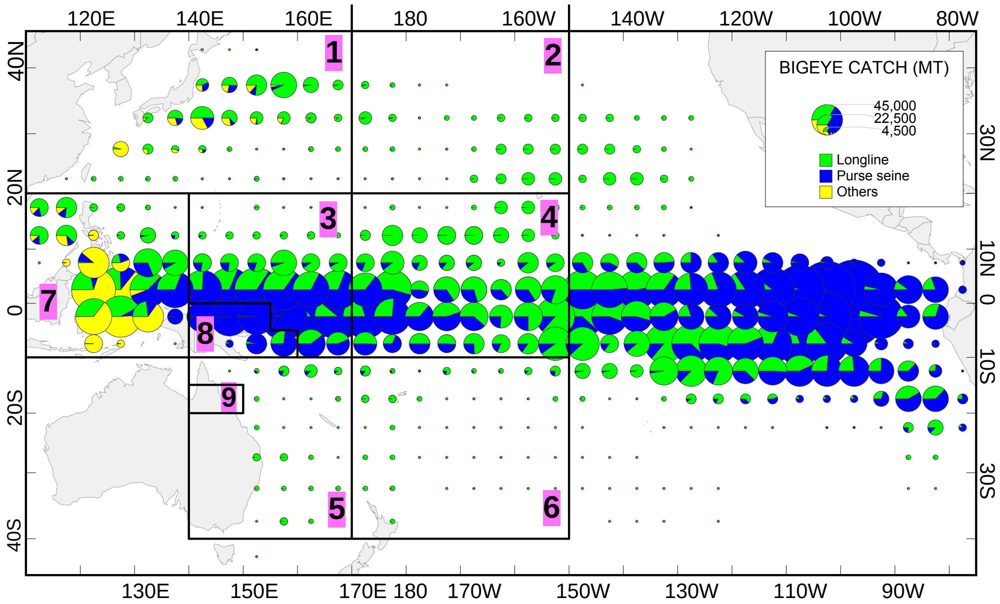


Figure 62. Distribution of bigeye tuna catch, 1990J2015.

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 2015 show that (i) the average size of longline-caught bigeye was larger than in previous years (as has been reported in anecdotes from the fishery), (ii) the size composition of the purse seine associated-set catch is similar to 2009 with a mode around 50cm, but with fewer fish than in 2009, and (iii) the maintenance of relatively high numbers of bigeye tuna taken in unassociated sets (which is similar to recent years).

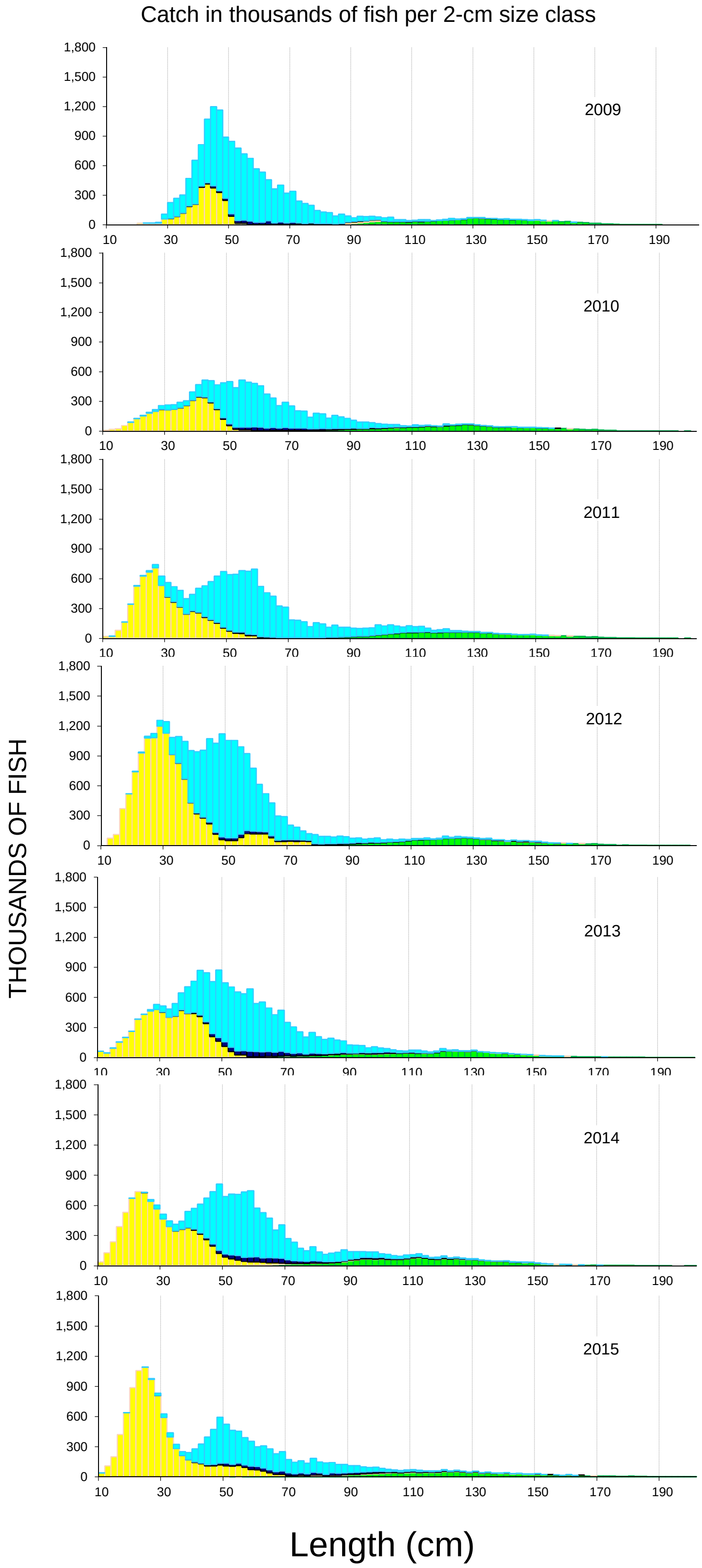


Figure 63. Annual catches (no. of fish) of bigeye tuna in the WCPO by size and gear type, 2009–2015.
(green–longline; yellow–Phil-Indo archipelagic fisheries; light blue–purse seine associated; dark blue–purse seine unassociated)

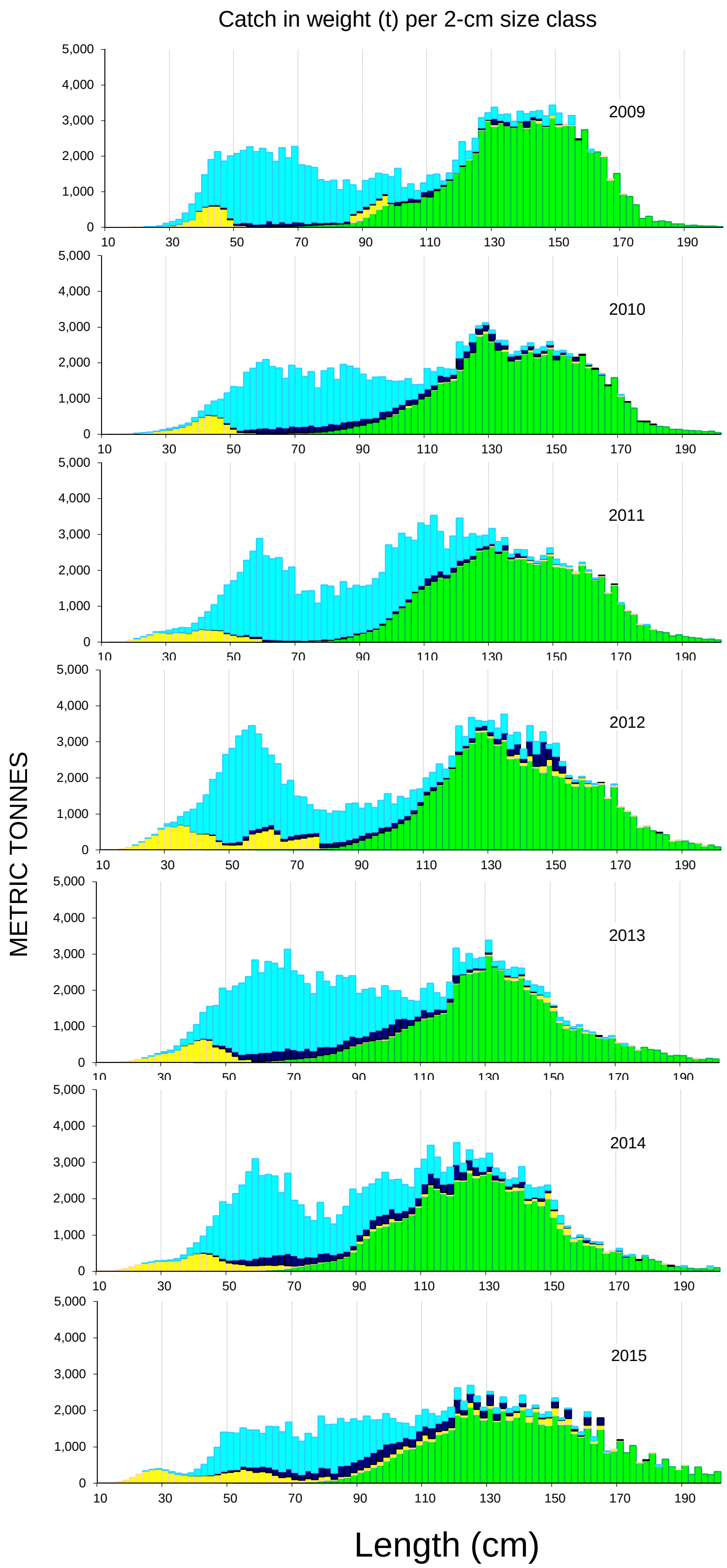


Figure 64. Annual catches (MT) of bigeye tuna in the WCPO by size and gear type, 2009–2015.
(green–longline; yellow–Phil-Indo archipelagic fisheries; light blue–purse seine associated; dark blue–purse seine unassociated)

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 2015 (68,594 mt) was about 12,000 mt lower than in 2014 and nearly 20,000 mt lower than the record catch in 2010 of 87,292 mt.

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 2015 (120,043 mt) was the lowest since 2011 and nearly 28,000 mt lower that the record (147,793 mt in 2002).

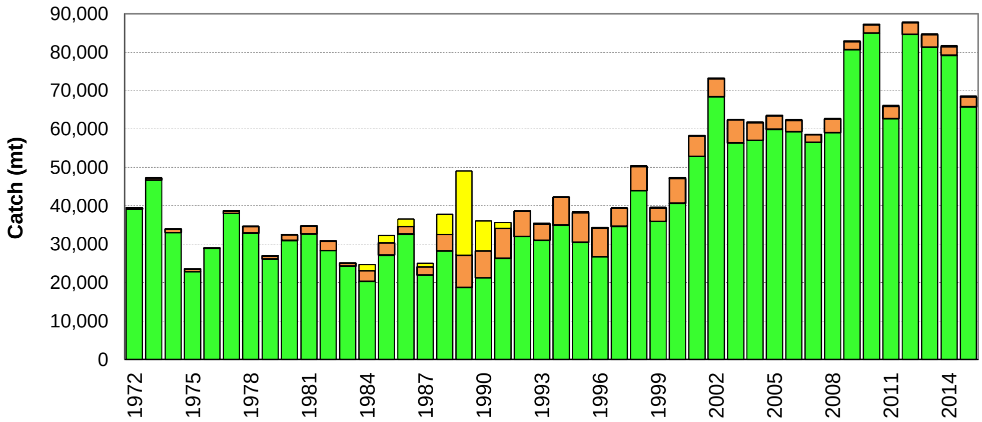


Figure 65. South Pacific albacore catch (mt) by gear ("Other" is primarily catch by the driftnet fishery.)

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.

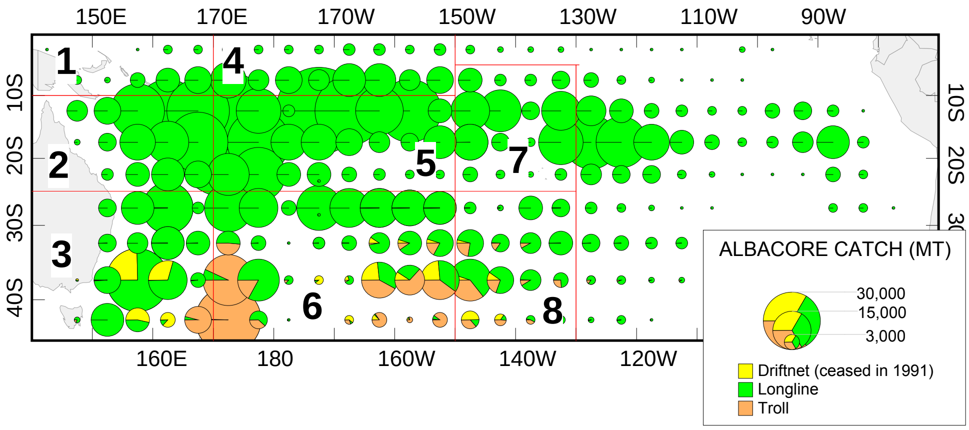


Figure 66. Distribution of South Pacific albacore tuna catch, 1988–2015.
The eight-region spatial stratification used in stock assessment is shown.

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 catch in 2015 is very similar to that of 2010.

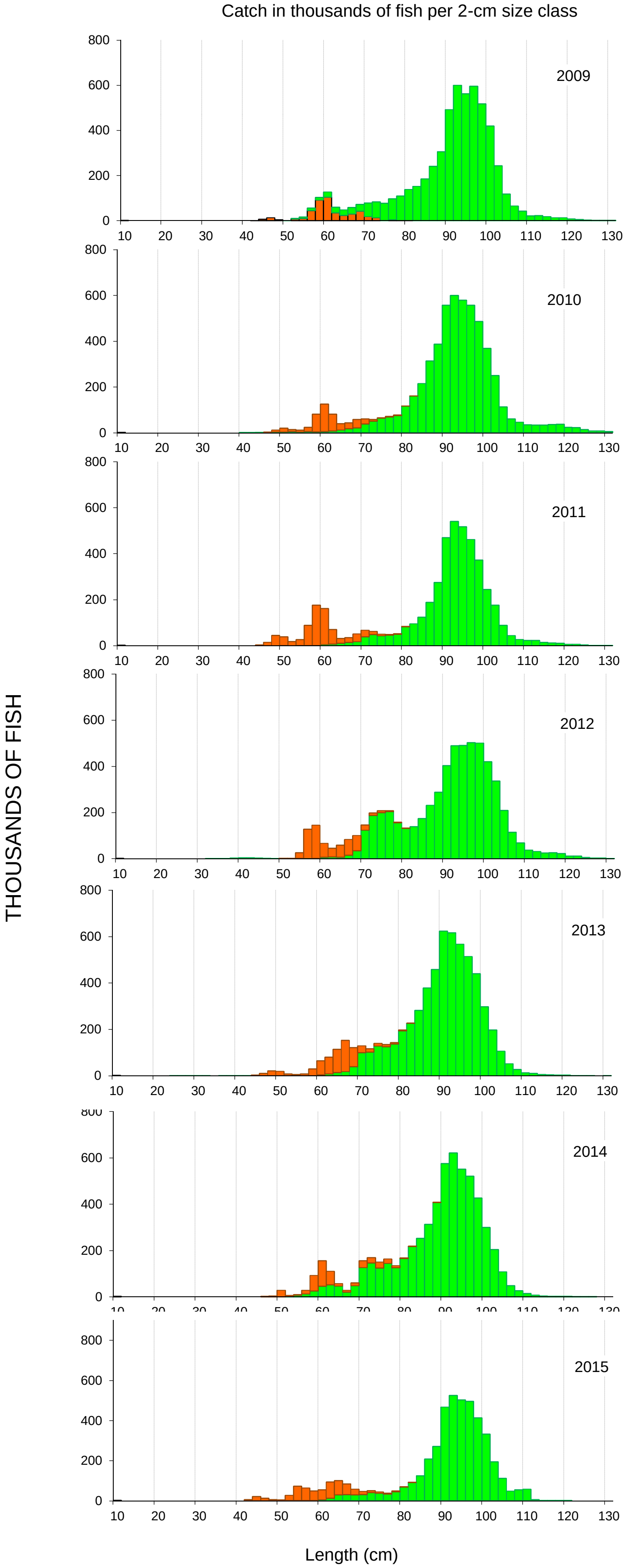


Figure 67. Annual catches (no. of fish) of albacore tuna in the South Pacific Ocean by size and gear type, 2009–2015. **(green–longline; orange–troll)**

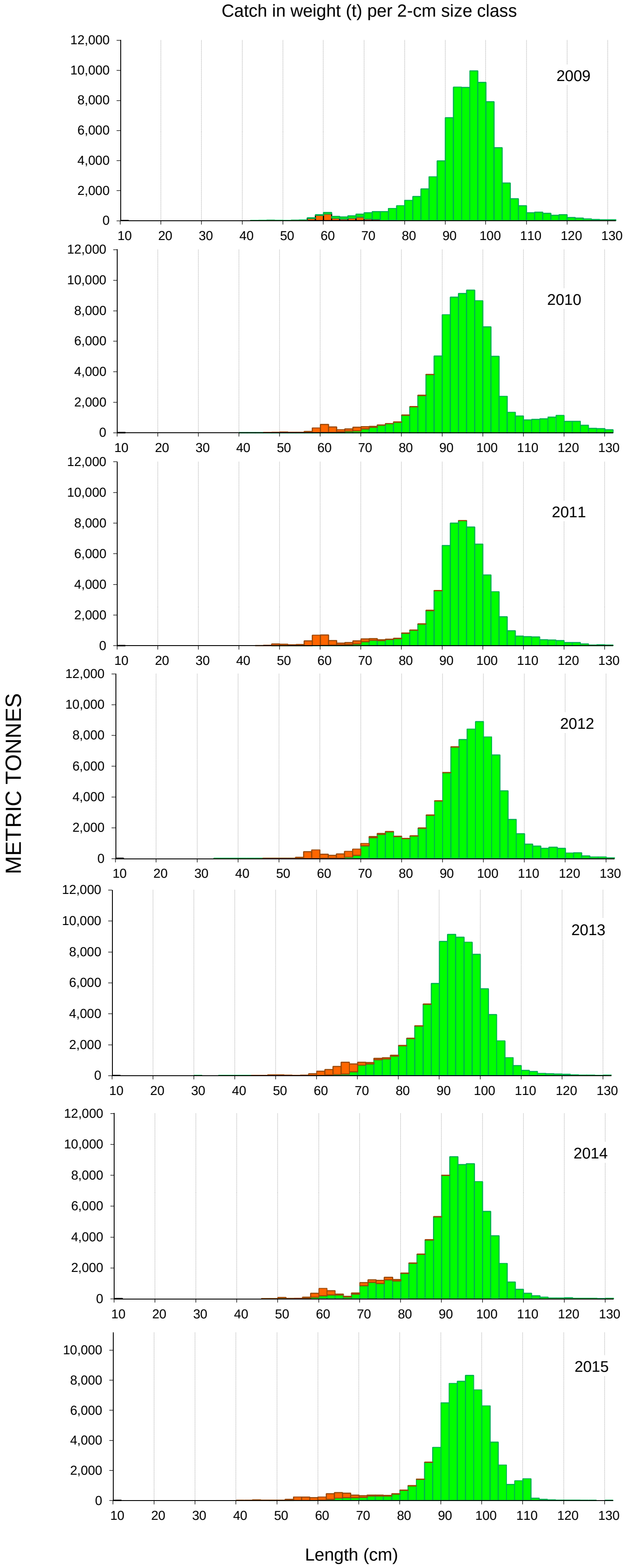


Figure 68. Annual catches (MT) of albacore tuna in the South Pacific Ocean by size and gear type, 2009–2015. **(green–longline; orange–troll);**

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 past three years, with contributions from the distant-water Asian fleet catches. These estimates do not include catches from the South American fleets catching swordfish and the South Pacific Spanish longline fleet catch estimate for 2015 was not available at the time of writing this paper.

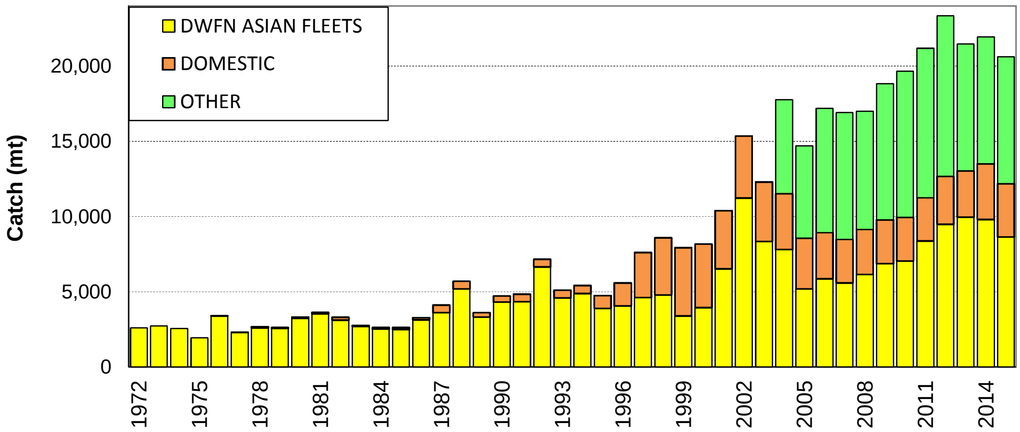


Figure 69. South Pacific longline swordfish catch (mt) by fleet

The longline catch of swordfish is distributed over a large area of the south Pacific (Figure 70–data covering entire south Pacific for 2011–2015 yet to be provided for some fleets). 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.

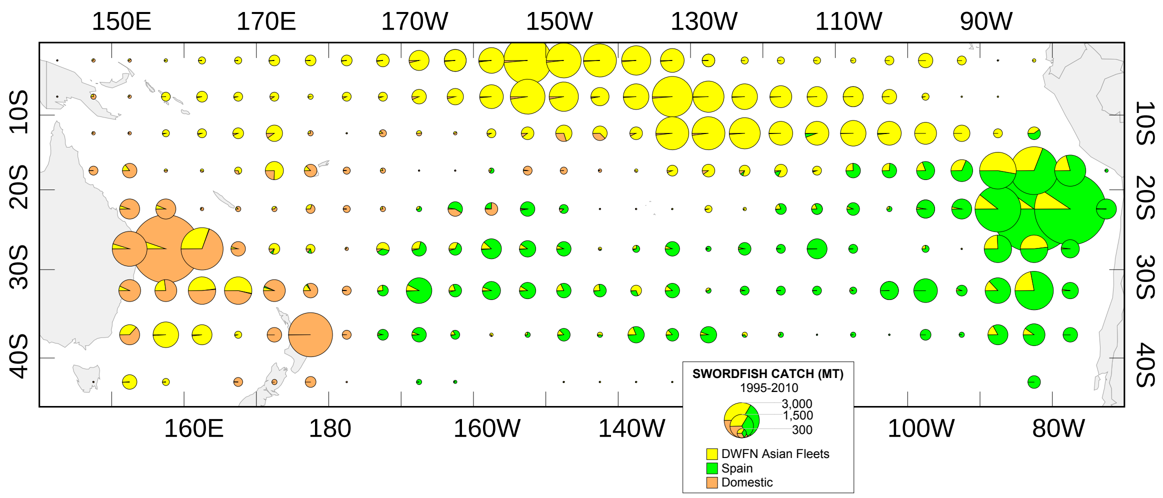


Figure 70. Distribution of South Pacific longline swordfish catch, 1995–2010.

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.

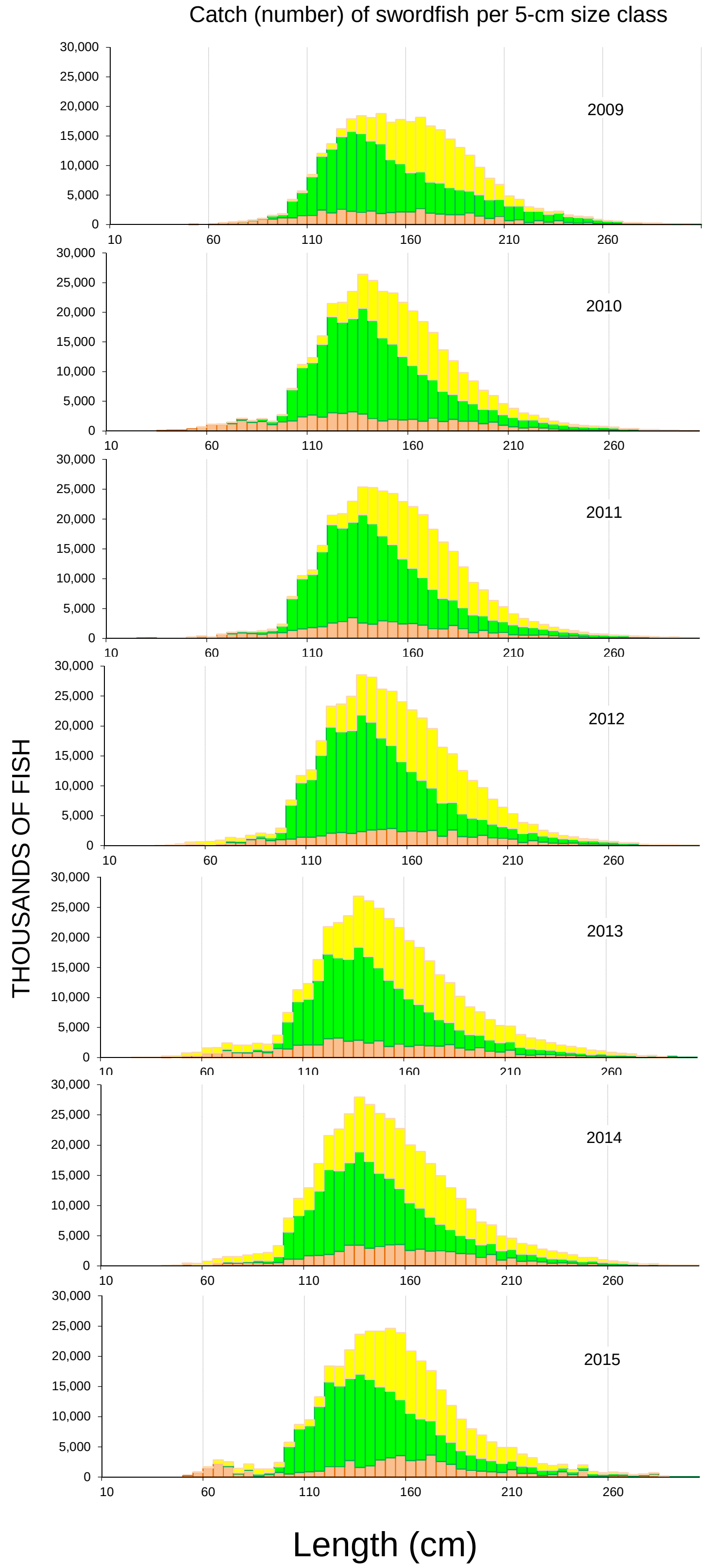


Figure 71. Annual catches (number of fish) of swordfish in the South Pacific Ocean by size and fleet, 2009–2015. (green–Spanish fleet catch; yellow–distant-water Asian fleet catch; orange– Domestic fleets)
2012, 2013, 2014 and 2015 data are provisional (data for some fleets have yet to be provided, so 2011 data have been carried over).

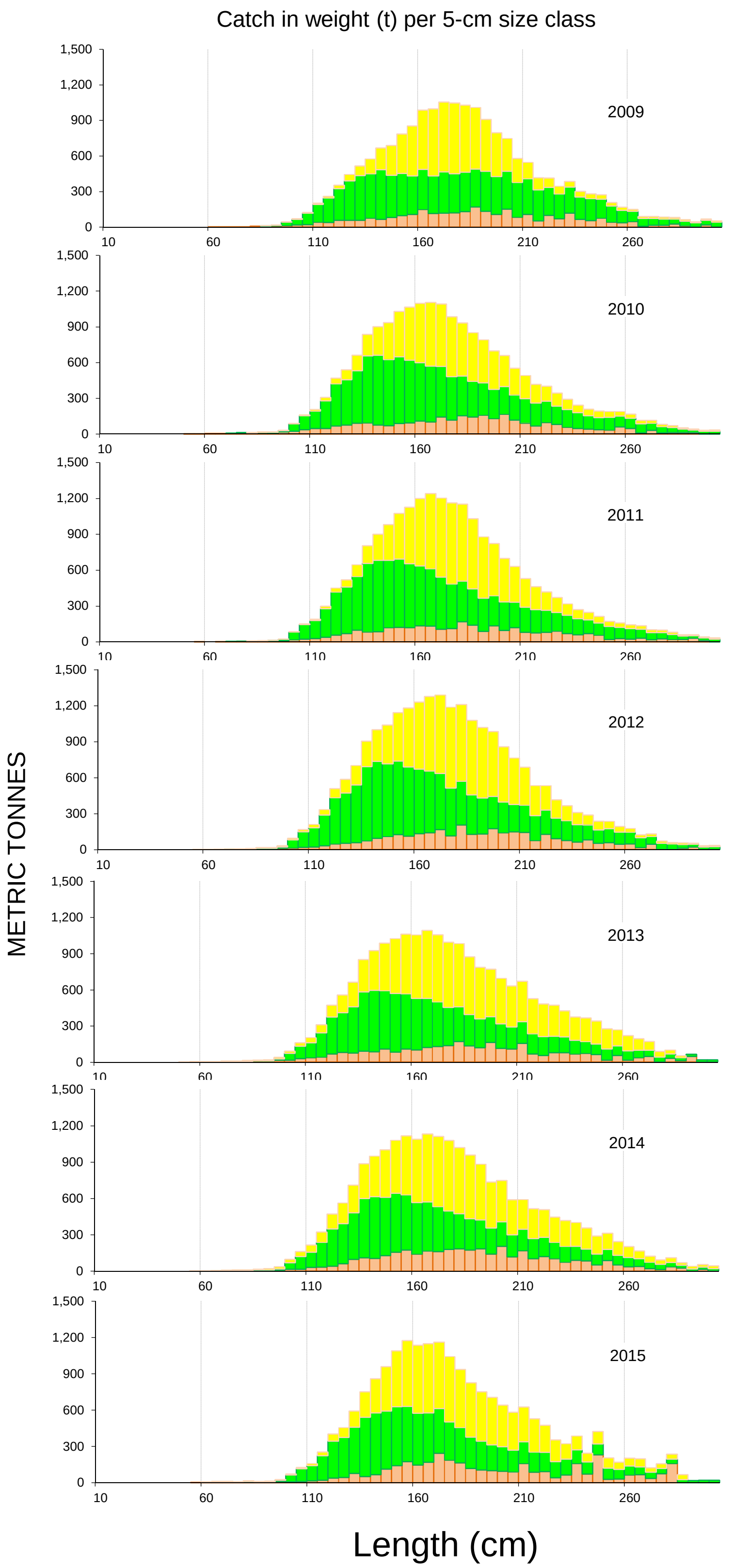


Figure 72. Annual catches (metric tonnes) of swordfish in the South Pacific Ocean by size and fleet, 2009–2015. **(green–Spanish fleet catch; yellow–distant-water Asian fleet catch; orange–Domestic fleets)**
2012, 2013, 2014 and 2015 data are provisional (data for some fleets have yet to be provided, so 2011 data have been carried over).

REFERENCES

OFP (2016). Estimates of annual catches in the WCPFC Statistical Area. Information Paper ST–IP–1. Twelfth Regular Session of the Scientific Committee of the WCPFC (SC12). Bali, Indonesia, 3–11 August 2016.

Pilling, G., R, Scott, P. Williams & J. Hampton (2016) A compendium of fisheries indicators for bigeye and yellowfin t Working Paper SA-WP-03. Twelfth Regular Session of the Scientific Committee of the WCPFC (SC12). Bali, Indonesia. 3–11 August 2016.

Tidd, A., G. Pilling & S. Harley (2015) Examining productivity changes within the tropical WCPO purse seine fishery Information Paper MI-IP-01. Eleventh Regular Session of the Scientific Committee of the WCPFC (SC11). Pohnpei, Federated States of Micronesia, 5–13 August 2015.

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, 2000-2015. 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	7,479	4,270	57%
2010	6,218	3,424	55%
2011	8,484	4,992	59%
2012	8,786	4,894	56%
2013	8,261	4,589	56%
2014	8,600	4,854	56%
2015	6,954	3,909	56%

Table A2. Proportion of Longline SWORDFISH catch by 10° latitude band in the WCPFC Convention Area south of the equator, 2000-2015. 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	3,063	1,526	1,658	1,803	211	37%	18%	20%	22%	3%
2014	3,608	1,246	2,059	1,474	213	42%	14%	24%	17%	2%
2015	2,997	912	1,619	1,197	229	43%	13%	23%	17%	3%

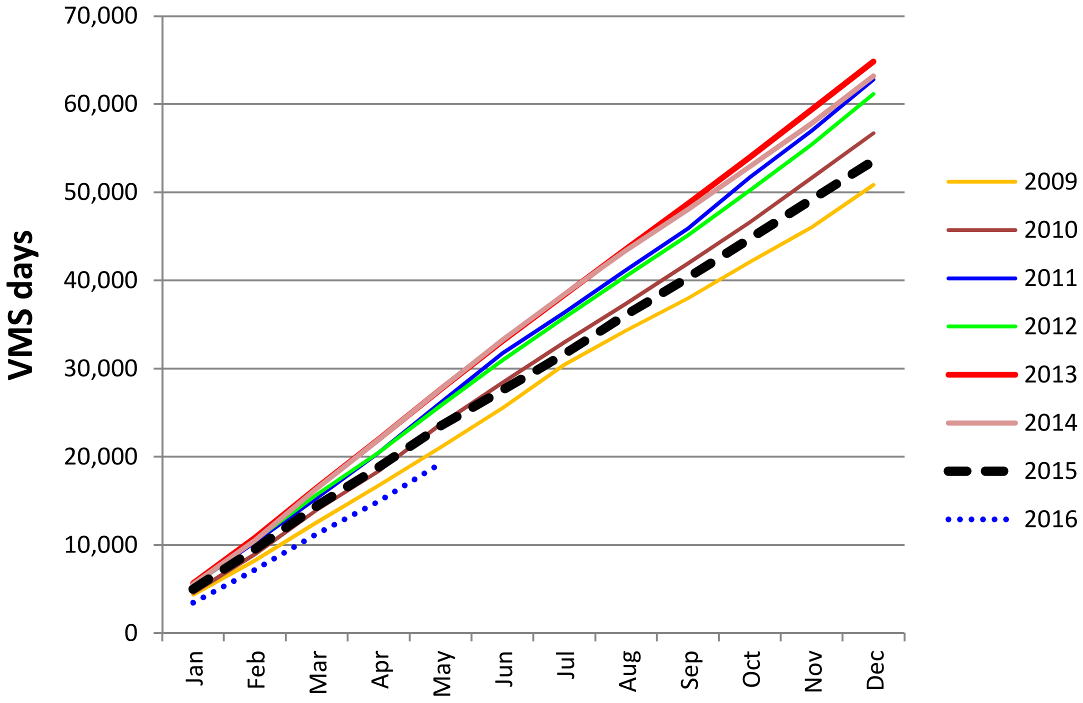


Figure A1. Cumulative purse seine effort by month, 2009-2016, as measured by VMS (days in port and transit days omitted).

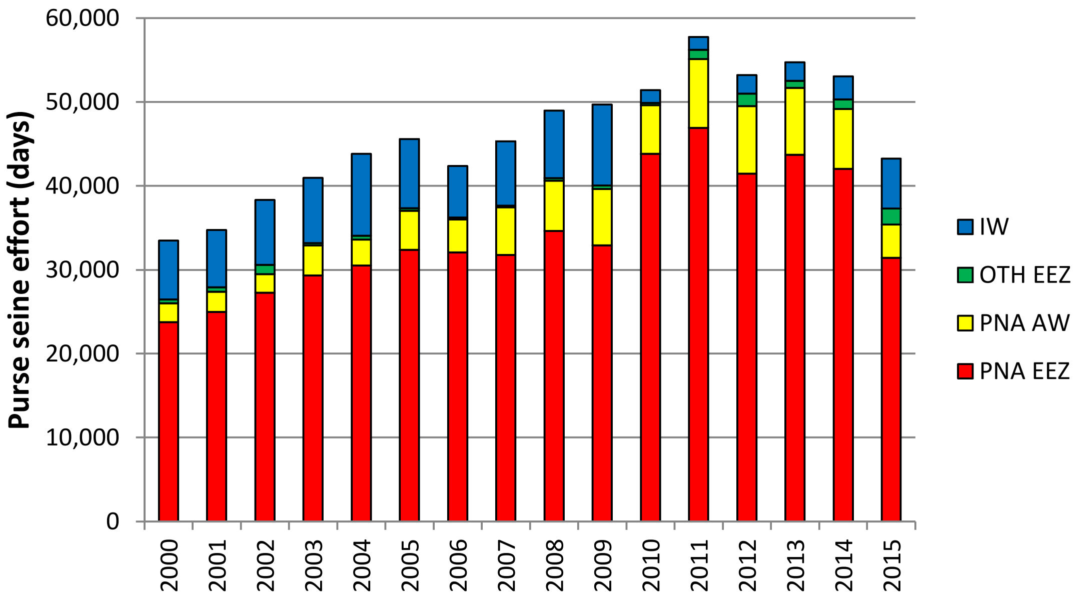


Figure A2. Purse seine effort (days fishing and searching) in the WCPFC Convention Area between 20°N and 20°S, excluding domestic purse seine effort in Philippines and Indonesia. Estimates are based on raised logsheet data.

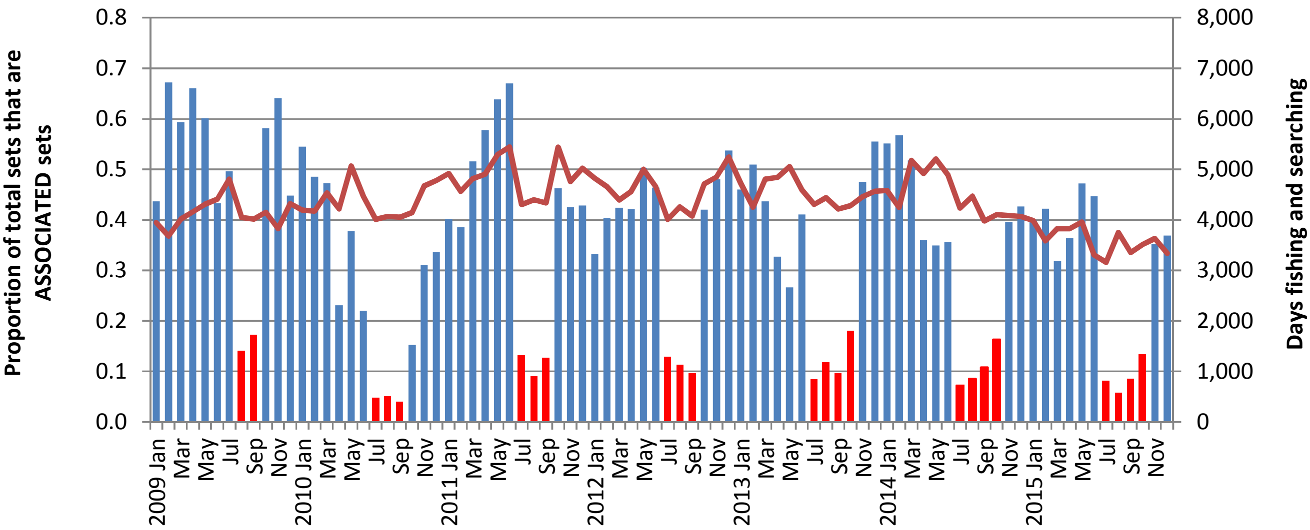


Figure A3. Proportion of the total purse seine fishing activity comprising associated sets, as indicated by logsheet data. Red bars indicate the FAD closure months. Total effort in days is shown by the plotted line. Activities in the domestic purse seine fisheries of Indonesia and Philippines are excluded**.**

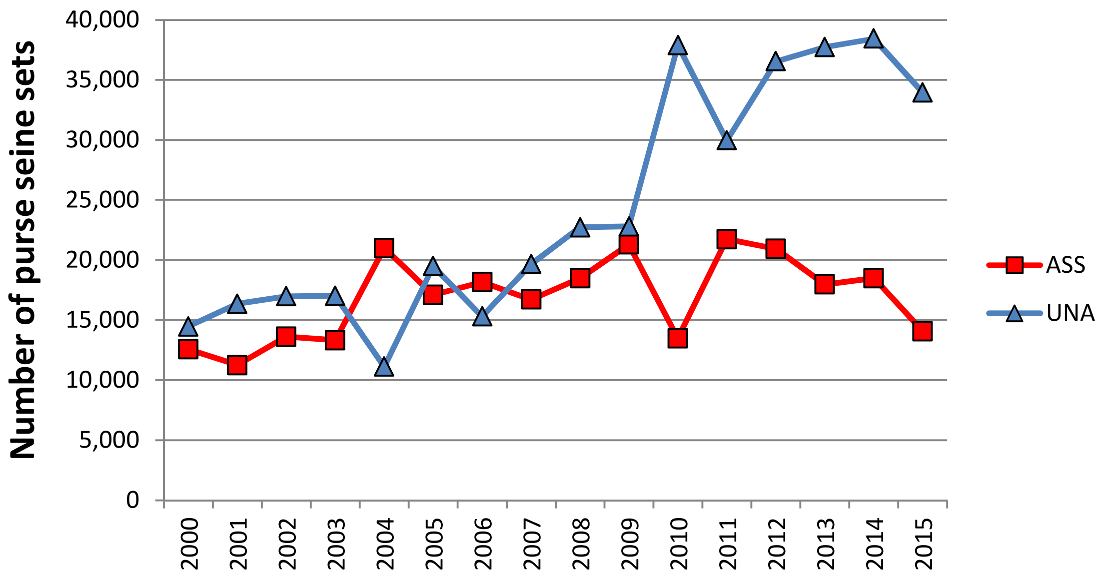
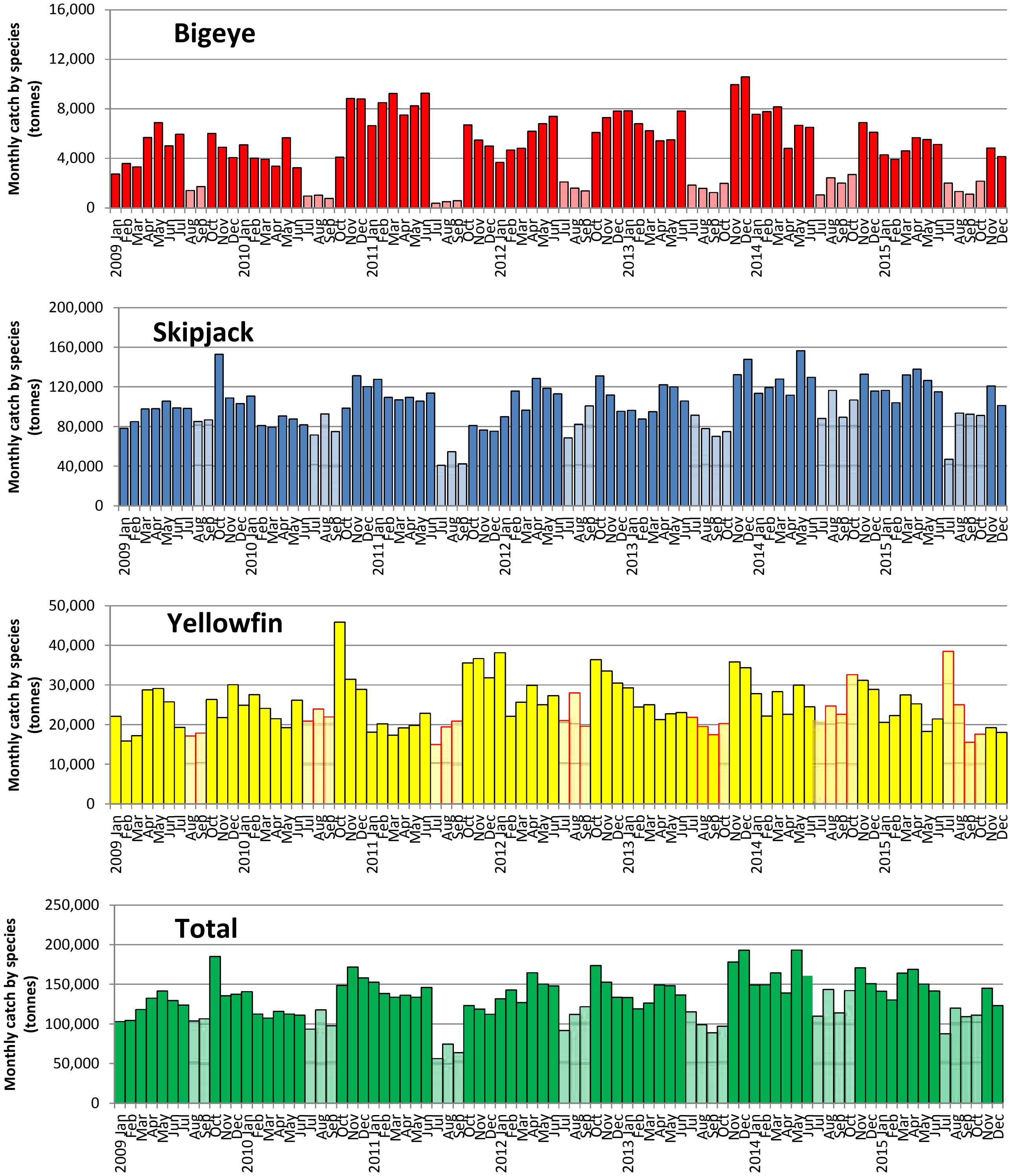


Figure A4. Number of associated (ASS) and unassociated (UNA) sets made in the WCPO tropical purse seine fishery, 2000 – 2015. Activities in the domestic purse seine fisheries of Indonesia and Philippines are excluded. Associated sets include animal-associated sets.



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.

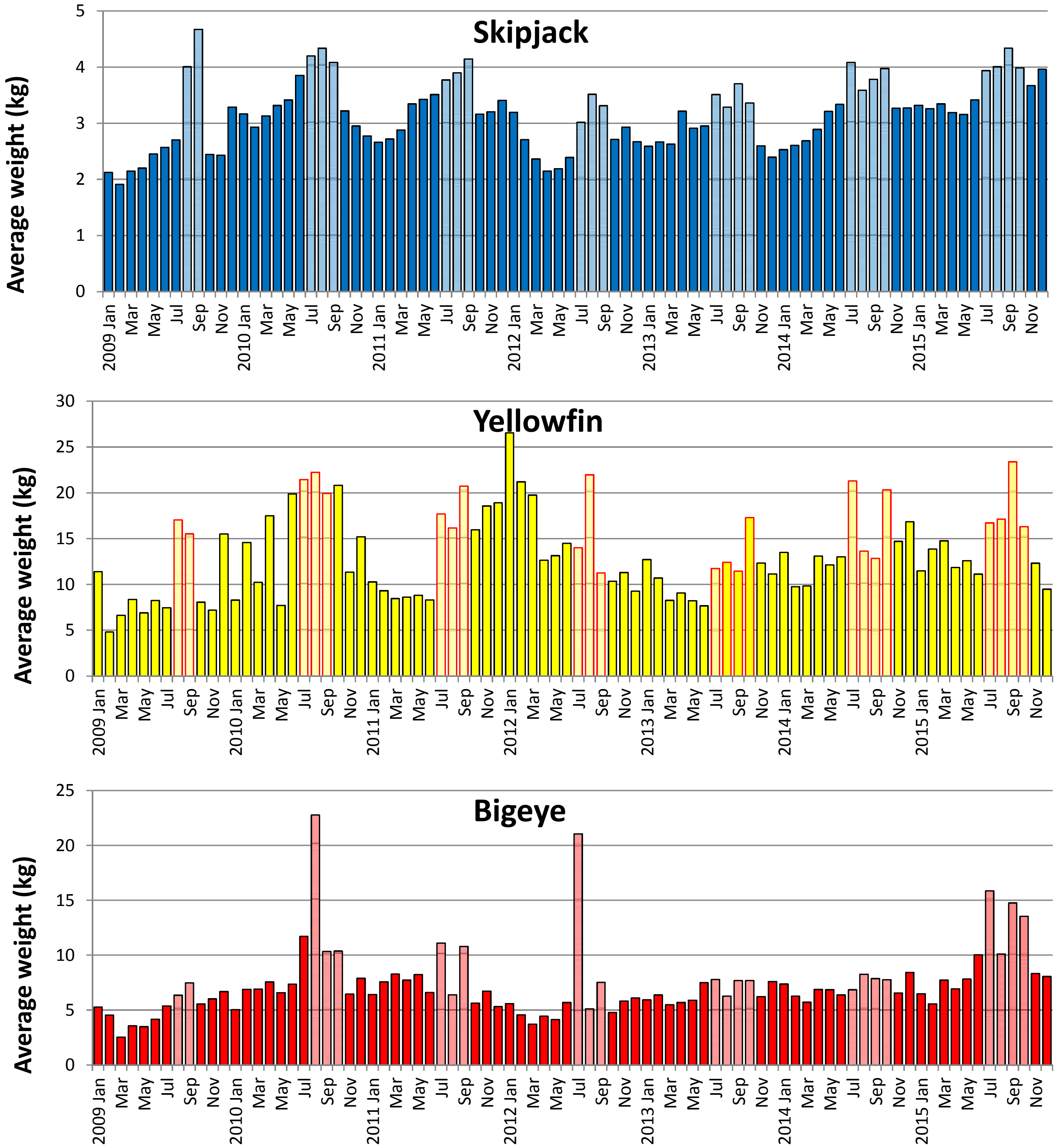


Figure A6. Monthly average weight of bigeye, skipjack and yellowfin tuna, estimated from observer sampling data, 2009-2015.

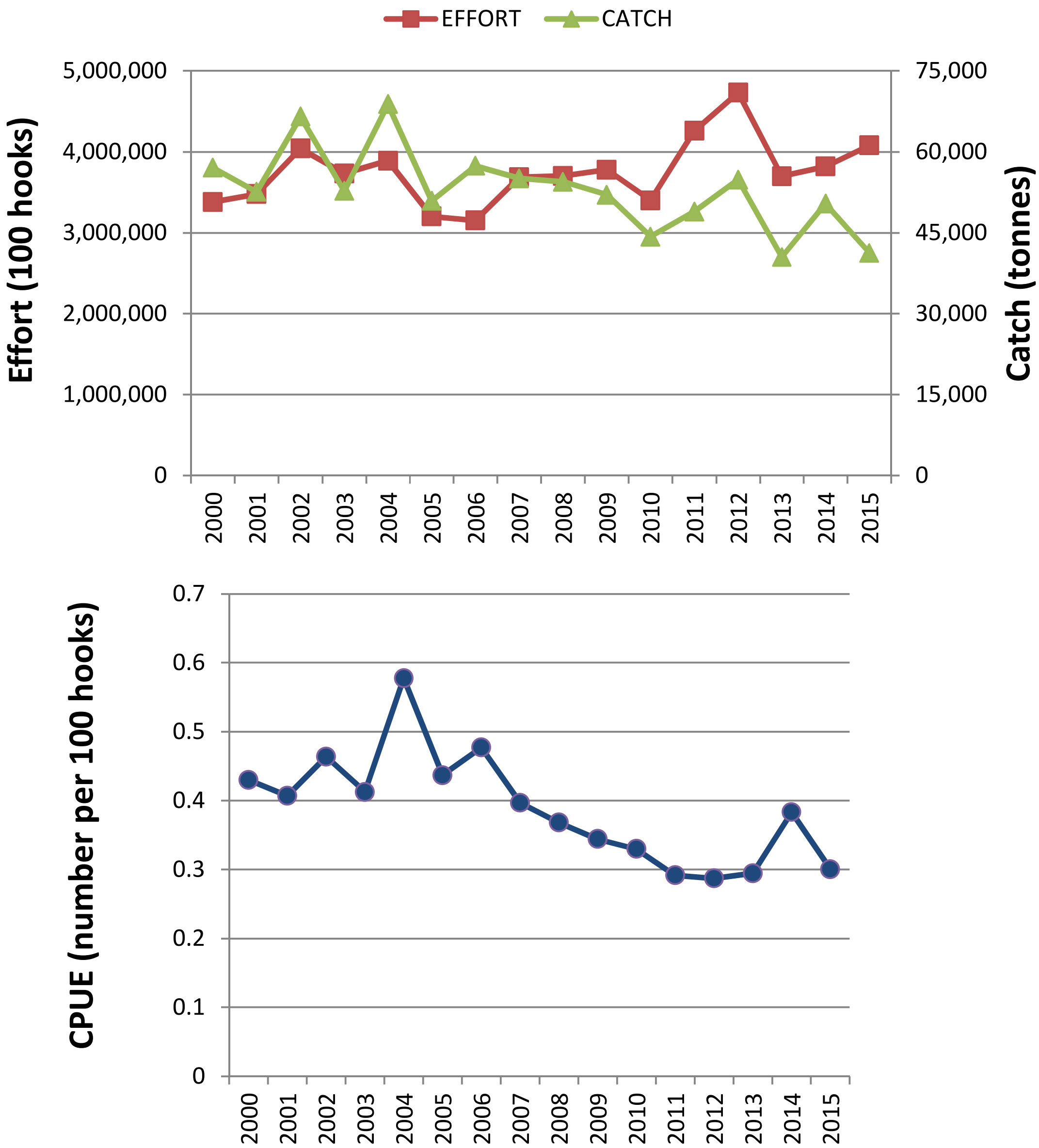


Figure A7. Estimates of longline effort and bigeye catch (upper panel) and bigeye CPUE (lower panel) for the CORE area of the tropical WCPFC longline fishery (130°E - 150°W, 20°N - 10°S).
2015 data are provisional.

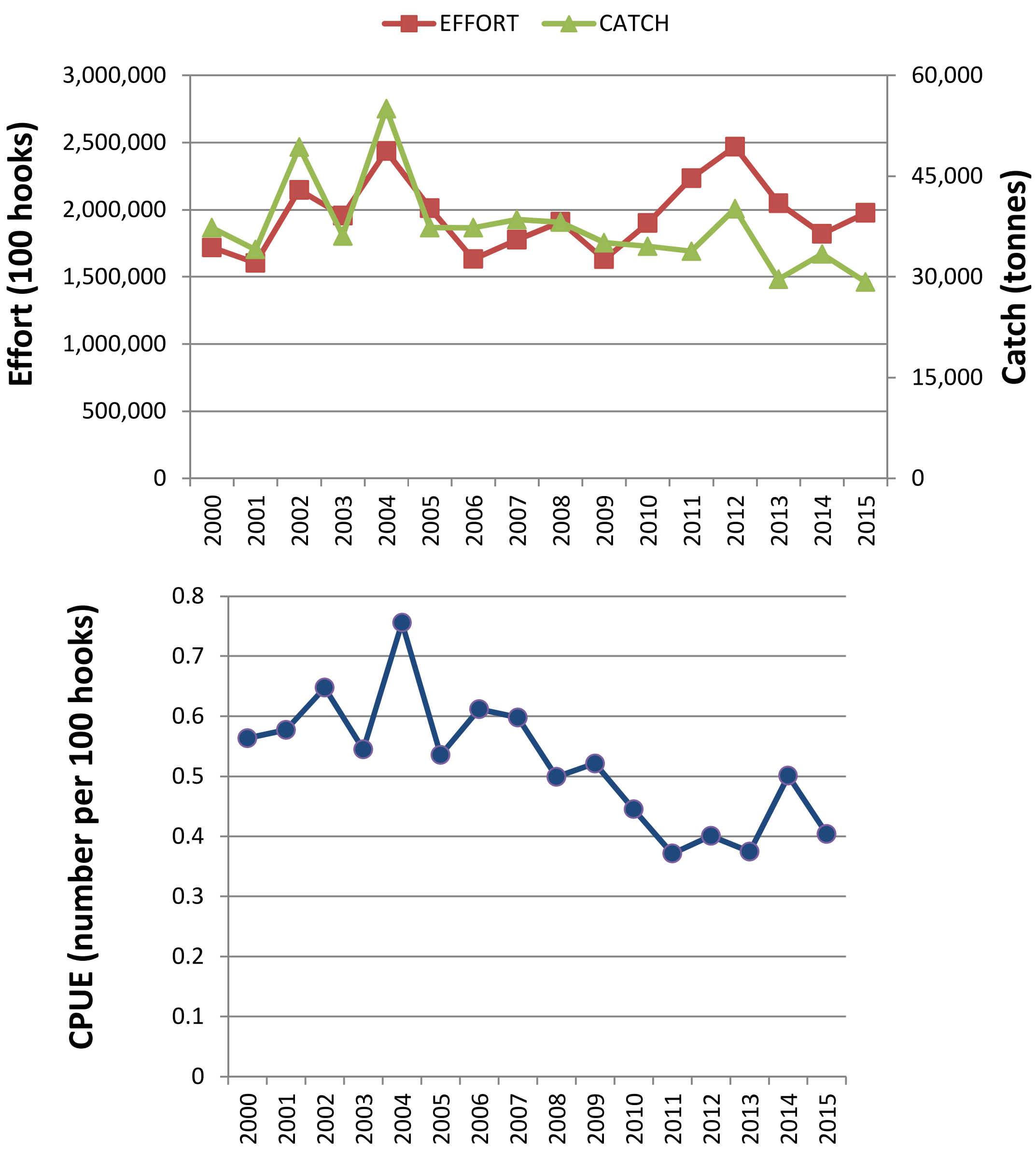


Figure A8. Estimates of longline effort and bigeye catch (upper panel) and bigeye CPUE (lower panel) for the EASTERN area of the tropical WCPFC longline fishery (170°E - 150°W, 20°N - 10°S).
2015 data are provisional.

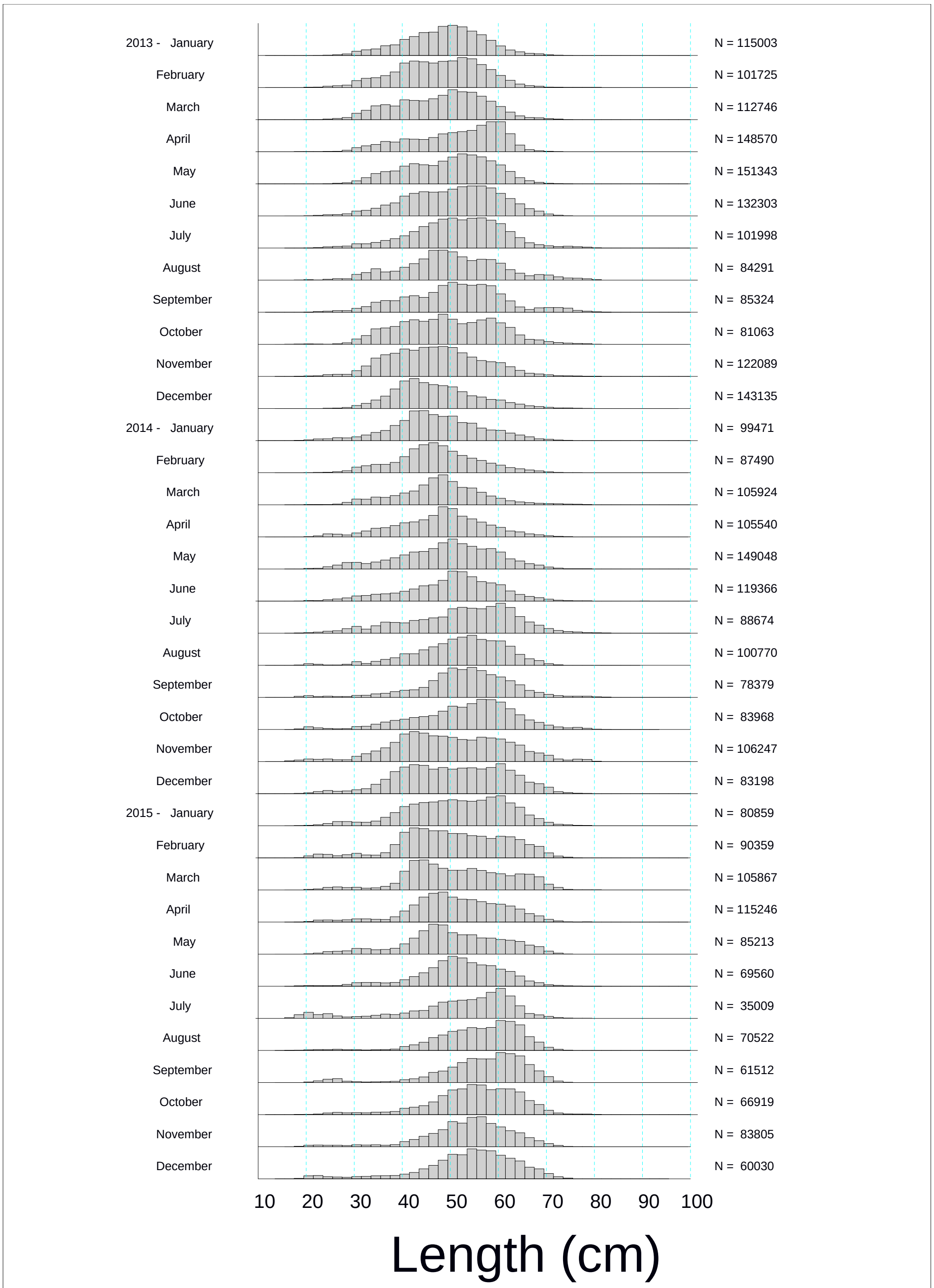


Figure A9. Monthly purse seine SKIPJACK length frequency histograms for the tropical WCPFC area, 2013-2015.

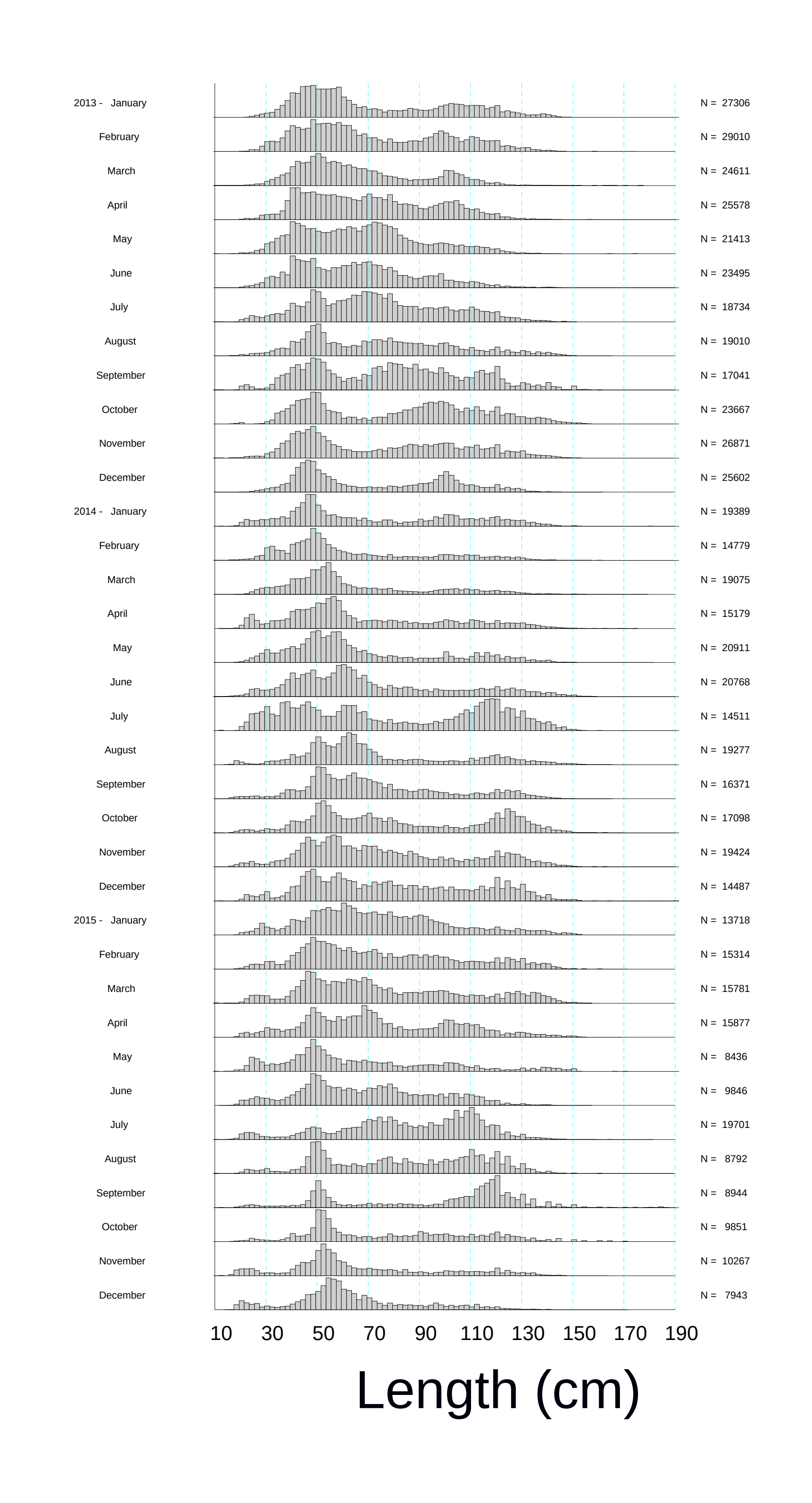


Figure A10. Monthly purse seine YELLOWFIN TUNA length frequency histograms for the tropical WCPFC area, 2013-2015.

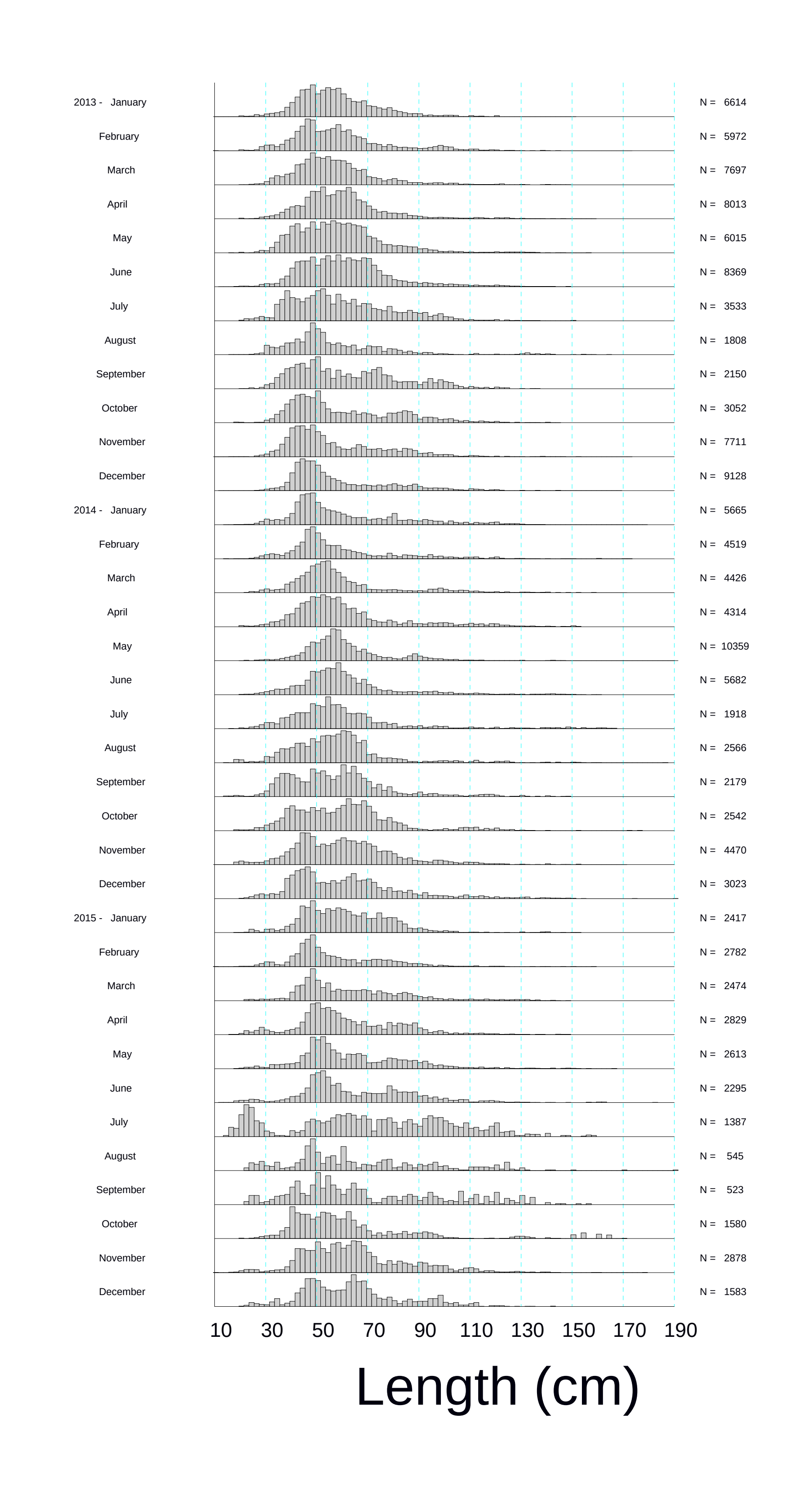


Figure A11. Monthly purse seine BIGEYE TUNA length frequency histograms for the tropical WCPFC area, 2013-2015.

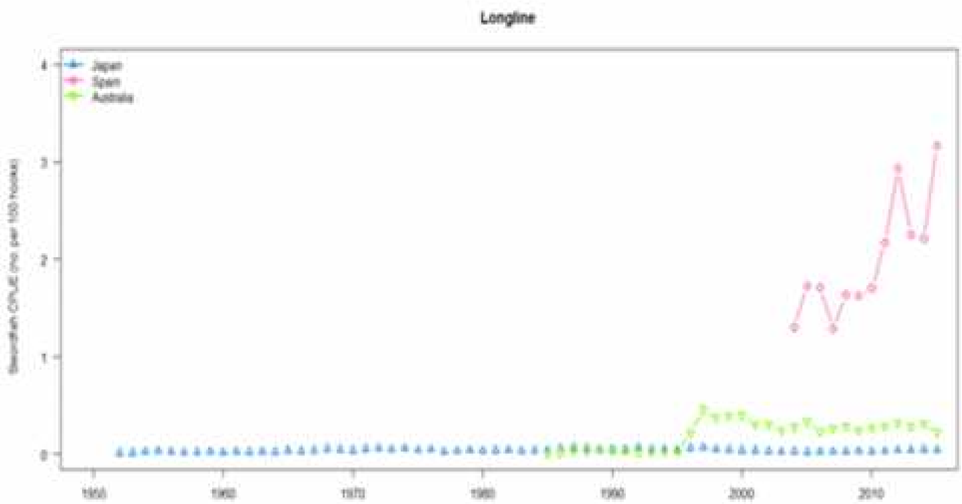


Figure A12. Trends in SWORDFISH nominal CPUE (number of fish per 100 hooks) over time for key LONGLINE fleets in the south Pacific Ocean.

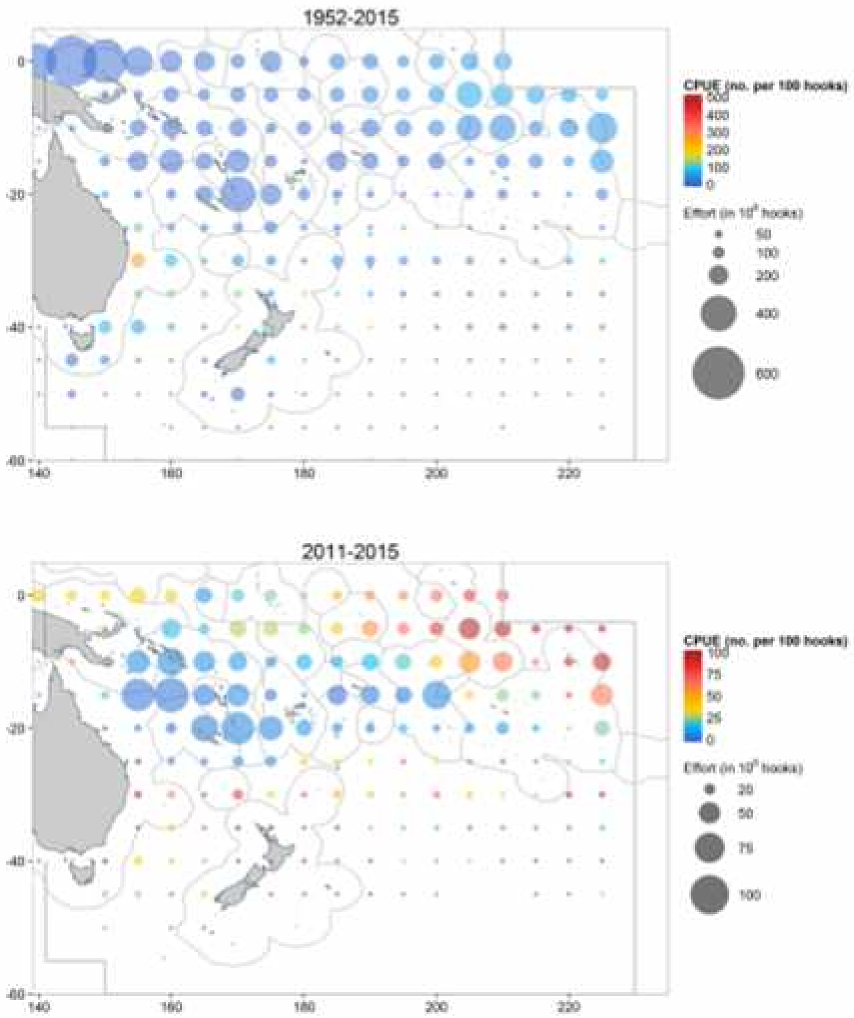


Figure A13. Distribution of South Pacific SWORDFISH longline CPUE and effort for the period 1952-2015 (top) and 2011-2015 (bottom).

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. Estimates are based on raised logsheet data with species composition adjusted using observer sampling with grab sample bias correction. Associated sets include animal-associated sets. "VESSELS (LOG)" represents the total number of vessels based on logsheet data.

YEAR	VESSELS (LOG)	DAYS	UNASSOCIATED SCHOOLS								ASSOCIATED SCHOOLS								TOTAL				
				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	218	33,483	14,462	278,051	70%	120,777	30%	1,423	0%	400,251	12,563	305,459	60%	164,333	32%	36,666	7%	506,458	27,025	583,510	285,110	38,088	906,708
2001	207	34,738	16,347	328,264	67%	154,962	32%	5,291	1%	488,517	11,246	260,525	63%	112,479	27%	39,801	10%	412,804	27,594	588,789	267,441	45,092	901,321
2002	215	38,317	16,977	380,175	79%	93,801	20%	6,536	1%	480,512	13,612	384,562	68%	133,034	24%	48,125	9%	565,722	30,590	764,737	226,835	54,662	1,046,233
2003	218	40,938	17,013	373,180	72%	145,268	28%	3,602	1%	522,051	13,318	314,988	67%	120,270	26%	31,748	7%	467,007	30,332	688,168	265,539	35,350	989,057
2004	224	43,792	11,134	198,271	76%	58,714	23%	2,535	1%	259,520	20,998	534,761	67%	204,403	26%	59,184	7%	798,348	32,133	733,032	263,117	61,719	1,057,868
2005	211	45,583	19,494	407,545	75%	132,608	24%	5,058	1%	545,211	17,091	428,570	67%	169,654	27%	42,527	7%	640,751	36,585	836,115	302,262	47,585	1,185,962
2006	207	42,364	15,305	328,150	78%	90,661	22%	3,439	1%	422,251	18,153	607,168	76%	144,569	18%	44,891	6%	796,628	33,459	935,318	235,230	48,331	1,218,879
2007	228	45,328	19,648	429,959	77%	125,273	22%	2,968	1%	558,199	16,703	611,260	77%	143,050	18%	38,892	5%	793,202	36,351	1,041,219	268,322	41,859	1,351,401
2008	239	48,996	22,718	425,108	68%	200,112	32%	3,212	1%	628,432	18,474	561,432	73%	159,132	21%	45,893	6%	766,457	41,192	986,541	359,244	49,105	1,394,889
2009	254	49,695	22,803	485,859	82%	101,106	17%	3,652	1%	590,616	21,305	713,125	77%	170,264	18%	47,644	5%	931,032	44,108	1,198,984	271,370	51,296	1,521,649
2010	269	52,399	37,883	686,225	76%	208,345	23%	7,731	1%	902,301	13,481	434,691	74%	108,143	19%	42,110	7%	584,944	51,364	1,120,916	316,488	49,840	1,487,245
2011	271	58,204	29,952	426,534	76%	129,899	23%	2,630	1%	559,063	21,735	617,999	74%	147,060	18%	65,459	8%	830,518	51,687	1,044,533	276,959	68,089	1,389,581
2012	285	55,240	36,547	630,315	75%	205,538	24%	7,669	1%	843,522	20,927	622,418	77%	131,642	16%	52,193	7%	806,253	57,474	1,252,733	337,180	59,862	1,649,775
2013	287	54,532	37,721	651,045	81%	147,540	18%	7,556	1%	806,141	17,954	571,024	73%	147,654	19%	59,259	8%	777,938	55,675	1,222,070	295,194	66,816	1,584,079
2014	293	53,965	38,423	758,046	80%	186,749	20%	8,522	1%	953,317	18,469	651,036	78%	129,244	16%	54,179	7%	834,459	56,892	1,409,082	315,993	62,702	1,787,776
2015	282	43,231	33,944	703,410	80%	168,367	19%	9,841	1%	881,617	14,064	575,324	81%	100,938	14%	34,933	5%	711,196	48,008	1,278,734	269,306	44,774	1,592,813

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)

For more comprehensive information on purse seine capacity, refer to

SC12\MI-WP-08 - Examining indicators of effort creep in the WCPO purse seine fishery