SCIENTIFIC COMMITTEE
FOURTH REGULAR SESSION

11–22 August 2008
Port Moresby, Papua New Guinea

OVERVIEW OF TUNA FISHERIES IN THE WESTERN AND CENTRAL PACIFIC OCEAN, INCLUDING ECONOMIC CONDITIONS – 2007

WCPFC-SC4-2008/GN WP-1

Paper prepared by

Peter Williams[1] and Peter Terawasi [2]

[1] Secretariat of the Pacific Community (SPC), Ocean Fisheries Programme (OFP), Noumea, New Caledonia
[2] Pacific Islands Forum Fisheries Agency (FFA), Honiara, Solomon Islands

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 targetted 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 – 2007. The review draws on the latest catch estimates compiled for the WCP–CA, which can be found in Information Paper WCPFC–SC4 ST IP–1 *(Estimates of annual catches in the WCPFC Statistical Area – OFP, 2008a)*. Where relevant, comparisons with previous years' activities have been included, although it should be noted that data for 2007, for some fisheries, are provisional at this stage.

This paper includes sections covering a summary of total target tuna catch in the WCP–CA tuna fisheries, an overview of the WCP–CA tuna fisheries by gear, including economic conditions in each fishery, and a summary of target tuna catches by species. In each section, the paper makes some observations on recent developments in each fishery, with emphasis on 2007 catches relative to those of recent years, but refers readers to the SC4 National Fisheries Reports, which offer more detail of recent activities at the fleet level.

This paper acknowledges, but does not currently include, information on several WCP–CA fisheries, including the north Pacific albacore troll, the north and south Pacific swordfish, the Vietnamese and several artisanal fisheries. These fisheries may be covered in future reviews, depending on the availability of more complete data. This paper does not include a description of non-target species catches at this stage.

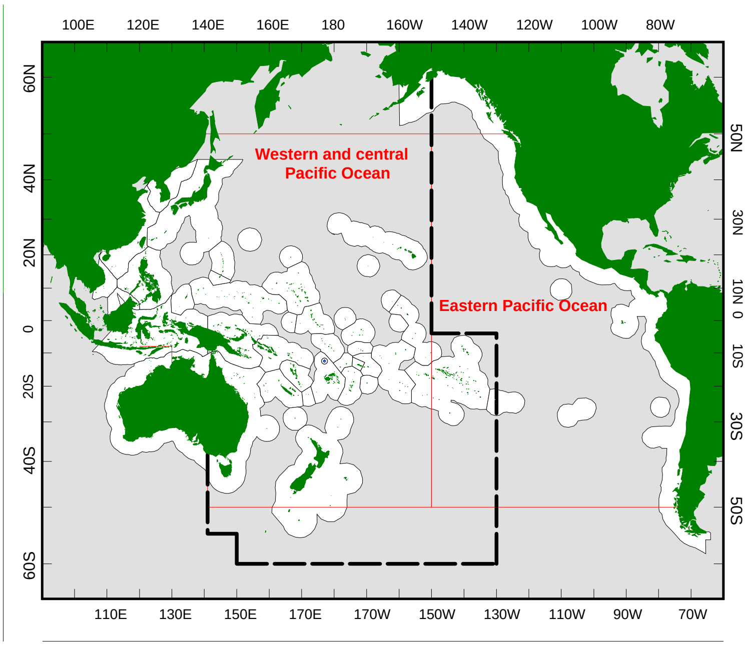

Figure 1. The western and central Pacific Ocean (WCPO), the eastern Pacific Ocean (EPO) and the WCPFC Convention Area (WCP–CA in dashed lines)

2. TOTAL TUNA CATCH FOR 2007

Annual total catches of the four main tuna species (skipjack, yellowfin, bigeye and albacore) in the WCP–CA increased steadily during the 1980s as the purse seine fleet expanded and remained relatively stable during most of the 1990s until the sharp increase in catch during 1998. Over the past 6 years, there has been an increasing trend in total tuna catch, primarily due to increases in purse-seine fishery catches (Figure 2 and Figure 3). The provisional total WCP–CA tuna catch for 2007 was estimated at **2,396,815 mt**, clearly the highest annual catch recorded, and more than 120,000 mt higher the previous record in 2006 (2,273,322 mt). During 2007, the purse seine fishery accounted for an estimated 1,739,859 mt (73% of the total catch, and a record for this fishery), with pole-and-line taking an estimated 214,935 mt (9%), the longline fishery an estimated 232,388 mt (10%), and the remainder (8%) taken by troll gear and a variety of artisanal gears, mostly in eastern Indonesia and the Philippines. The WCP–CA tuna catch (2,396,815 mt) for 2007 represented 84% of the total Pacific Ocean catch of 2,800,740 mt, and 55% of the global tuna catch (the provisional estimate for 2007 is just under 4.4 million mt).

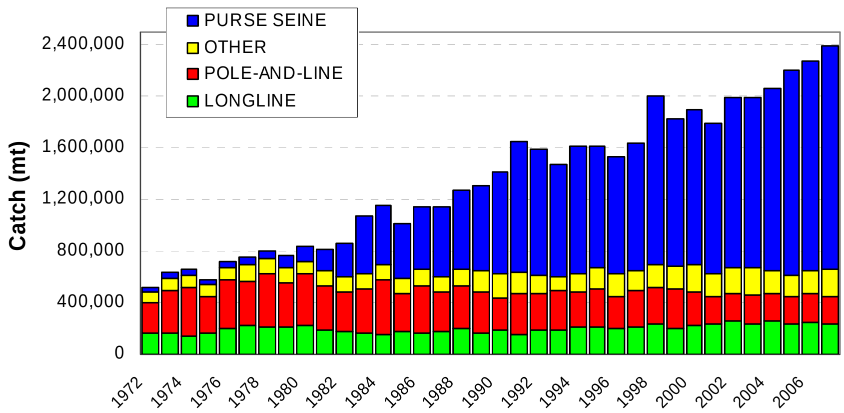

Figure 2. Catch (mt) of albacore, bigeye, skipjack and yellowfin in the WCP–CA, by longline, pole-and-line, purse seine and other gear types

The 2007 WCP–CA catch of skipjack (1,726,702 mt – 72% of the total catch) was the highest ever, continuing the trend of consecutive record catches since 2002. The WCP–CA yellowfin catch for 2007 (431,814 mt – 18%) was lower than in 2006 (442,288 mt), but higher than the average catch level for the period since 2000 (~424,000 mt). The WCP–CA bigeye catch for 2007 (143,059 mt – 6%) was the second highest on record (after the catch in 2004–156,768 mt), mainly due to a relatively high estimated bigeye catch from the purse seine fishery[1]. The 2007 WCP–CA albacore[1] catch (95,240 mt [4%] was the lowest for over ten years, primarily due to the continuing trend of low catches in the North Pacific in recent years.

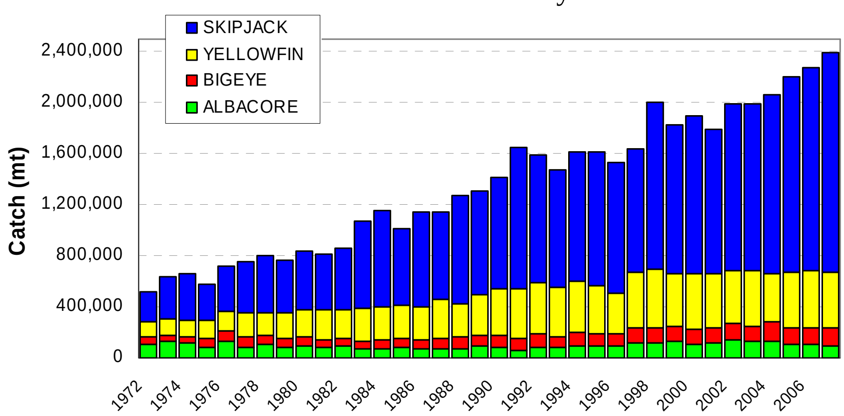

Figure 3. Catch (mt) of albacore, bigeye, skipjack and yellowfin in the WCP–CA.

[1] although observer data for 2007, used to estimate the purse-seine bigeye tuna catch, are very preliminary

[1] includes catches of North and South Pacific albacore in the WCP–CA, which comprised 77% of the total Pacific Ocean albacore catch of 124,496 mt in 2007; the section 7.4 "Summary of Catch by Species - Albacore" is concerned only with catches of South Pacific albacore, which make up approximately 50% of the Pacific albacore catch.

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 contributing around 73% of total tuna catch volume (~1,700,000 mt – Figure 2). The majority of the historic WCP–CA purse seine catch has come from the four main DWFN fleets – Japan, Korea, Chinese-Taipei and USA, which numbered 147 vessels in 1995, but has gradually declined in numbers to 110 vessels in 2007[2]. In contrast, there has been a steady increase in the number of vessels from Pacific Islands fleets, which totalled 66 vessels in 2007 (Figure 4). The remainder includes a large number of smaller vessels in the Indonesian and Philippines domestic fisheries, and a variety of other domestic and foreign fleets, including several relatively recent distant-water entrants into the tropical fishery (e.g. China, New Zealand and Spain).

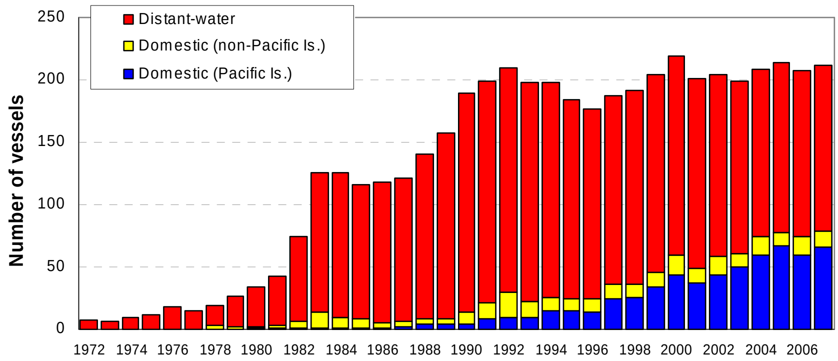

Figure 4. Number of purse seine vessels operating in the WCP–CA
(this does not include the Japanese Coastal purse seine fleet and the Indonesian and Philippines domestic purse-seine/ringnet fleets which account for over 1,000 vessels)

The WCP–CA purse-seine fishery is essentially a skipjack fishery, unlike those of other ocean areas. Skipjack generally account for 70–85% of the purse seine catch, with yellowfin accounting for 15–30% and bigeye accounting for only a small proportion (Figure 5). 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 decade include:

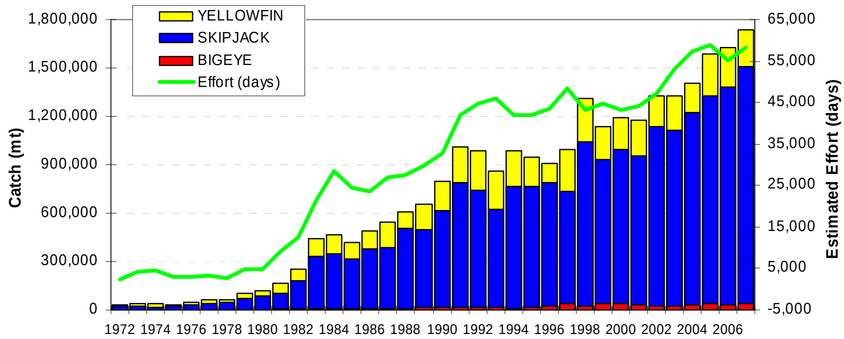

Figure 5. Purse seine catch (mt) of bigeye, skipjack and yellowfin and estimated fishing effort (days fishing and searching) in the WCP–CA

- Annual skipjack catches fluctuating between 600,000 and 800,000 mt prior to 1998, a significant increase in the catch during 1998, with catches now maintained well above 1,000,000 mt;
- Annual yellowfin catches fluctuating considerably between 115,000 and 270,000 mt. The proportion of yellowfin in the catch is generally higher during El Niño years and lower during La Niña years (for example, 1995/96 and to a lesser extent 1999/2000);
- Increased bigeye tuna purse seine catches, (e.g. 42,633 mt in 1997 and 37,525 mt in 2000) coinciding with the introduction of drifting FADs (since 1996). In the period 2001–2006, bigeye catches were generally lower, but the provisional catch estimate for bigeye in 2007 (38,324 mt) was the second highest on record.

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[2] The number of vessels by fleet in 1995 was Japan (31), Korea (30), Chinese-Taipei (42) and USA (44) and in 2007 the number of vessels by fleet was Japan (35), Korea (28), Chinese Taipei (34) and USA (13). However, the US fleet began rebuilding their purse-seine fleet in the latter part of 2007, and by early 2008 numbered 21 vessels with further increases during 2008 – refer to the SC4 National Report for the USA.

Total estimated effort tends to track the increase in the catch over time (Figure 5), with years of exceptional catches apparent when the effort line overlays the histogram bar (i.e. in 1998, 2002, 2006 and 2007).

3.2 Provisional catch estimates, fleet size and effort (2007)

The provisional **2007 purse-seine catch of 1,739,859 mt** was the highest on record, with most fleets catching more than in 2006, particularly the Chinese Taipei, PNG and Marshall Islands fleets. The 2007 purse-seine catch was dominated by a record catch of skipjack tuna (1,472,746 mt – 85% of the total catch). The purse-seine skipjack catch increased by more than 500,000 mt (or 59%) since 2001, at an average of about 90,000 mt per year. The 2007 purse-seine catch of yellowfin tuna (228,426 mt – 13%) was lower than catches in recent years, but still higher than the average for the period since 2000 (~218,000 mt). The provisional catch estimate for bigeye tuna for 2007 (38,324 mt – 2%) was the second highest on record but may be revised once all observer data for 2007 have been received and processed[3].

Figure 6 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 2007 catch for these fleets was the highest ever even though effort has not changed significantly over the past six years, suggesting the continuation of the high catch rates experienced in recent years (see section 3.4). The Chinese-Taipei fleet had been the highest producer in the tropical purse seine fishery until 2004, when surpassed by the combined Pacific Islands purse seine fleets fishing under the FSM Arrangement; in the past two years, the Korean and FSM Arrangement fleets have been the highest producers. 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 FSM Arrangement fleet until 2005 corresponds to an increase in vessel numbers, and coincidently, mirrors the decline in US purse seine catch, vessel numbers and effort over this period. However, as noted above, the US purse-seine fleet commenced a significant rebuilding phase in late 2007, with vessels numbers in mid-2008 close to double that of recent years.

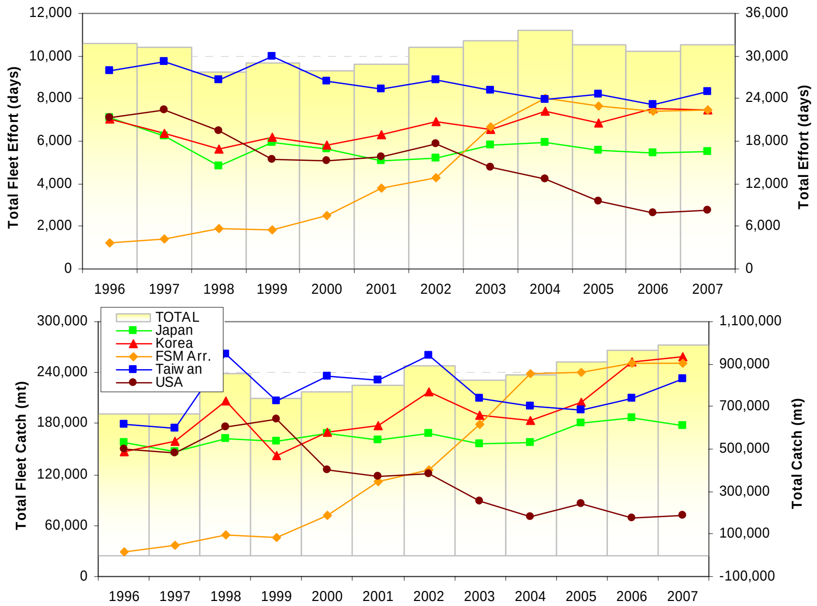


Figure 6. Trends in annual effort (top) and catch (bottom) estimates for the top five purse seine fleets operating in the tropical WCP–CA, 1996–2007.

The total number of Pacific-island domestic vessels has now stabilised at 66 vessels after a period of sustained growth over more than a decade – at its highest level, there were 67 vessels (2005) in this category. The Pacific-islands purse seine fleets comprise vessels fishing under the FSM Arrangement (32 vessels in 2007), the Vanuatu fleet operating under bilateral arrangements (10 vessels) and domestic vessels operating in PNG and Solomon Islands waters. The FSM Arrangement fleet comprises vessels managed by the Pacific Island "Home Parties" of PNG (19 vessels), the Marshall Islands (5 vessels), FSM (4 vessels), Kiribati (1 vessels) and the Solomon Islands (3 vessels) which fish over a broad area of the tropical WCP–CA.

[3] Purse-seine bigeye catches have been adjusted to account for the mis-identification of bigeye as yellowfin in operational catch data and reports of unloadings by a process which uses observer data (see Lawson, 2007). The methodology for estimating the purse-seine bigeye catch will be refined based on the findings in Lawson, 2008.

The domestic Philippine purse-seine and ring-net fleets operate in Philippine and northern Indonesian waters, and have taken a combined catch of around 200,000 t. in recent years (OFP, 2008a). The domestic Indonesian purse-seine and ringnet fleets take a similar catch level which means that between 20-25% of the WCP-CA purse seine catch now comes from the waters of these countries.

Figure 7 shows the annual trends in the school types set on by the major purse-seine fleets. The proportion of sets on free-swimming (unassociated) schools of tuna increased for all fleets in 2007 (compared to 2006), with a corresponding decrease on the number of sets on associated schools (logs and drifting FADs) – this trend was also experienced from 2004 to 2005. Overall, unassociated sets accounted for about 60% of all sets for these fleets during 2007 (compared to around 50% in 2006). The Korean purse-seine fleet predominantly fish on unassociated, free-swimming schools (75% of all sets during 2007). Of the associated set types, log sets have been favoured over drifting FAD sets by most purse seine fleets in recent years, with the exception being the US fleet which continues to operate in more eastern (and southern) areas of the WCP–CA concentrating on drifting FAD sets (59% in 2007 according to available logsheet data). Preliminary review of available observer data for the period 2004-2006 shows similar trends in effort by flag and set type when compared to the logsheet data (OFP, 2008b).

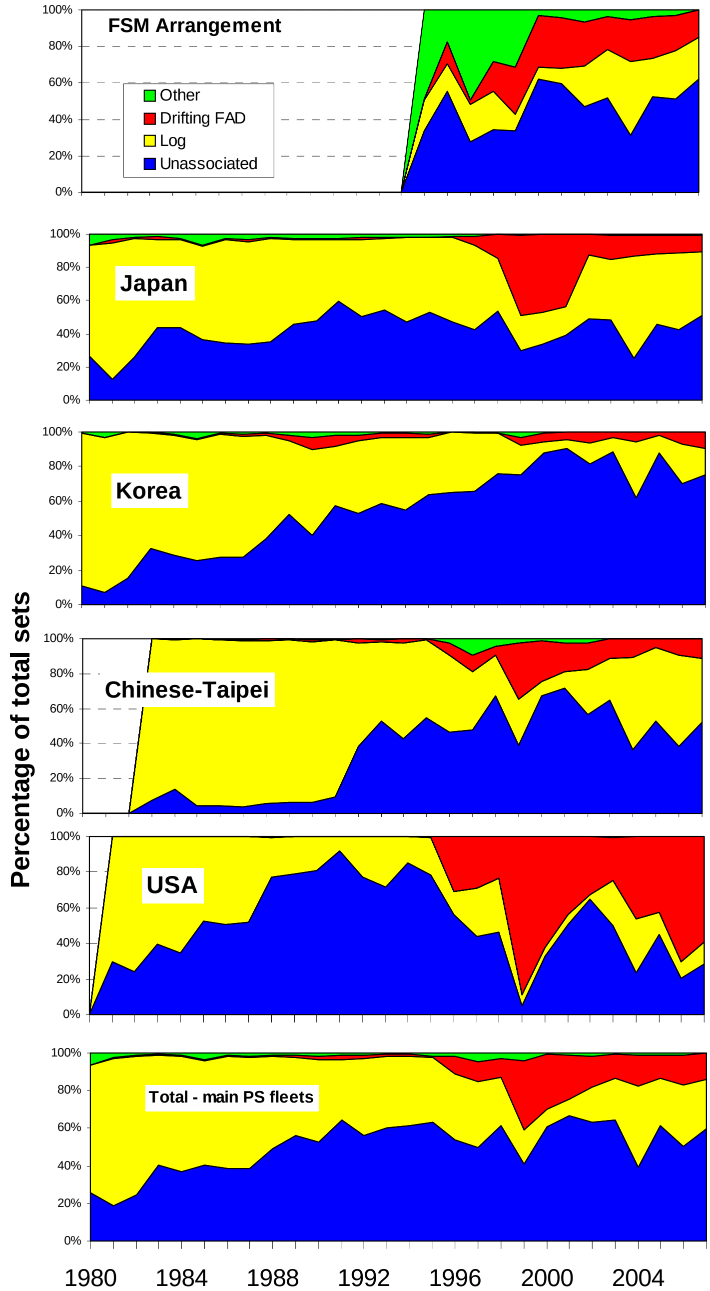


Figure 7. Time series showing the percentage of total sets by school type for the major purse-seine fleets operating in the WCP–CA.

3.3 Distribution of fishing effort and catch

The purse seine catch distribution in tropical areas of the WCP–CA is strongly influenced by El Nino–Southern Oscillation Index (ENSO) events. Figure 8 demonstrates the effect of ENSO events on the spatial distribution of the purse-seine activity, with fishing effort typically distributed further to the east during El Nino years and a contraction westwards during La Nina periods.

The WCP–CA experienced an ENSO-transitional (or neutral) period during 2001, an El Nino period during 2002 and into the first quarter of 2003, followed by a return to an ENSO-transitional (neutral) period for the remainder of 2003. The ENSO-neutral state continued into the first half of 2004 and then moved to a weak El Nino state in the second half of 2004. During 2005, the WCP–CA was generally in an ENSO-neutral state, moving from a weak El Niño in the early months of 2005 through to a weak La Nina-state by the end of 2005.

The weak La Nina established at the end of 2005 continued into the first part of 2006, but soon dissipated and a weak El Nino event then presided over the remainder of 2006. During the first half of 2007, the WCP–CA was in an ENSO-neutral state, but then moved into a well-established La Nina state, which persisted into the 2nd quarter 2008. Fishing activity during 2007 remained concentrated in the PNG, FSM and Solomon Islands area and was restricted from extending east beyond the 175°E longitude (compared to activity in recent years) due to cooler surface water temperatures flowing in from the east, in line with the prevailing ENSO conditions.

The distribution of effort by set type Figure 8 (right) for the past seven years shows that the establishment of the El Nino event during 2002 resulted in a higher proportion of log-associated sets east of 160°E than in 2001 when drifting FADs were used to better aggregate schools of tuna in the absence of logs, and/or where unassociated schools were not as available in this area. The reduction in the use of drifting FAD sets in recent years is probably related to the displacement of effort further west to an area where free-swimming and log-asssociated tuna schools were more available to purse seine fleets, and therefore less of a need to use drifting FADs. There was a significant increase in the number of log sets made during 2004 suggesting that, for one reason or another, more logs had moved into the main fishing area and had successfully aggregated tuna schools. In contrast to the period 2001–2003, the distribution of effort by set type has not changed significantly over the past four years (2004–2007). The proportion of sets by set type to the east of 170°E appears to depend on the availability of free-swimming schools (there were more available during 2005 than in 2004 and 2006, for example).

Figure 9 through 13 show the distribution of purse seine effort for the five major purse seine fleets during 2006 and 2007. The distribution of effort for the FSM Arrangement and Chinese Taipei fleets in 2007 was very similar to that of 2006. The Japanese fleet concentrated effort in the western areas during 2007, with less effort in Kiribati and the Solomon Islands than in 2006. In contrast, the Korean fleet effort during 2007 was concentrated in the waters of the Solomon Islands, Nauru, Kiribati and the adjacent high seas. There was less overlap in the areas fished by the US fleet to the areas fished by the other major fleets during 2007, with most activity in the far eastern areas (i.e. the area from the Phoenix to Line Islands) conducted in the 3rd Quarter 2007 (Figure 13 – right). The FSM Arrangement fleet tends to fish in a similar area to the Asian fleets, although there is also activity in the home waters of some vessels (Figure 9).

Figure 14 shows the distribution of catch by species for the past seven years, Figure 15 shows the distribution of skipjack and yellowfin catch by set type for the past seven years, and Figure 16 shows the distribution of estimated bigeye catch by set type for the past seven years. The distribution and proportion of skipjack and yellowfin in the purse-seine catch has been relatively consistent over the past three years (Figure 14–left).

Unassociated sets tend to account for a higher proportion of the total yellowfin catch in the area to the east of 160°E than they do for the total skipjack catch. Higher proportions of yellowfin in the overall catch (by weight) usually occur during El Nino 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 evidence of this during 2001 (Figure 15) and for the most recent strong El Nino year (2002), despite it being considered an overall poor year for yellowfin catch (Langley et al., 2008). Yellowfin tuna comprised a slightly lower proportion of the total logsheet-reported catch in 2007 than in 2006 and 2005 (Figure 14) since there was less effort in the eastern tropical WCP–CA during 2007 due to the prevailing La Nina conditions (Figure 15–right).

In contrast to yellowfin, associated-school sets usually account for a higher proportion of the skipjack and bigeye catch in the respective total catch of each species (Figure 15–left and Figure 16). The estimated proportion of bigeye in the “yellowfin plus bigeye” catch tends to be dominated by anchored FADs and logs in the area to the west of 170°E, and drifting FAD sets in the area to the east of 170°E (Figure 16), although there are certain conditions conducive to relatively large unassociated-school catches of bigeye in the east (for example, during 2001 and 2002 in Figure 16). The distribution of the estimated bigeye catch by set type for 2007 is based on very few observer data and should be treated as provisional at this stage.

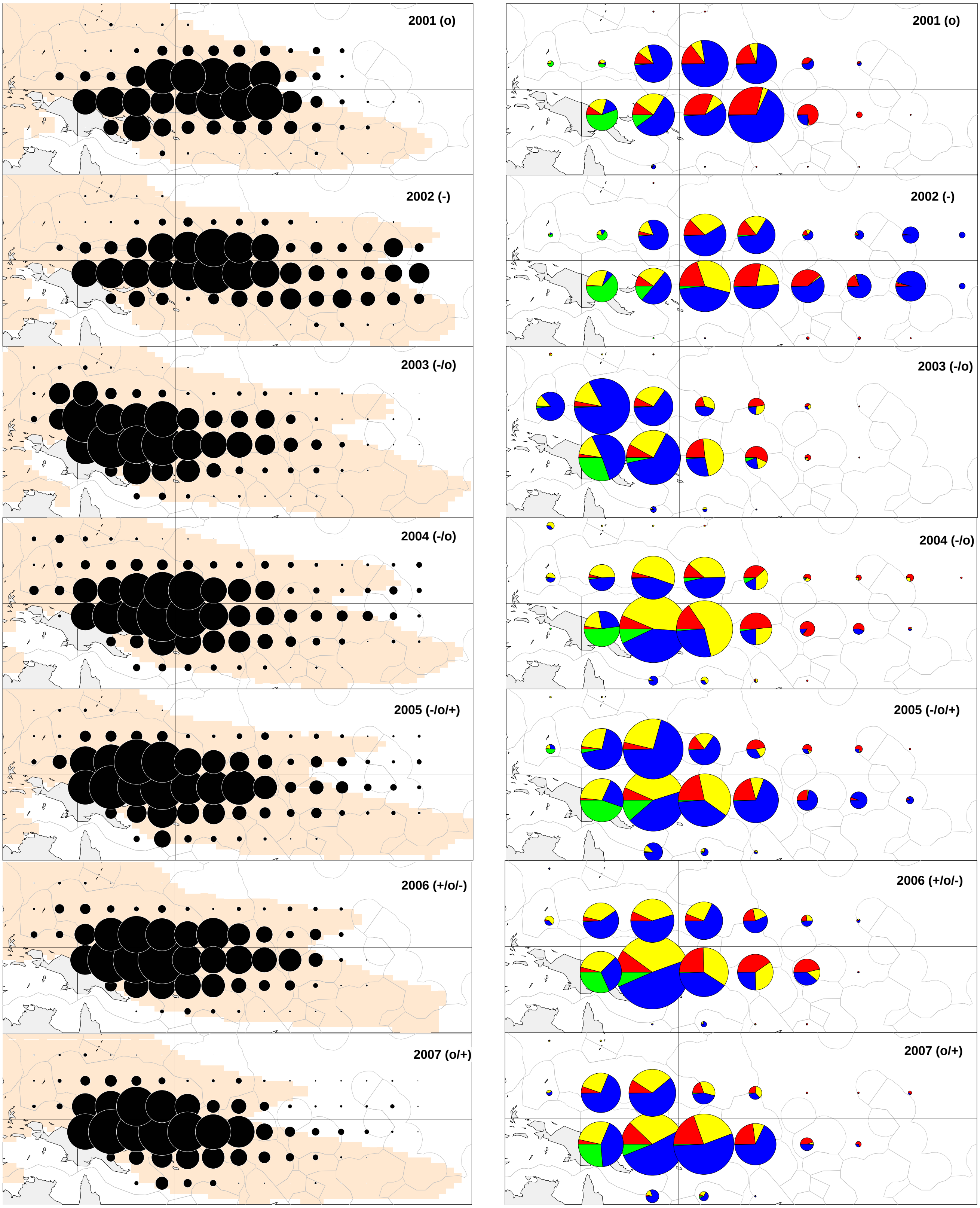
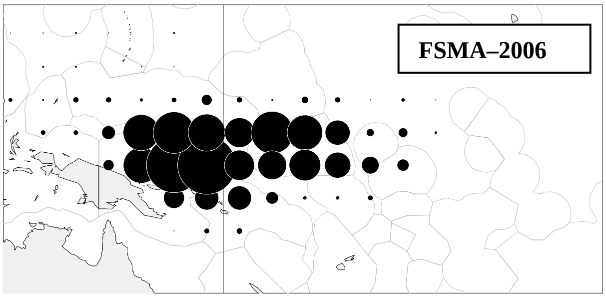


Figure 8. Distribution of purse-seine effort (days fishing – left; sets by set type – right), 2001–2007. (Blue–Unassociated; Yellow–Log; Red–Drifting FAD; Green–Anchored FAD).

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

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



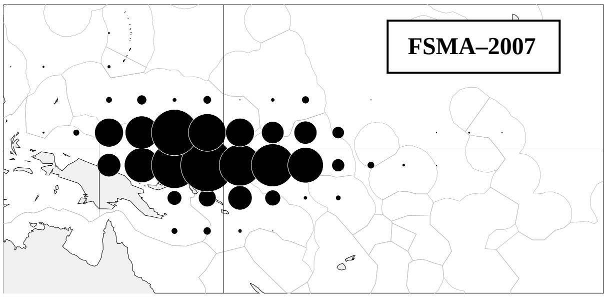
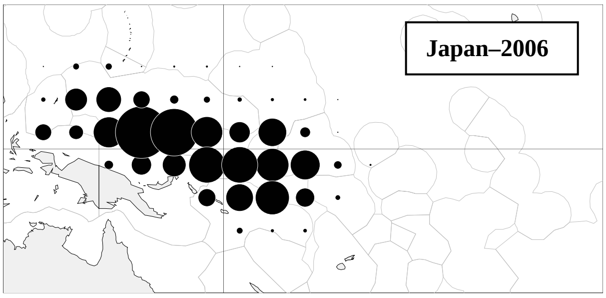


Figure 9. Distribution of effort by fleets operating under the FSM Arrangement during 2006 and 2007
lines for the equator (0° latitude) and 160°E longitude included.



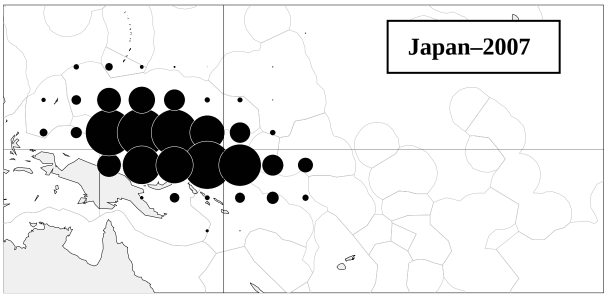
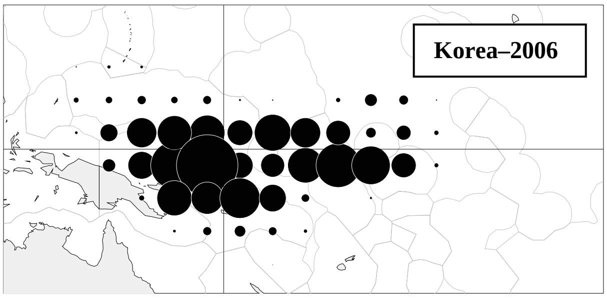


Figure 10. Distribution of effort by the Japanese purse seine fleet during 2006 and 2007
lines for the equator (0° latitude) and 160°E longitude included.



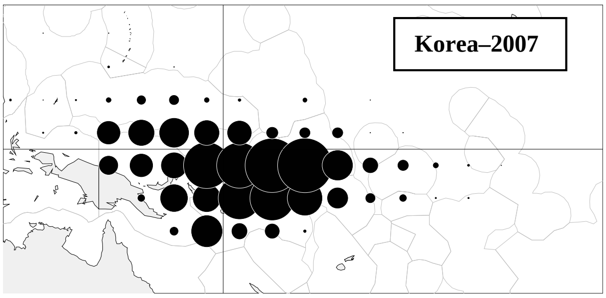
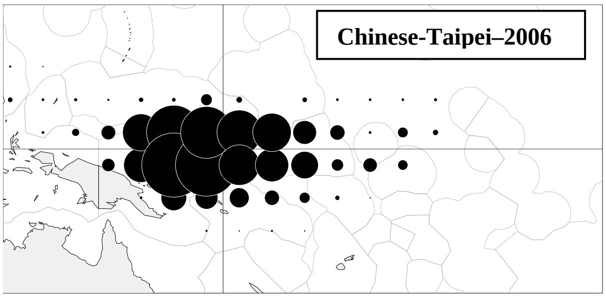


Figure 11. Distribution of effort by the Korean purse seine fleet during 2006 and 2007
lines for the equator (0° latitude) and 160°E longitude included.



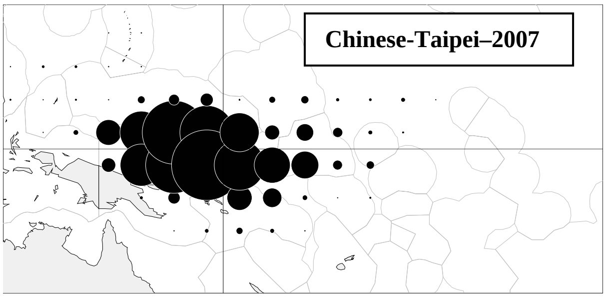
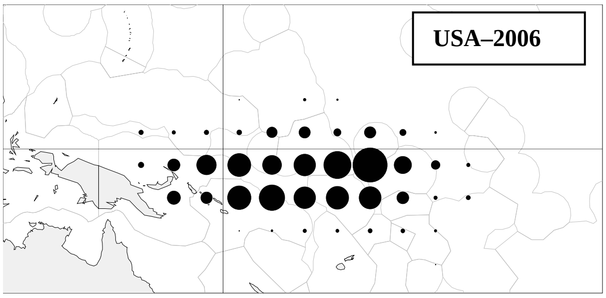


Figure 12. Distribution of effort by the Chinese-Taipei purse seine fleet during 2006 and 2007
lines for the equator (0° latitude) and 160°E longitude included.



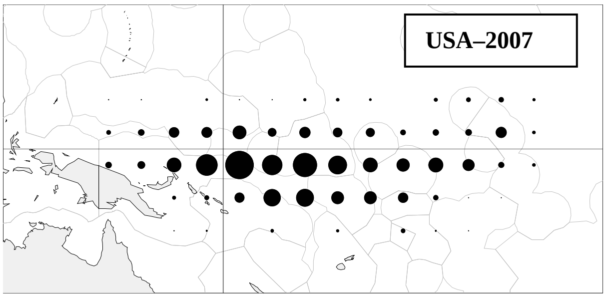


Figure 13. Distribution of effort by the US purse seine fleet during 2006 and 2007
lines for the equator (0° latitude) and 160°E longitude included.

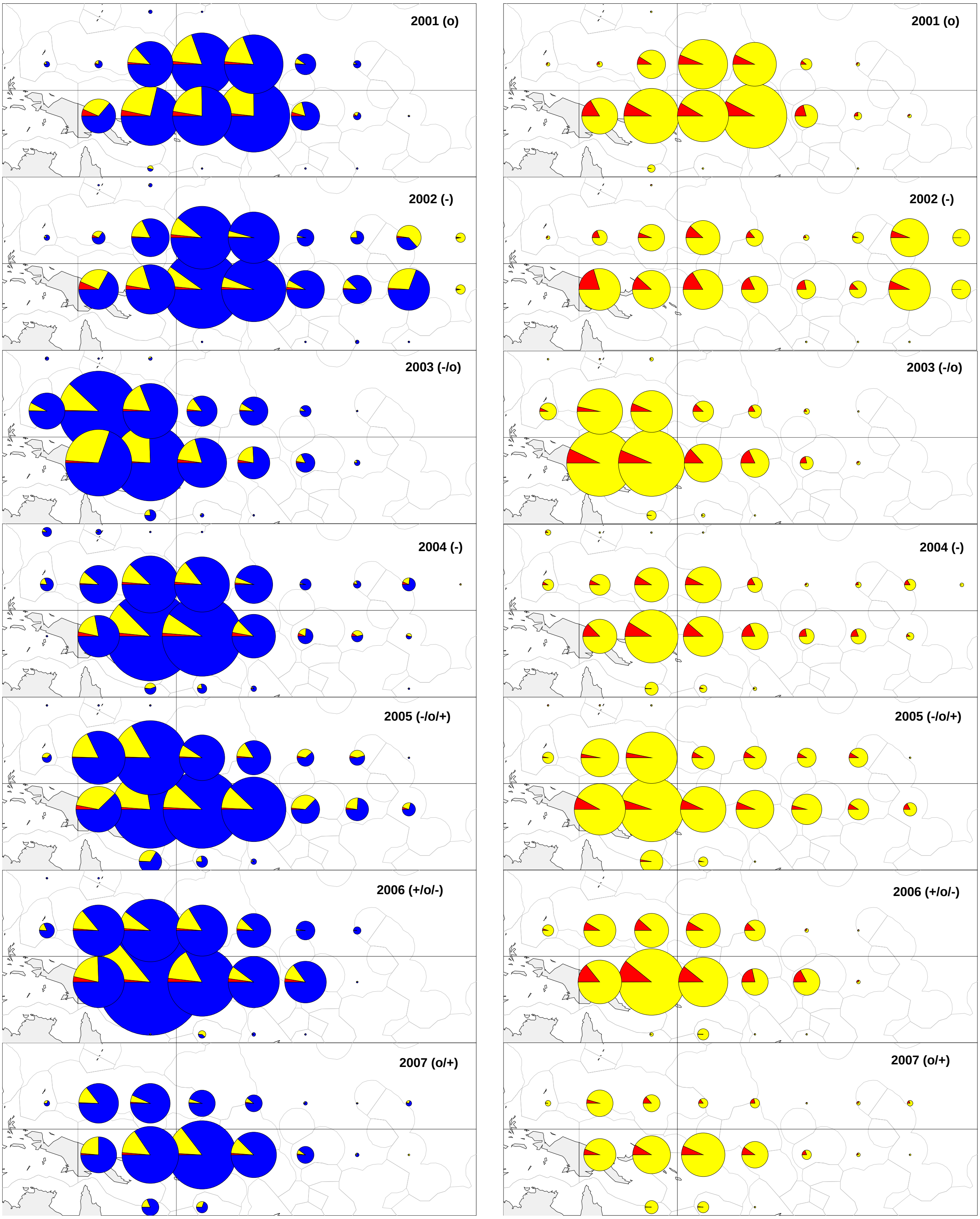


Figure 14. Distribution of purse-seine skipjack/yellowfin/bigeye tuna catch (left) and purse-seine yellowfin/bigeye tuna catch only (right), 2001–2007 (Blue–Skipjack; Yellow–Yellowfin; Red–Bigeye).

ENSO periods are denoted by "+": La Niña; "-": El Niño; "--": strong El Niño; "0": transitional period.
Estimates of bigeye catch for 2007 are provisional.

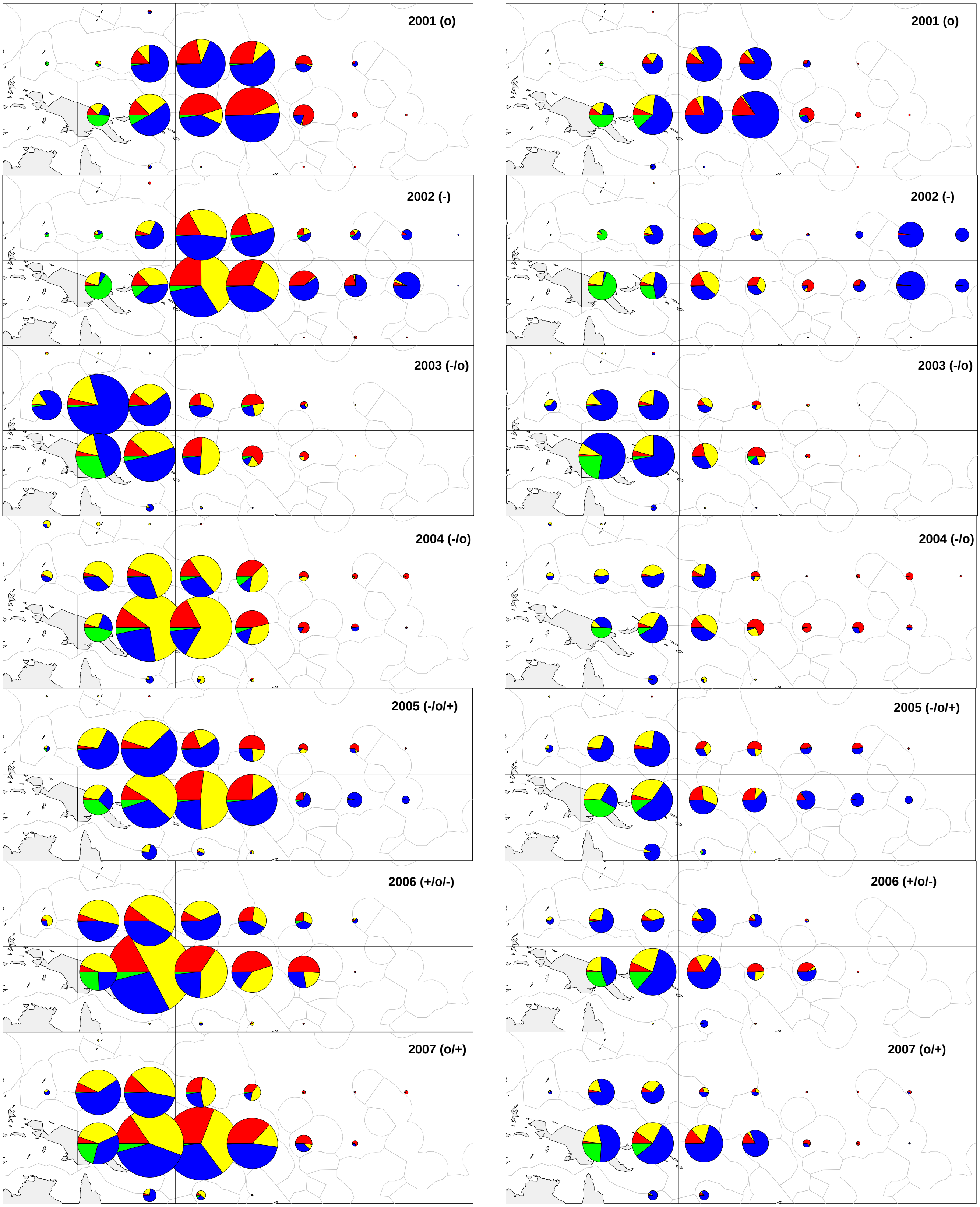


Figure 15. Distribution of skipjack (left) and yellowfin (right) tuna catch by set type, 2001–2007 (Blue–Unassociated; Yellow–Log; Red–Drifting FAD; Green–Anchored FAD).

ENSO periods are denoted by "+": La Niña; "-": El Niño; "--": strong El Niño; "o": transitional period.
Sizes of circles for all years are relative for that species only.

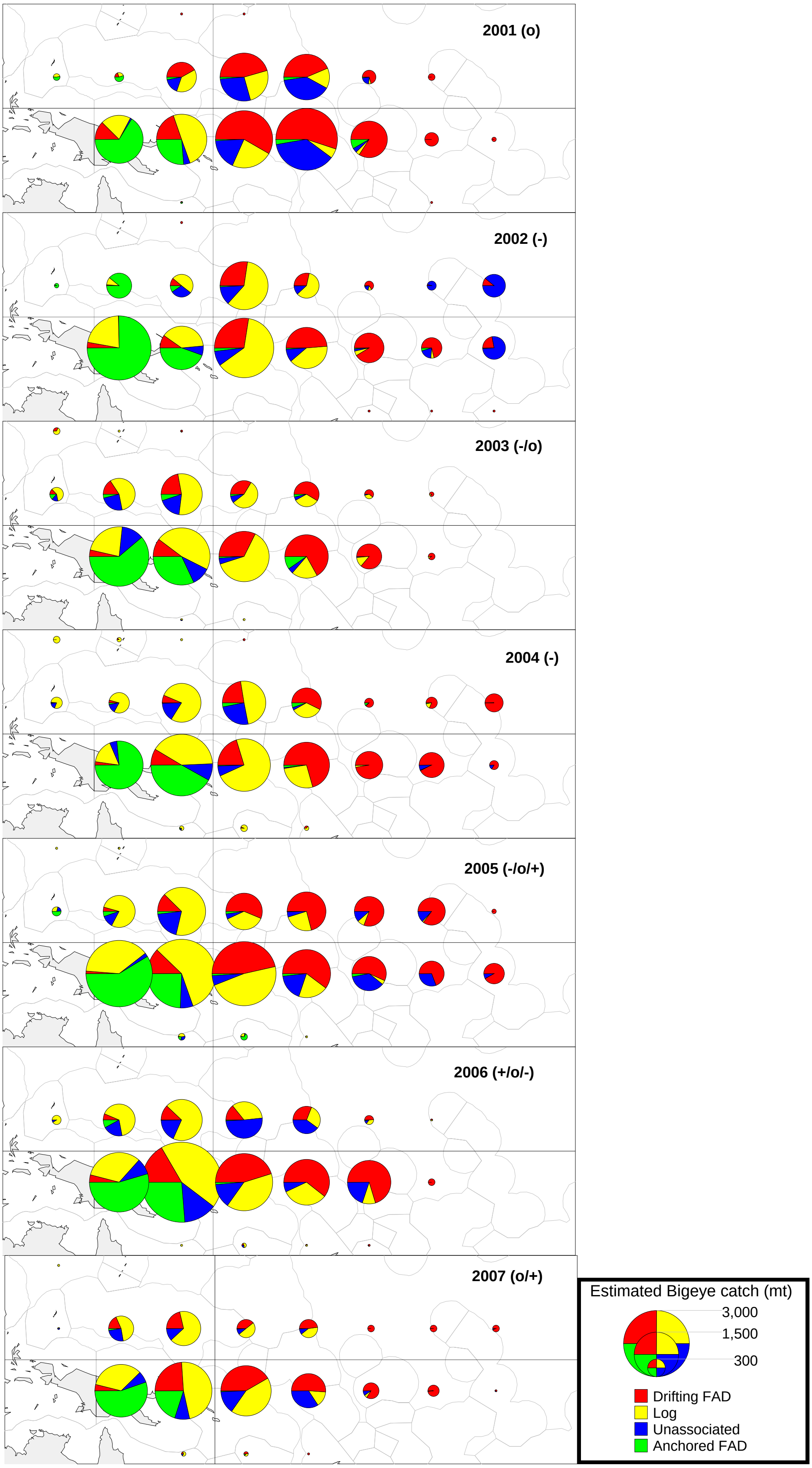


Figure 16. Distribution of estimated bigeye tuna catch by set type, 2001–2007 (Blue–Unassociated; Yellow–Log; Red–Drifting FAD; Green–Anchored FAD).
ENSO periods are denoted by "+": La Niña; "-": El Niño; "--": strong El Niño; "0": transitional period.
Estimates of bigeye catch for 2007 are provisional.

3.4 Catch per unit of effort

Figure 17 shows the annual time series of CPUE by set type and vessel nation for skipjack (left) and yellowfin (right). Purse-seine skipjack CPUE for unassociated sets increased slightly for most of the major fleets in 2007, with the exception of the Japanese fleet. In contrast, 2007 catch rates for log- and drifting FAD-associated schools of skipjack were stable or slightly lower than in 2006. The overall skipjack CPUE during 2007 was similar to 2006, but a higher level of effort (Figure 5) resulted in a record catch. Contrary to the period 2000–2004, the skipjack CPUE for the US fleet has returned to the level of the other major fleets in recent years. The level of skipjack CPUE for the US fleet appears to be related to the overlap (or not) of areas fished with other fleets during respective periods – this is likely to be more accentuated in the future, with the addition of vessels into the US purse-seine fleet that will mainly operate in the more western areas of the tropical WCP–CA.

Yellowfin purse-seine CPUE is characterised by strong inter-annual variability and differences among the fleets. School-set CPUE is strongly related to 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. ENSO variability is also believed to impact the size of yellowfin and other tuna stocks through impacts on recruitment. Associated (log and drifting FAD) sets generally produce higher catch rates (mt/day) for skipjack than unassociated sets, yet unassociated sets produce a higher catch rate for yellowfin than associated sets. This is mainly due to unassociated sets in the eastern areas of the tropical WCP–CA taking large, adult yellowfin, which account for a larger catch (by weight) than the (mostly) juvenile yellowfin encountered in associated sets.

Figure 17. 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.

The Yellowfin CPUE for all set types in 2007 was generally higher than in 2006, but not as high as the level experienced in 2005 (Figure 17). The trend in total skipjack CPUE over this time series (Figure 17) is clearly upwards and related to increased abundance and improved efficiency in fishing strategy and technological advances in equipment used to better locate schools of tuna. In contrast, the trend in total yellowfin tuna CPUE is clearly downwards over the period 1998–2004; since the very low yellowfin CPUE experienced in 2004, there is some indication of an upward trend for these fleets (Figure 17–right).

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 an order of magnitude higher (Figure 18). The trends in estimated bigeye tuna CPUE are similar to the trends in yellowfin tuna CPUE to a certain extent, bearing in mind that the 2007 estimates are provisional.

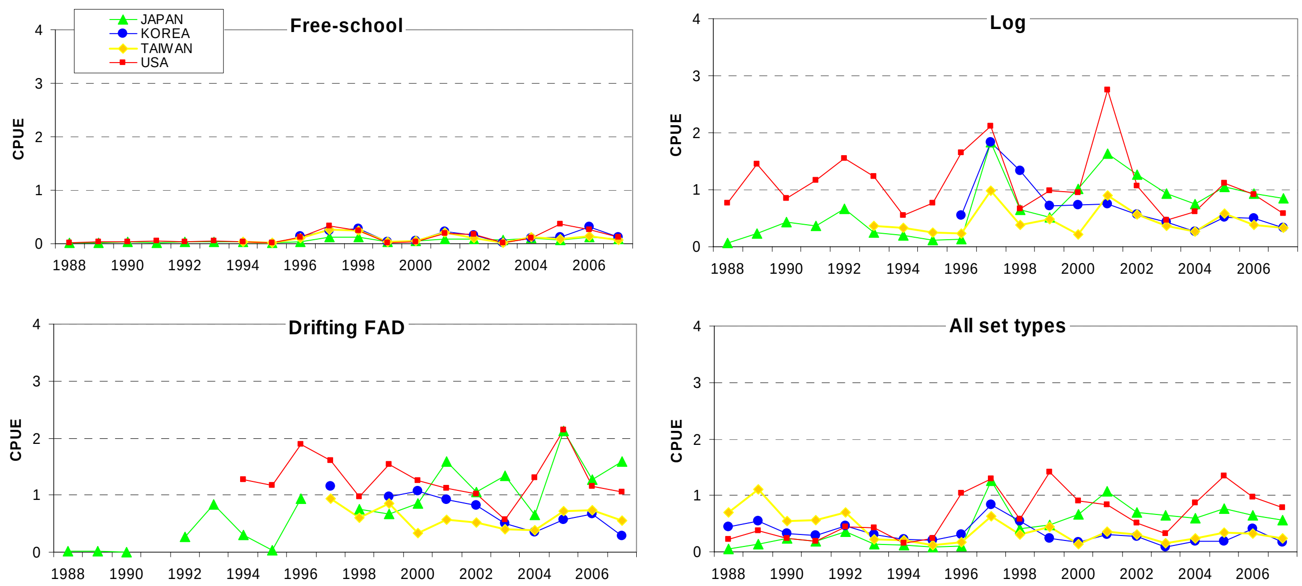
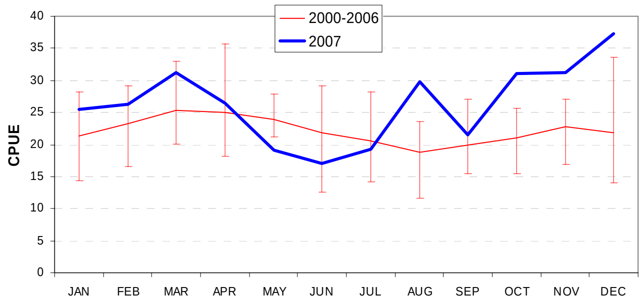


Figure 18. Estimated Bigeye tuna CPUE (mt per day) by major set-type categories (free-school, log and drifting FAD sets) and all set types combined for Japanese, Korean, Chinese-Taipei and US purse seiners fishing in the tropical WCP–CA.

Effort and CPUE were partitioned by set type according to the proportions of total sets attributed to each set type.
Estimates of bigeye catch for 2007 are provisional.

3.5 Seasonality

Figure 19 shows the seasonal average CPUE for skipjack (left) and yellowfin (right) in the purse seine fishery for the period 2000–2007, and Figure 20 shows the distribution of effort by quarter for the period 2000-2006 contrasting with seasonal effort in 2007. Over the period 2000–2006, the average monthly skipjack CPUE was highest from February–May which is in contrast to the yellowfin CPUE, which was at its lowest during the early part of the year, but gradually increased towards the end of the year. This situation corresponds to the extension east of the fishery in the second half of the year (Figure 20), 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 thermocline. Evident in the CPUE graphs (Figure 19) are the exceptional catches of skipjack tuna experienced during the first and fourth quarters of 2007, with October–November 2007 producing amongst the highest monthly catch rates for the period 2000–2007. The monthly Yellowfin tuna CPUE for the first quarter 2007 was above the average for the period 2000–2006, but then shows a declining trend over most months for the remainder of the year, which is in contrast to the trend in average monthly Yellowfin CPUE for the period 2000–2006. The prevailing La Nina conditions restricted 2007 purse seine effort to the area west of 175°E and resulted in lower catches of large yellowfin which are typically taken in eastern tropical WCP–CA waters (Figure 20). At the height of the La Nina conditions, in the 3rd and 4th quarters 2007, there was minimal activity in the northern hemisphere band east of 160°E, an area where cooler than normal surface waters had flowed in from the east, compared to average quarterly effort for the period 2000–2006 (Figure 20).



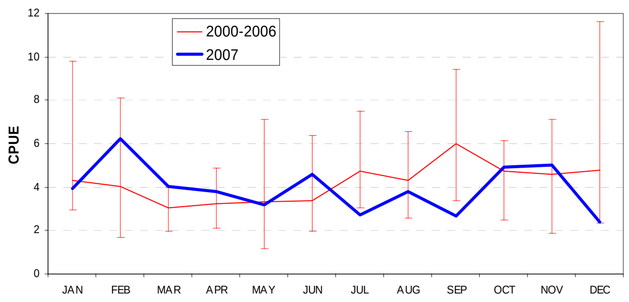


Figure 19. Average Monthly Skipjack (left) and Yellowfin (right) tuna CPUE (mt per day) for purse seiners fishing in the tropical WCP–CA, 2000–2007.
Red line represents the period 2000–2006 and the blue line represents 2007.
The bars represent the extent (i.e. minimum and maximum) of monthly values for the period 2000–2006.

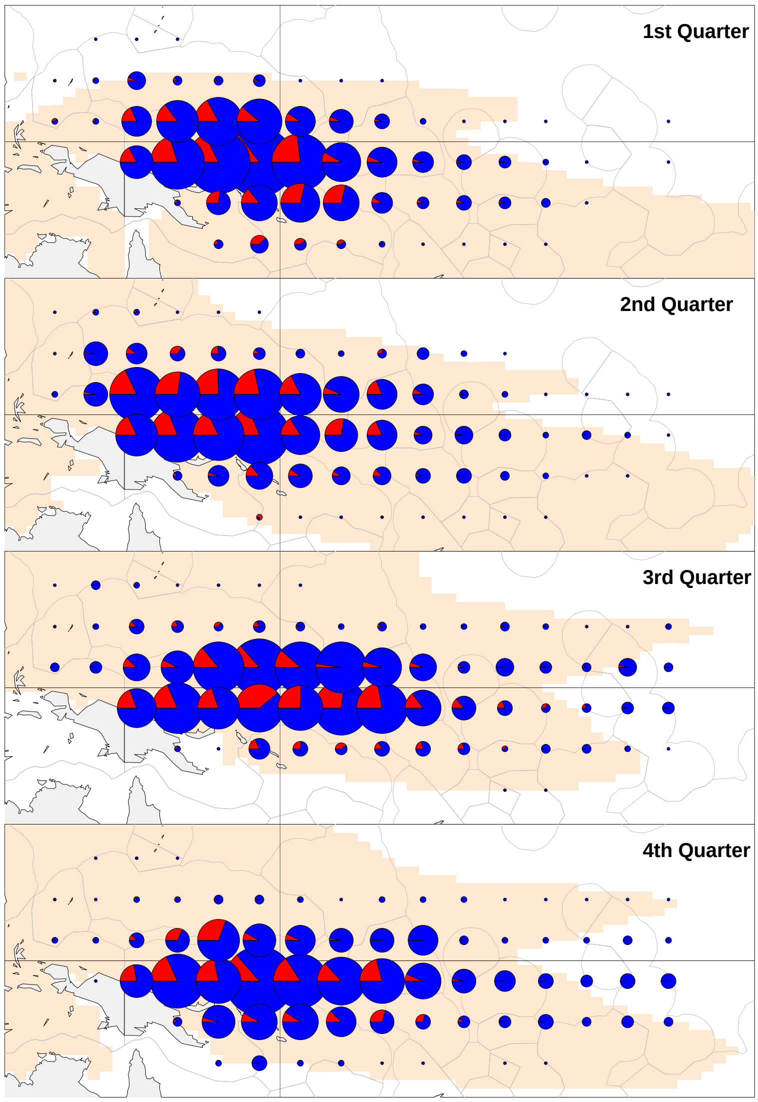


Figure 20. Distribution of purse-seine effort by quarter, 2000–2007.
Blue – Total Effort for the period 2000–2006; Red – Effort for 2007 only.
Pink shading represents the extent of average sea surface temperature > 28.5°C by quarter for the period 2000–2007

3.6 Economic overview of the purse seine fishery

3.6.1 Price trends – Skipjack

Skipjack prices began noticeable increases to current record levels after mid-2007 following a relatively flat and stable trend throughout 2006. In 2007, Bangkok benchmark skipjack prices (4-7.5lbs, c&f) increasingly traded in a range above the US$1000/Mt mark, Thai imports of frozen skipjack averaged US$1319/Mt and monthly prices at Yaizu for purse seine caught tuna varied between US$943/Mt and US$1547/Mt, averaging US$1256/Mt[4].

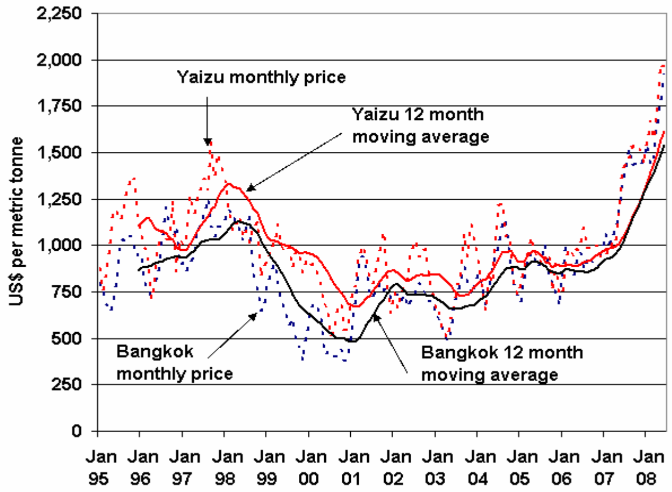


Figure 21. Skipjack prices, Bangkok (4-7.5lbs, c&f) and Yaizu (ex-vessel) monthly and 12 month moving average

Note: The Bangkok prices shown in the above figure are indicative figures only. They reflect estimates of the mid-point of prices paid during the respective month based on information received from a range

Over the first half of 2008 skipjack prices took a further sharp upturn with Bangkok prices (4-7.5lbs, c&f) rising from over US$1500/Mt in January to over US$1900/Mt by end June and Yaizu monthly average prices rising from US$1555/Mt in January to US$1960/Mt in June.

3.6.2 Price trends – Yellowfin

Bangkok yellowfin prices (20lbs and up, c&f) over 2007 had an average low of US$1425/Mt in January and a peak of US$1975/Mt in December. Bangkok yellowfin prices have been trending up for much of the period since 2000 when prices averaged around US$950/Mt for the year. In 2007, prices averaged US$1773/Mt and have continued to increase in 2008 with the June average of US$2200/Mt.

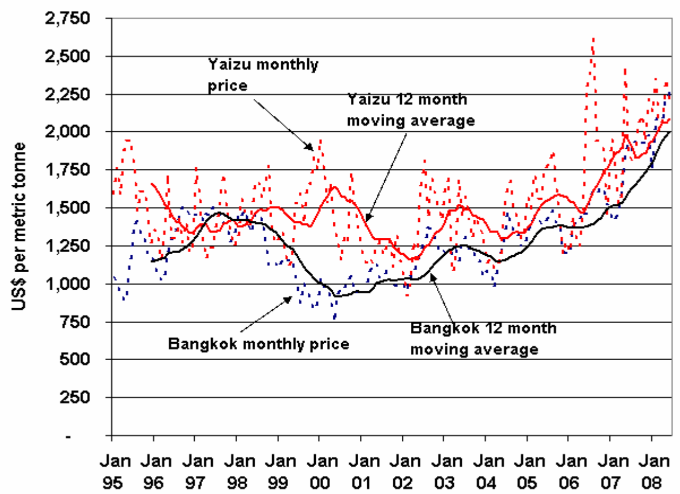


Figure 22. Yellowfin prices, Bangkok (20lbs and up, c&f) and Yaizu (ex-vessel) monthly and 12 month moving average

Note: The Bangkok prices shown in the above figure are indicative figures only. They reflect estimates of the mid-point of prices paid during the respective month based on information received from a range of sources

Yaizu purse seine caught yellowfin average monthly prices in 2007 in US$ terms ranged between US$1524/Mt in March and US$2429/Mt in May with end of year December average of US$2215/Mt. The average price over 2007 was US$1935/Mt.

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[4] Where prices are obtained in currencies other than US$ they are converted using inter-bank exchange rates as given by www.oanda.com/convert/fxhistory.

3.6.3 Value of the Purse-seine Catch

As a means of examining the effect of the changes to prices and catch levels, estimate of the "delivered" value of the purse seine fishery tuna catch in the WCPFC Area from 1997 to 2007 are obtained (Figure 23 – 25). 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.[5]

The estimated delivered value of the purse seine tuna catch in the WCPFC area for 2007 is US$2,373 million the highest level since at least 1997. This represents an increase of US$743 million or 43 per cent on the estimated delivered value of the catch in 2006. This increase was driven by a US$680 million (54 per cent) increase in delivered value of the skipjack catch, which is estimated to be worth US$1,249 million in 2007, resulting from a 9 per cent increase in catch and a 42 per cent increase in the composite delivered price. The value of the yellowfin catch also rose to around US$393 million with a rise of 21 per cent in the composite price being offset by an 8 per cent decline in catch.[6]

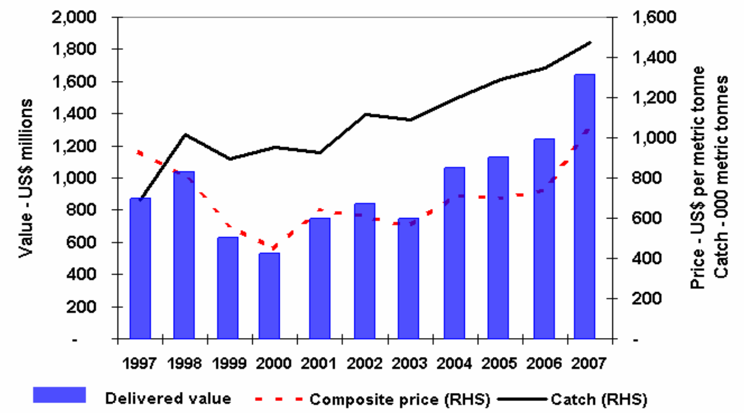

Figure 23. Skipjack in the WCPFC purse seine fishery – Catch, delivered value of catch and composite price

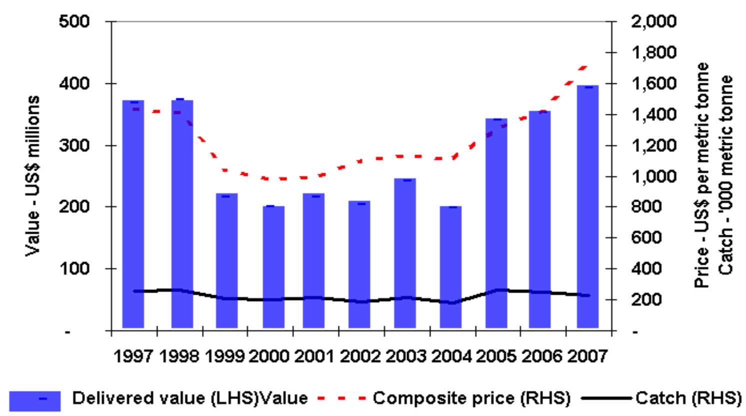

Figure 25. Yellowfin in the WCPFC purse seine fishery – Catch, delivered value of catch and composite price

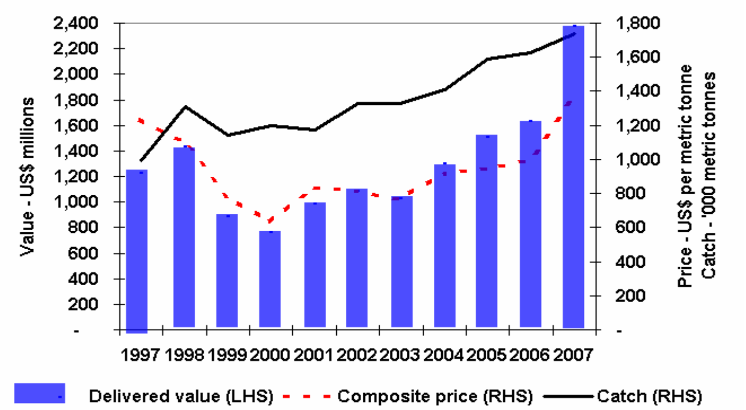

Figure 24. All tuna in the WCPFC purse seine fishery – Catch, delivered value of catch and composite price

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[5] The delivered value of each years 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 yellowfin) 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 where 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.

[6] 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).

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 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).

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 26[7]) and in the annual pole-and-line catch during the past 15–20 years (Figure 27). 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 Palau, Papua New Guinea and Kiribati are no longer active, only one vessel is now operating (seasonally) in Fiji, and fishing activity in the Solomons fishery is very much reduced from the level experienced during the 1990s. Several vessels continue to fish in Hawai'i, and the French Polynesian *bonitier* fleet remains active, but more vessels have turned to longline fishing. Provisional statistics also suggest that the Indonesian pole-and-line has also declined over the past decade.

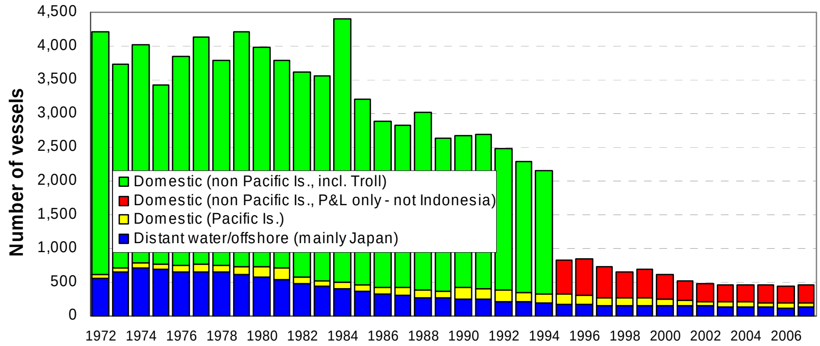

Figure 26. Pole-and-line vessels operating in the WCP–CA
(excludes pole-and-line vessels from the Indonesian domestic fishery)

4.2 Provisional catch estimates (2007)

The 2007 catch estimates for the key pole-and-line fleets operating in the WCP–CA have yet to be provided, although the total catch estimate is expected to be similar to the level of recent years (i.e. 200,000–220,000 mt). Skipjack tends to account for the vast majority of the catch (typically more than 85% of the total catch in tropical areas), while albacore, taken by the Japanese coastal and offshore fleets in the temperate waters of the north Pacific, yellowfin (5–7%) and a small component of bigeye (1–4%) make up the remainder of the catch. The Japanese distant-water and offshore (115,568 mt in 2006) and the Indonesian

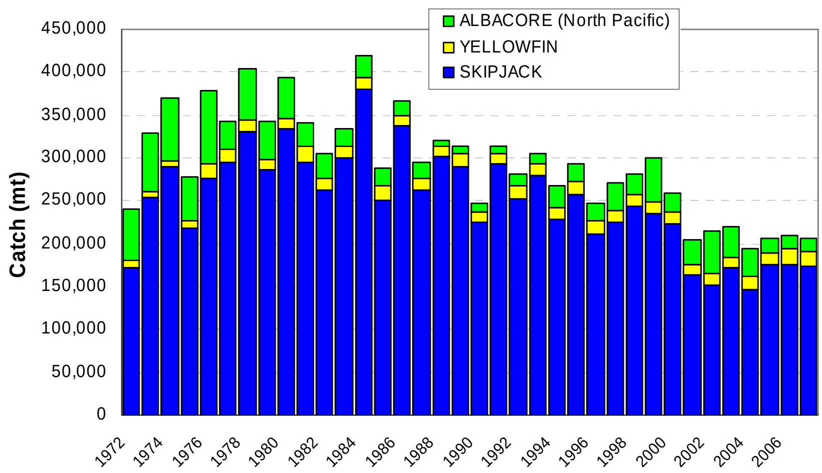

Figure 27. Pole-and-line catch in the WCP–CA

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[7] (note that distinction between troll and pole-and-line gears in the Japanese coastal fleet was not possible for years prior to 1995)

fleets[8] (60,415 mt in 2006) account for most of the WCP–CA pole-and-line catch. The 2006 catch by the Japanese distant-water and offshore fleet was clearly the lowest in the available time series of annual catch estimates which date back to 1972, and appears to be related to a reduction in vessels numbers (which for 2006 was also the lowest on record). The Solomon Islands fleet recovered from low catch levels experienced in the early 2000s (only 2,778 mt in 2000 due to civil unrest), but with vessel numbers dwindling, the catch in recent years (only 3,937 mt in 2007) is not expected to attain the level (of over 20,000 mt annually) experienced during the 1990s.

Figure 28 shows the average distribution of pole-and-line effort for the period 1995–2006 (2007 data are incomplete). Effort in tropical areas is usually year-round and includes the 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 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 absent from this figure (spatial data are not available).

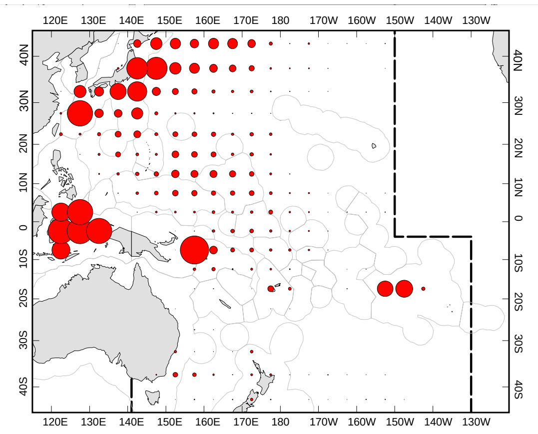

Figure 28. Average distribution of WCP–CA pole-and-line effort (1995–2006).

[8] Indonesia has recently revised the proportion of catch taken by gear type for their domestic fisheries which has resulted in a much larger allocation to their domestic purse seine fishery (at the expense of catches in the pole-and-line and “unclassified” fisheries) since 2004 than has been reported in previous years.

4.3 Economic overview of the pole-and-line fishery

4.3.1 Market conditions

During 2007, the Yaizu price of pole and line caught skipjack in waters off Japan averaged 282JPY/kg (US$2390/Mt) an increase of 22 per cent on 2006. By contrast, the Yaizu price of pole and line caught skipjack in waters south of Japan decreased averaging 190JPY/kg (US$1610/Mt) during 2007, a decrease of 10 per cent.

4.3.2 Value of the pole-and-line catch

As a means of examining the effect of the changes to prices and catch levels over the period 1997-2007, a rough estimate of the annual delivered value of the tuna catch in the pole and line fishery in the WCPFC Area is provided in Figure 29 and Figure 30. The estimated delivered value of the total catch in the WCPFC pole and line fishery for 2007 is US$362 million.[9] This represents a 1 per cent decrease on the estimated value of the catch in 2006 with prices unchanged but catch dropped also by 1 per cent.

The estimated delivered value of the skipjack catch in the WCPFC pole and line fishery for 2007 is US$286 million. This represents a similar level on the estimated value of the catch in 2006 with a 1 per cent increase in prices offset by a 1 percent decrease in catch.

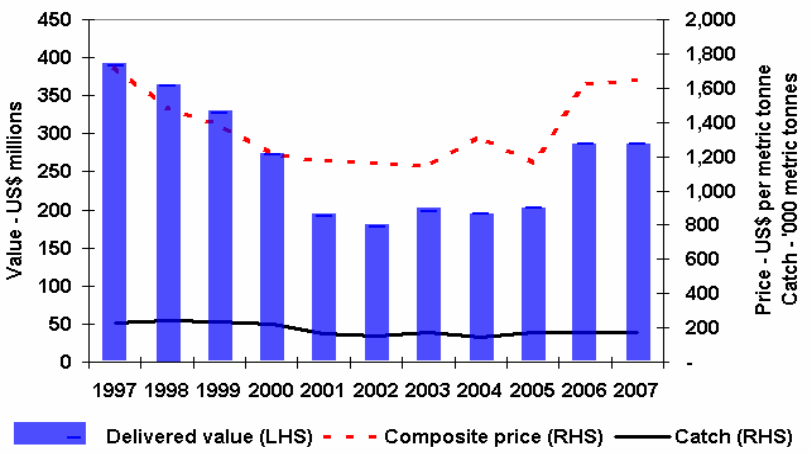

Figure 29. Skipjack in the WCPFC pole and line fishery – Catch, delivered value of catch and composite price

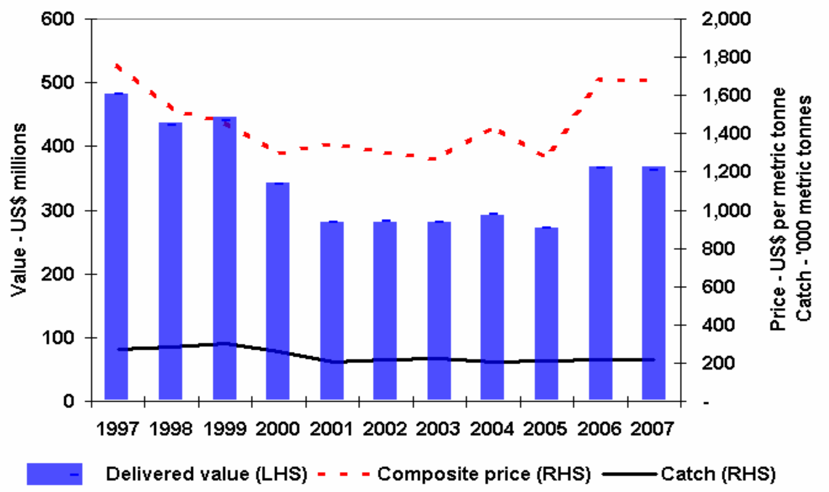

Figure 30. All tuna in the WCPFC pole and line fishery – Catch, delivered value of catch and composite price

[9] 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, 2008a), 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 (OFP, 2008a). The total number of vessels involved in the fishery has generally fluctuated between 4,000 and 5,000 for the last 30 years (Figure 31).

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 one at least one fleet has occurred in recent years;
- smaller (typically <100 GRT) **offshore** vessels which are usually **domestically-based**, undertaking trips less than one month, with ice or chill capacity, and serving fresh or air-freight sashimi markets, or [albacore] canneries.

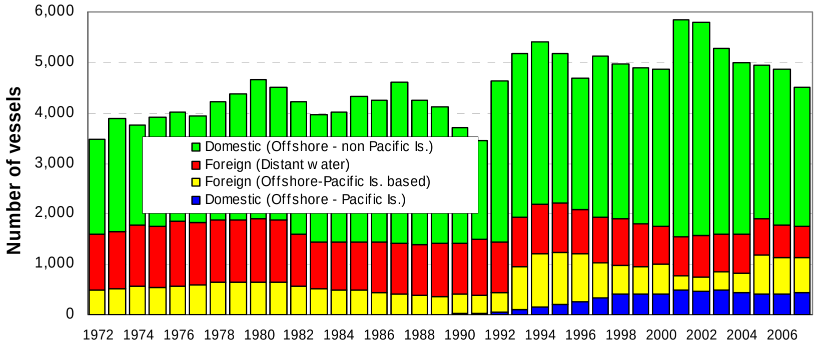

Figure 31. Longline vessels operating in the WCP–CA

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, New Caledonia, Samoa, Solomon Islands, Tonga and Vanuatu; these fleets mainly operate in subtropical waters, with **albacore** the main species taken.
- **Tropical offshore bigeye/yellowfin-target fishery** includes "offshore" sashimi longliners from Chinese-Taipei, based in Micronesia, Guam, Philippines and Chinese-Taipei, mainland Chinese vessels based in Micronesia, and domestic fleets based in Indonesia, Micronesian countries, Philippines, PNG, the Solomon Islands and Vietnam.
- **Tropical distant-water bigeye/yellowfin-target fishery** comprises "distant-water" vessels from Japan, Korea, Chinese-Taipei, mainland China and Vanuatu. These vessels primarily operate in the eastern tropical waters of the WCP–CA (and into the EPO), targeting bigeye and yellowfin tuna for the frozen sashimi market.
- **South Pacific distant-water albacore fishery** comprises "distant-water" vessels from Chinese-Taipei, mainland China and Vanuatu operating in the south Pacific, generally below 20°S, targeting albacore tuna destined for canneries.
- **Domestic fisheries in the sub-tropical and temperate WCP–CA** comprise vessels targeting different species within the same fleet depending on market, season and/or area. These fleets include the domestic fisheries of Australia, Japan, New Zealand and Hawaii. For example, the Hawaiian longline fleet has a component that targets swordfish and another that targets bigeye tuna.
- **South Pacific distant-water swordfish fishery** is a relatively new fishery and comprises "distant-water" vessels from Spain.
- **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 more recently in Papua New Guinea target yellowfin by handlining and small vertical longlines, usually around the numerous arrays of anchored FADs in home waters (although, not included in Figure 31). The commercial handline fleets target large yellowfin tuna which comprise the majority of the overall catch (> 85%).

The WCP–CA longline tuna catch steadily increased from the early years of the fishery (i.e. the early 1950s) to 1980 (227,707 mt), but declined in the five years after this to 157,072 mt in 1984 (Figure 32). Since 1984, 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–36%;YFT–30%; SKJ–2% in 2007) differs considerably from the period of the late 1970s and early 1980s, when yellowfin tuna were the main target species (e.g. ALB–19%;BET–27%;YFT–54% in 1980).

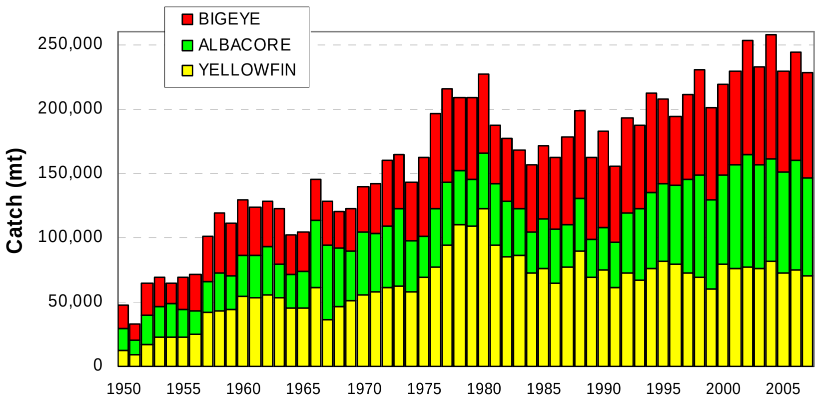

Figure 32. Longline catch (mt) of target tunas in the WCP–CA

5.2 Provisional catch estimates and fleet sizes (2007)

The provisional WCP–CA longline catch (232,388 mt) for 2007 was the lowest since 2000 and around 12% lower than the highest on record which was attained in 2004 (264,465 mt). The WCP–CA albacore longline catch (76,151 mt – 33%) for 2007 was the lowest since 2000. The provisional bigeye catch (82,735 mt – 36%) for 2007 was close to the average for the period 2000–2007, and the yellowfin catch (69,857 mt – 30%) was the lowest for 8 years.

A significant change in the WCP–CA longline fishery over the past 10 years has been the growth of Pacific Islands domestic albacore fishery, which has gone from taking 33% of the total south Pacific albacore longline catch in 1998, to accounting for over 57% of the catch in 2007. The combined national fleets making up the Pacific Islands domestic albacore fishery have numbered around 300 (mainly small “offshore”) vessels in recent years.

The clear shift in effort by some vessels in the Chinese-Taipei distant-water longline fleet to targeting bigeye in the eastern equatorial waters of the WCP–CA resulted in a reduced contribution to the albacore catch in recent years (which was compensated by the increase in Pacific-Islands fleet albacore catches), and a significant increase in bigeye catches. During the 1990s, this fleet consistently took less than 2,000 mt of bigeye tuna each year, but in 2002, the bigeye catch went up to 8,741 mt, and by 2004 it was up to 16,888 mt. The bigeye catch by the Chinese-Taipei distant-water longline fleet has since declined to 9,108 mt, related to a significant drop in vessel numbers (142 vessels in 2003 down to 90 vessels in 2007). The Korean distant-water longline fleet has also experienced a large decline in bigeye and yellowfin catches in recent years, with a corresponding drop in vessel numbers – from 184 vessels active in 2002 down to 122 vessels in 2007 (33% decline).

With domestic fleet sizes continuing to increase at the expense of foreign-offshore and distant-water fleets (Figure 31), the 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 has been balanced to some extent by the switch to targeting bigeye tuna (from albacore) by certain vessels in the distant-water Chinese-Taipei fleet. More detail on individual fleet activities during recent years is available in the WCPFC–SC4 National Fisheries Reports.

5.3 Catch per unit effort

Time series of nominal CPUE provides 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 on. 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.

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. For example, SC4 Working Paper **ME WP–3** (Bigelow & Hoyle, 2008) looks at the standardisation of CPUE for distant-water longline fleets targeting south Pacific albacore and SC4 Information Paper **ME IP–1** (Molony & Sisior, 2008) looks at the use of principal components analyses to assist in selecting variables to include in longline catch rate standardisations. SC4 Working Paper **SA WP–9** (Hampton & Williams, 2008) includes time series of nominal catch rates of longline-caught albacore, yellowfin and bigeye tuna in one paper, which complements the information provided in the papers on the full stock assessments of these species and provides the latest fishery information for stocks for which full assessments have not been conducted.

5.4 Geographic distribution

Figure 33 shows the distribution of effort by category of fleet for the period 2000–2006 (representing the most recently available data for all fleets, but reflecting the likely distributions for 2007).

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 reductions 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 in the more temperate waters for canning. Activity by the **foreign-offshore fleets** from Japan, mainland China and Chinese-Taipei are restricted to the tropical waters, targetting 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 and Chinese-Taipei **domestic fleets** targeting yellowfin and bigeye. The growth in **domestic fleets** in the South Pacific over recent years has been noted; the most significant examples are the increases in the American Samoan, Fijian and French Polynesian fleets and the recent establishment of the Niue fleet (Figure 34).

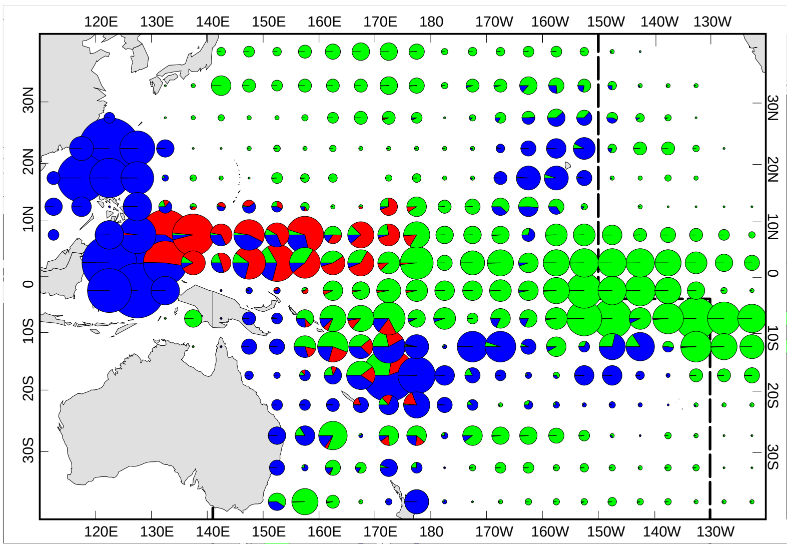

Figure 33. Distribution of longline effort for distant-water fleets (green), foreign-offshore fleets (red) and domestic fleets (blue) for the period 2000–2006.

(Note that the domestic fleet effort excludes the Japanese coastal fishery and the Vietnam fishery; distant-water effort for Chinese-Taipei and other fleets targeting albacore in the North Pacific are poorly covered)

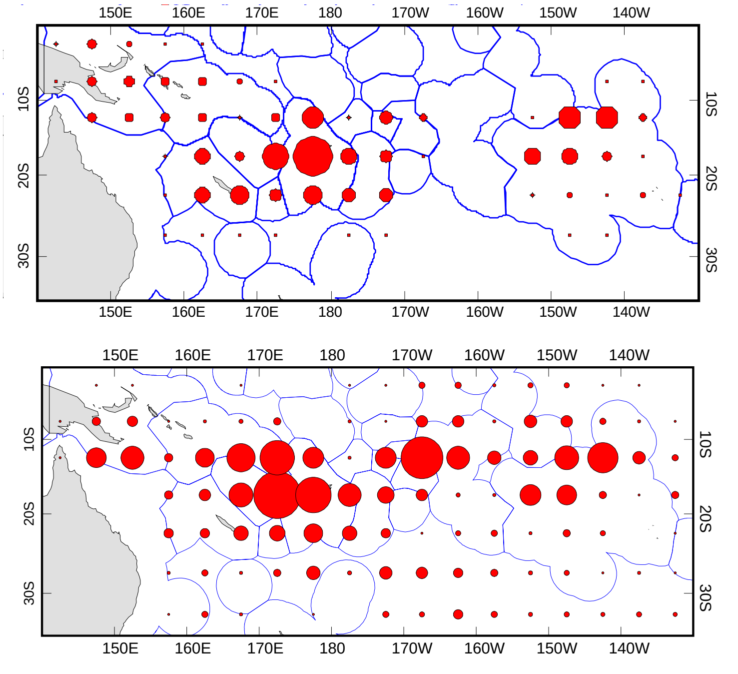

Figure 34. Distribution of south Pacific-islands domestic longline effort for 2000 (top) and 2006 (bottom).

Figure 35 shows species composition by area for 2005 and 2006 (2007 data incomplete). 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. Species composition is likely to vary from year to year in waters where there is some overlap in species targeting, for example, in the latitudinal band from 10°–20°S. The 23% reduction in the WCP–CA bigeye tuna catch between 2004 and 2005 corresponded to a reduction in effort by the distant-water fleets in the eastern tropical WCP–CA (where bigeye tuna are targeted), although it appears better catches of bigeye tuna were experienced in 2006 and 2007.

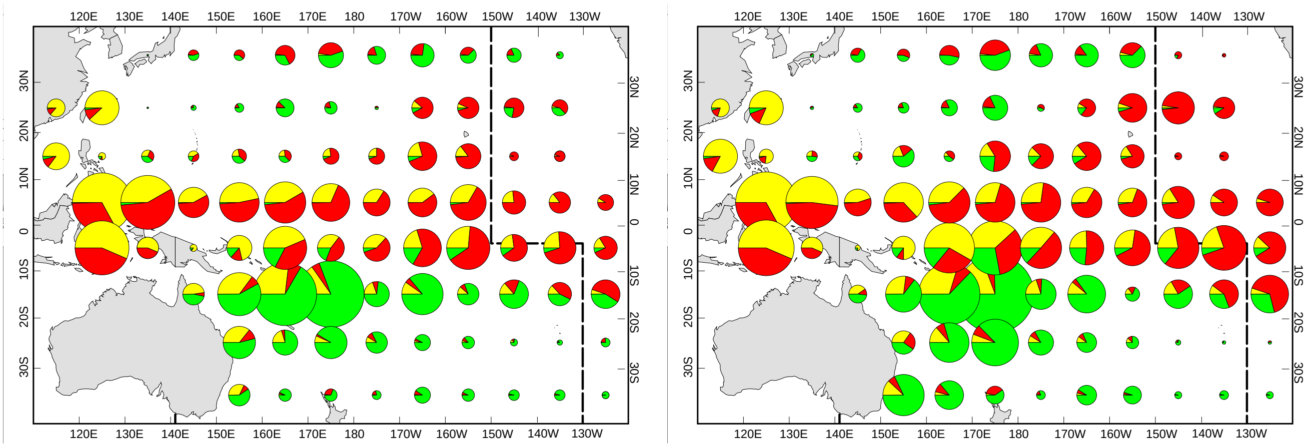

Figure 35. Distribution of longline tuna catch by species during 2005 (left) and 2006 (right–*provisional)*
(Yellow–yellowfin; Red–bigeye; Green–albacore)
(Note that the domestic fleet effort excludes the Japanese coastal fishery and the Vietnam fishery; catches from some distant-water fleets targeting albacore in the North Pacific are not covered)

5.5 Economic overview of the longline fishery

5.5.1 Price trends – Yellowfin

Longline caught yellowfin prices (ex-vessel) landed at Yaizu rose by 1 per cent to 561JPY/kg and average fresh yellowfin prices (ex-vessel) at selected Japanese ports rose 16 per cent to 735JPY/kg. Fresh yellowfin import prices (c.i.f.) rose 5 per cent to 893JPY/kg, in US$ terms the rise was greater as a result of the depreciation of the US$ against the JPY with prices rising by 17 per cent to US$8.47/kg. Japanese import prices for fresh yellowfin sourced from Oceania rose 3 per cent to 929JPY/kg (US$8.81/kg).

After steadily increasing over the period 1997 to 2001, Japanese imports[10] of fresh yellowfin fell sharply in 2002 and continued to decline though to 2007. Japanese imports of fresh yellowfin were 16,853Mt in 2007 down 11 per cent compared with 2006 and at their lowest level since at least 1990. After declining sharply in 2005 Japanese imports of fresh yellowfin from Oceania recovered in 2006 rising 22 per cent to 5,026Mt but declined again in 2007 by 12 per cent to 4,219Mt. US fresh yellowfin import volumes and prices (f.a.s.) continued to rise in 2007 both increasing 1 per cent, to 17,985Mt and US$7.65/kg respectively.

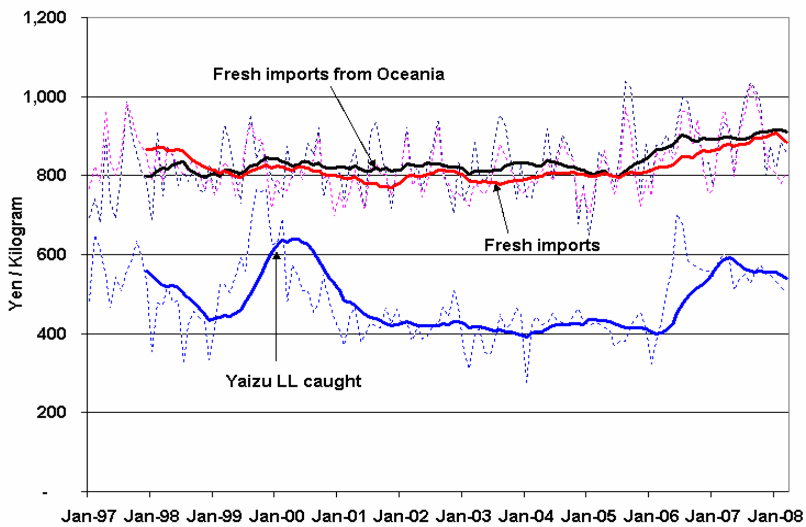

Figure 36. Yellowfin prices on Japanese markets; fresh imports (c.i.f.), fresh imports from Oceania (c.i.f.) and Yaizu longline caught (ex-vessel)

(Monthly price given by dashed lines, 12 month moving average price given by solid line)
Sources: Ministry of Finance (www.customs.go.jp), FFA Tuna Industry Advisor, and US National Marine and Fisheries Service (swr.nmfs.noaa.gov)

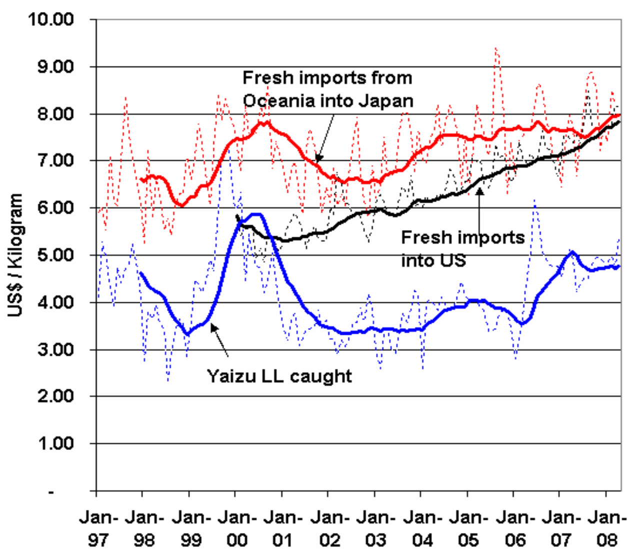

Figure 37. Yellowfin prices in US$: US fresh imports, Japanese fresh imports from Oceania (c.i.f.) and Yaizu longline caught (ex-vessel)

(Monthly price given by dashed lines, 12 month moving average price given by solid line)
Sources: Ministry of Finance (www.customs.go.jp), FFA Tuna Industry Advisor, and US National Marine and Fisheries Service (swr.nmfs.noaa.gov)

[10] Imports of tuna into Japan are defined to be tunas that are carried into Japan as imports. "That is, tuna which is caught by vessels of foreign nationality in the seas outside of territorial waters (including Japan's and other countries' exclusive economic zones) and carried into Japan, or tuna which is caught by vessels of Japanese nationality and first landed in other countries, and then brought into Japan. Those other than the above (i.e., tuna caught by vessels of Japanese nationality on high seas, etc.) are regard as Japanese products)".

5.5.2 Price trends – Bigeye

Frozen bigeye prices (ex-vessel) at selected major Japanese ports rose 10 per cent in 2007 to 799JPY/kg while fresh bigeye prices (ex-vessel) rose 30 per cent to 1129JPY/kg.

Fresh bigeye import prices (c.i.f.) rose 0.4 per cent to 901JPY while frozen bigeye import prices (c.i.f.) declined 10 per cent to 669JPY/kg. In US$ terms, fresh bigeye import prices were down marginally at US$7.65/kg while frozen bigeye import prices also declined 11 per cent to US$5.68/kg.

Import volumes of fresh bigeye declined 8 per cent in 2007 to 14,565Mt of which 4,463Mt was sourced from the Oceania region. Average prices for fresh bigeye from Oceania declined marginally to 1034JPY/kg (US$8.76/kg).

US fresh bigeye import volumes and prices (f.a.s.) both rose 14 per cent and 1 per cent to 5,618Mt and US$7.53/kg respectively.

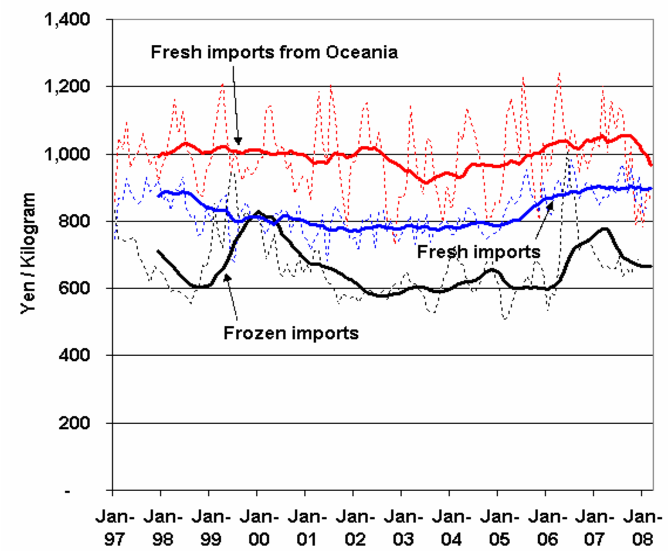

Figure 38. Bigeye prices on Japanese markets; fresh imports (c.i.f.), fresh imports from Oceania (c.i.f.) and frozen imports (ex-vessel)

(Monthly price given by dashed lines, 12 month moving average price given by solid line)
Sources: Ministry of Finance (www.customs.go.jp), FFA Tuna Industry Advisor, and US National Marine and Fisheries Service (swr.nmfs.noaa.gov)

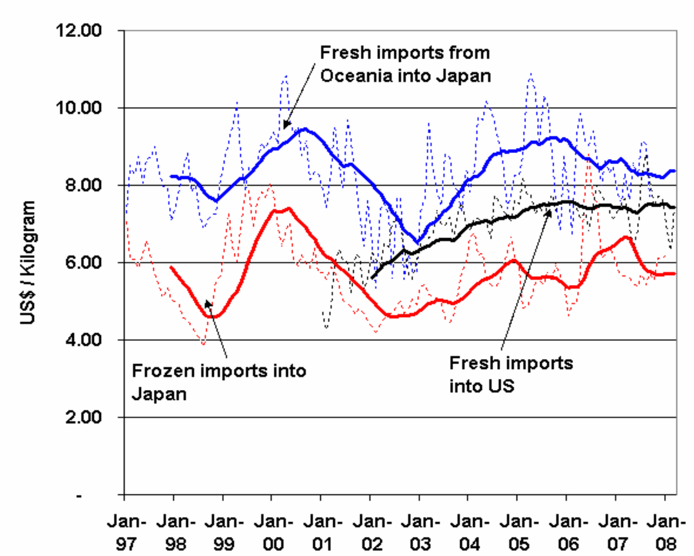

Figure 39. Bigeye prices in US$: US fresh imports, Japanese fresh imports from Oceania (c.i.f.) and Japanese frozen imports from Oceania (c.i.f.)

(Monthly price given by dashed lines, 12 month moving average price given by solid line)
Sources: Ministry of Finance (www.customs.go.jp), FFA Tuna Industry Advisor, and US National Marine and Fisheries Service (swr.nmfs.noaa.gov)

5.5.4 *Price trends – Albacore*

The Bangkok albacore market price (10kg and up, c&f) was at US$2000-2100/Mt in January 2007. According to FFA database[11] the price level fell in the following months and this decline continued into July when the lowest was reached at US$1750/Mt. Prices took an upturn as of mid-August when prices rose to US$2150/Mt because of shortage of supply. Prices increased further to US$2000-2250 in September and remained stable there till January 2008. Further increases occurred in the subsequent moths and by June 2008 prices were in the range of US$2500-2600/Mt.

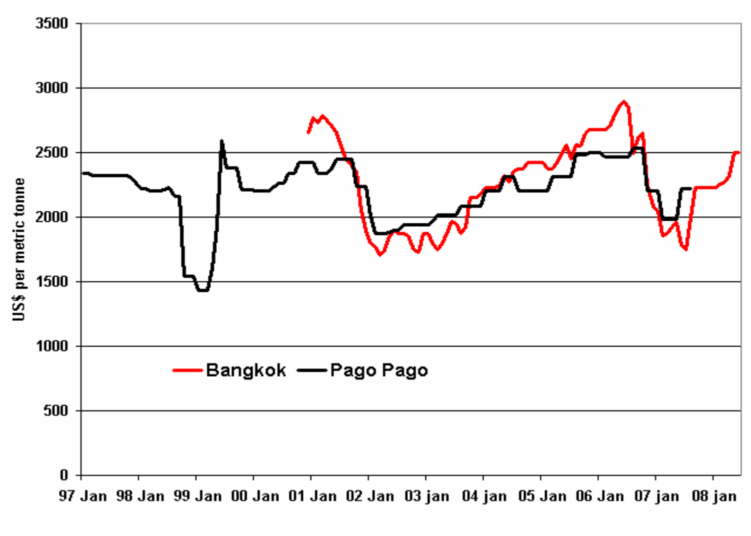

Figure 40. Albacore prices in US$: US fresh imports (f.a.s), fresh landings at selected Japanese ports and Thai frozen imports (c.i.f.)
(Monthly price given by dashed lines, 12 month moving average price given by solid line)
Sources: Thai Customs (www.customs.go.th), FFA Tuna Industry Advisor, and US National Marine and Fisheries Service (swr.nmfs.noaa.gov)

Thai imports of frozen albacore rose 6 per cent in 2007 to 35,008Mt following a stronger growth of 18 per cent the previous year. Prices declined by 27 per cent to US$1948 (1.95/kg) from 2674/Mt (US$2.67/kg).

The US import price for fresh albacore rose 1 per cent to US$4.08/kg while prices for fresh landings at selected Japanese ports declined 3 per cent to US$2.05/kg.

5.5.5 *Value of the longline catch*

As a means of examining the effect of the changes to prices and catch levels since 1997 estimate of the "delivered" value of the longline fishery tuna catch in the WCPFC Area from 1997 to 2007 are obtained (Figure 41–44). In deriving these estimates certain assumptions were made due to data and other constraints that may or may not be valid and as such caution is urged in the use of these figures.[12]

The estimated delivered value of the longline tuna catch in the WCPFC area for 2007 is US$1,160 million. This represents a decrease of US$103 million

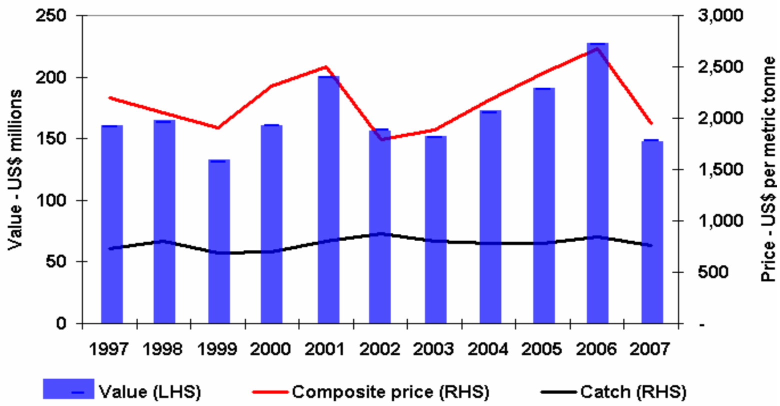

Figure 41. Albacore in the WCPFC longline fishery – Catch, delivered value of catch and composite price

[11] Data for Bangkok albacore market prices (10kg and up, c&f) held at the FFA dates back to 8 June 2001.

[12] For the yellowfin and bigeye caught by fresh longline vessels it is assumed that 80 per cent of the catch is of export quality and 20 per cent is non-export 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 US$1.50/kg throughout the period 1995-2005. 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.

on the estimated value of the catch in 2006. The value of the albacore catch decreased significantly by US$78 million (35 per cent) while the value of the bigeye catch increased by US$33 million (5 per cent) and the value of the yellowfin catch declined by $US28 million (6 per cent). The albacore catch was estimated to be worth US$148 million in 2007 with the 35 per cent decline being driven by 27 per cent decrease in the composite price and a 10 per cent decrease in catch. The bigeye catch was estimated to be worth US$668 million with the catch declining 2 per cent and the composite price increasing 7 per cent. The estimated delivered value of the yellowfin catch was at US$422 million as the 7 per cent decline in catch more than offset the 1 per cent rise in the composite price.

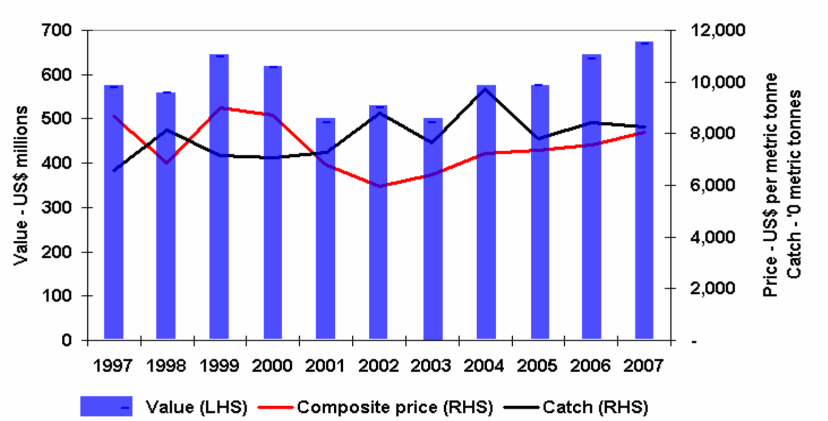

Figure 42. Bigeye in the WCPFC longline fishery – Catch, delivered value of catch and composite price

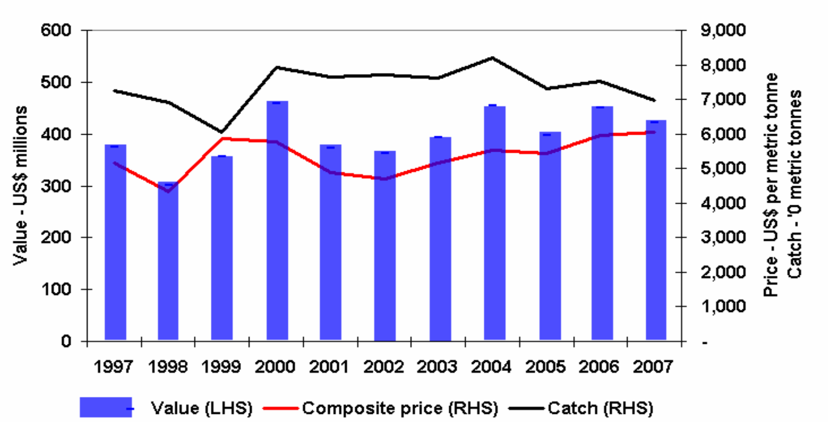

Figure 43. Yellowfin in the WCPFC longline fishery – Catch, delivered value of catch and composite price

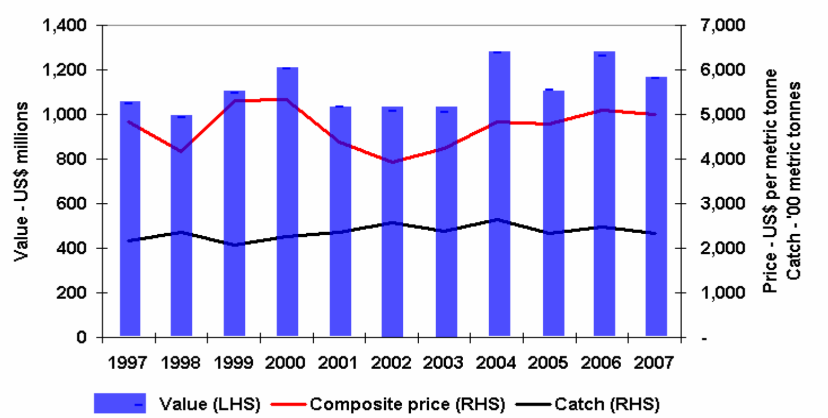

Figure 44. All tuna in the WCPFC longline fishery – Catch, delivered value of catch and composite price

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 NZ waters located near 40°S). The fleets of New Zealand and 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 below 3,000 mt for the first time since 1987. The level of effort expended by the troll fleets each year tends to reflect the price commanded for the product (albacore for canning) to some extent, and by expectations concerning likely fishing success.

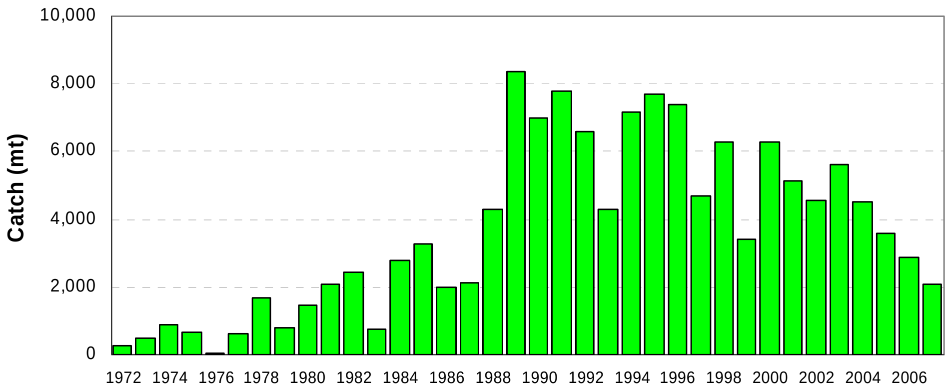

Figure 45. Troll catch (mt) of albacore in the south Pacific Ocean

6.2 Provisional catch estimates (2007)

The 2007 troll albacore catch (2,093 mt) was the lowest for nearly 20 years, and mainly due to a reduction in active vessel numbers due to economic conditions and hence a reduction in overall effort. The New Zealand troll fleet (137 vessels caught 1,734 mt in 2007) and USA (6 vessels caught 218 mt 2007) typically account for most of the albacore troll catch, with minor contributions coming from the Canadian, the Cook Islands and French Polynesian fleets.

Effort by the South Pacific Albacore troll fleets is concentrated off the coast of New Zealand and across the Sub-tropical convergence zone (STCZ). Figure 46 shows a clear reduction in effort by the US troll fleet in the STCZ from 2006 to 2007.

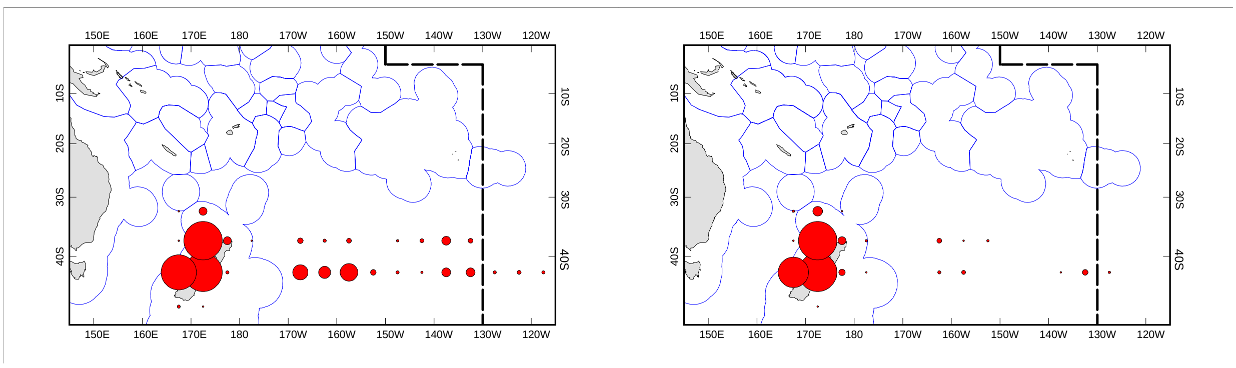

Figure 46. Distribution of South Pacific troll effort during 2006 (left) and 2007 (right)

7. SUMMARY OF CATCH BY SPECIES

7.1 SKIPJACK

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 1.2 million mt in seven of the last eight years (Figure 47). Pole-and-line fleets, primarily Japanese, initially dominated the fishery, with the catch peaking at 380,000 mt in 1984. The relative importance of this fishery, however, has declined over the years primarily due to economic constraints. 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 now make up 20–25% of the total skipjack catch in WCP–CA in recent years).

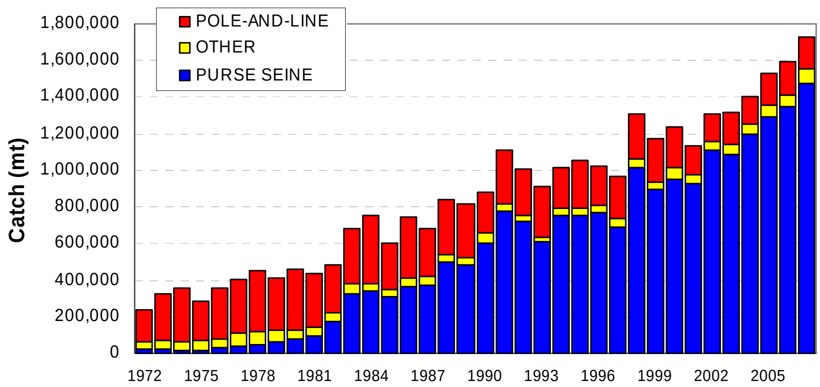

Figure 47. WCP–CA skipjack catch (mt) by gear

The 2007 WCP–CA skipjack catch of 1,726,702 mt was the sixth consecutive record catch and now nearly 600,000 mt more than the 2001 catch. This new level was attained due to another record catch taken in the **purse seine** fishery (1,472,746 mt – 85%). The balance of the catch was taken by the **pole-and-line** gear (173,362 mt – 10%) and the "**unclassified**" gears in the domestic fisheries of Indonesia, Philippines and Japan (~80,000 mt – 4%), while the **longline** fishery accounted for less than 1% of the total catch.

The majority of the skipjack catch is taken in equatorial areas, and most of the remainder is taken in the seasonal home-water fishery of Japan (Figure 48). 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. The central tropical waters are dominated by the 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 account for most of catch in 20–40 cm size range which represents a significant proportion of the WCP–CA skipjack catch, in numbers of fish (Figure 49). The dominant mode of the WCP–CA skipjack catch (by weight) typically falls in the size range 40–60 cm, corresponding to 1–2+ year-old fish (Figure 50). Unassociated (free swimming school) sets by purse seine vessels usually account for most of the large skipjack (i.e. fish over 70cm). There was a greater proportion of medium-large (60–80 cm) skipjack caught in the purse seine fishery during 2002, 2003 and 2005. In contrast, the WCP–CA skipjack purse-seine catch in 2004 and 2006 comprised younger

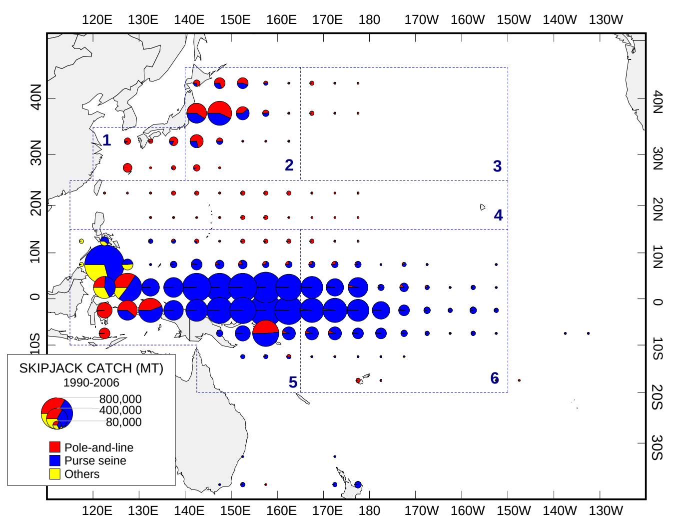

Figure 48. Distribution of skipjack tuna catch, 1990–2006.
The six-region spatial stratification used in stock assessment is shown.

fish, mainly from associated schools.

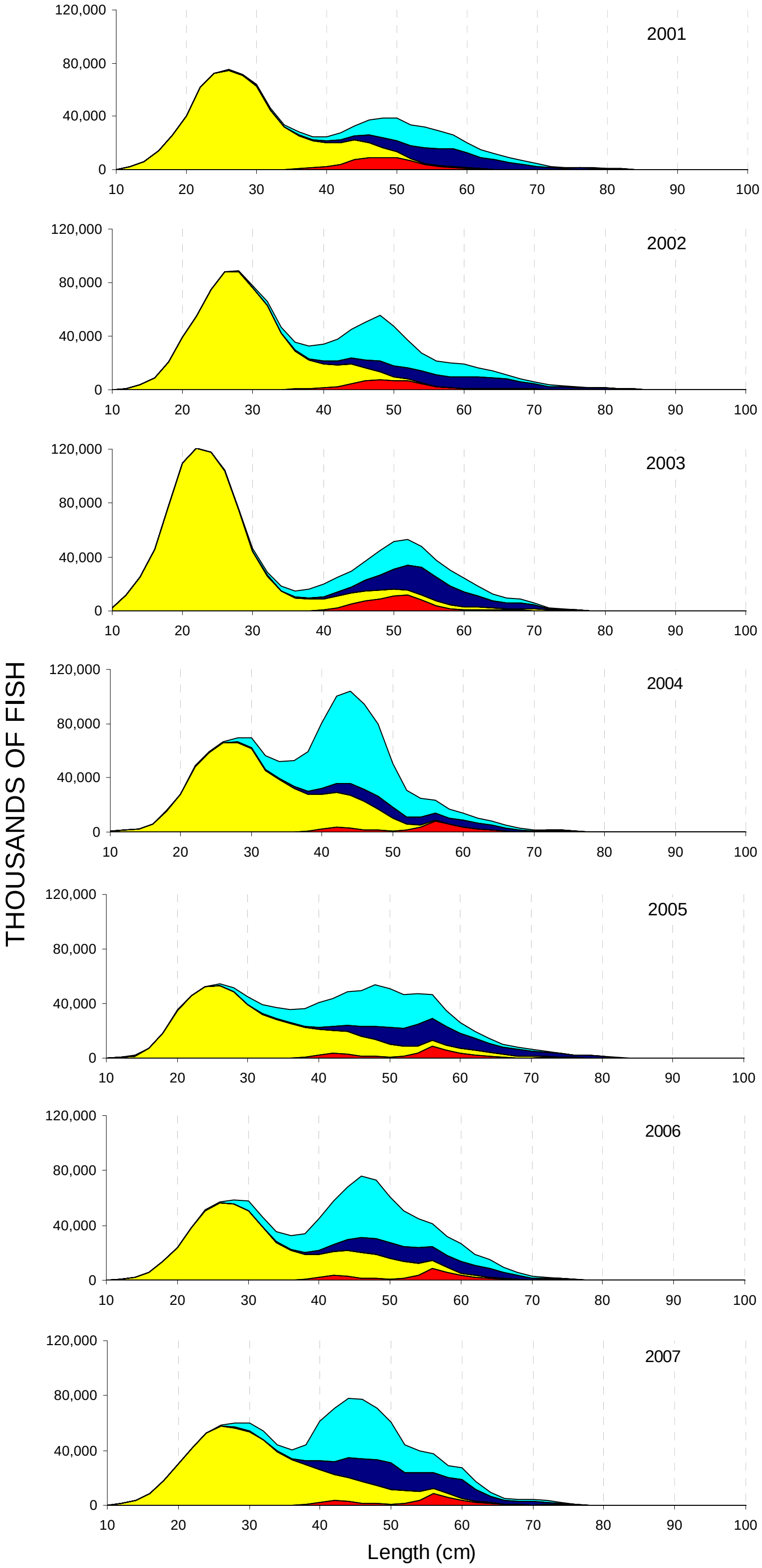

Figure 49. Annual catches (numbers of fish) of skipjack tuna in the WCPO by size and gear type, 2001–2007. **(red–pole-amd-line; yellow–Phil-Indo fisheries; light blue–purse seine associated; dark blue–purse seine unassociated)** **(Pole-and-line size data for 2005-2007 are not available, and have been substituted with size data from 2004)**

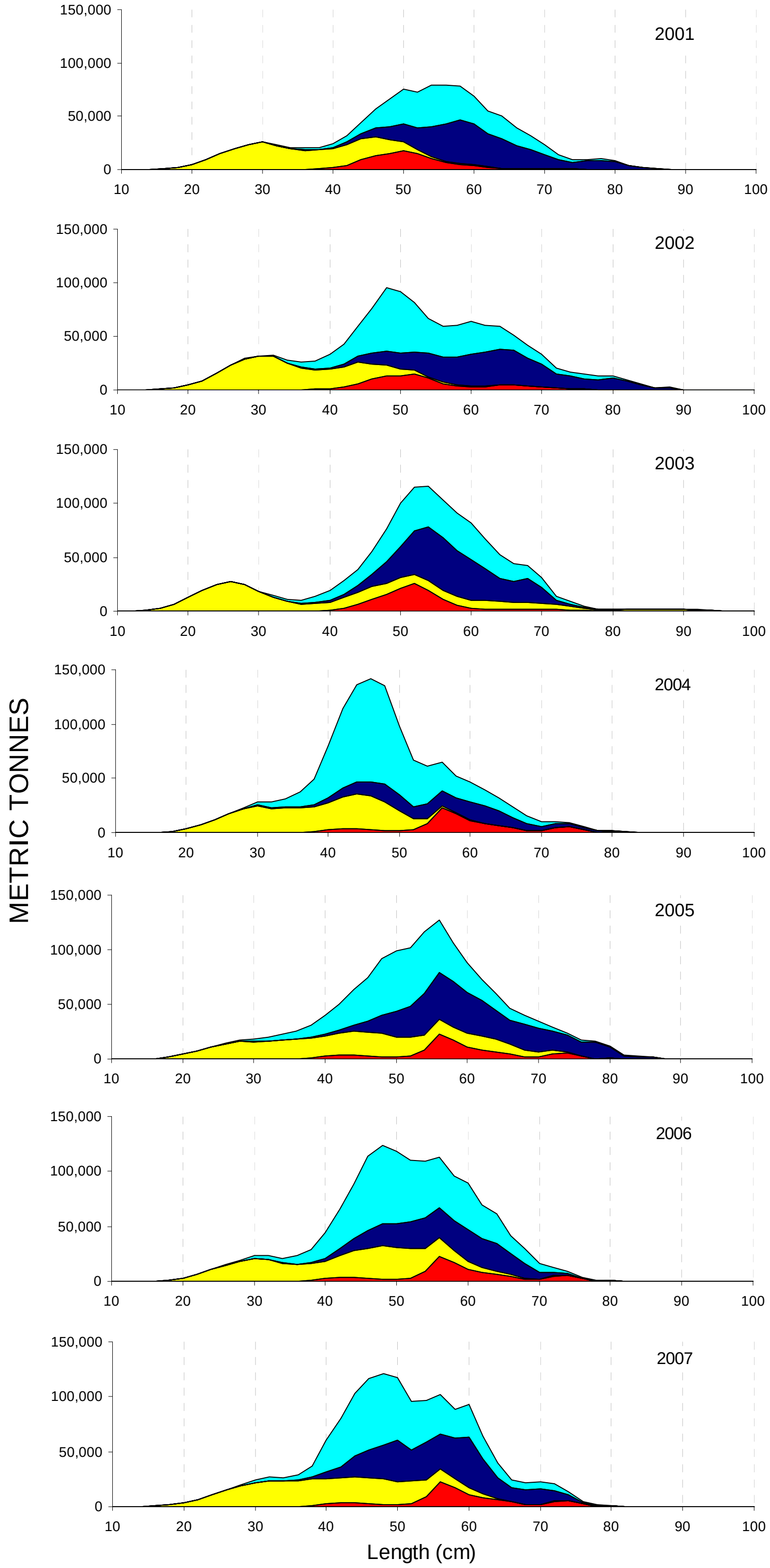

Figure 50. Annual catches (metric tonnes) of skipjack tuna in the WCPO by size and gear type, 2001–2007.

(red–pole-amd-line; yellow–Phil-Indo fisheries; light blue–purse seine associated; dark blue–purse seine unassociated)
(Pole-and-line size data for 2005-2007 are not available, and have been substituted with size data from 2004)

7.2 YELLOWFIN

Since 1997, the total yellowfin catch in the WCP–CA has been generally between 400,000–470,000 mt (Figure 51). The 1998 catch was the largest on record (462,457 mt) and followed two years after an unusually low catch in 1996, primarily due to poor catches in the purse seine fishery – the poor yellowfin catch experienced in the purse-seine fishery during 1996 was reflected in the age class that had recruited to the longline fishery by 1999 (which was a relatively poor catch year in that fishery).

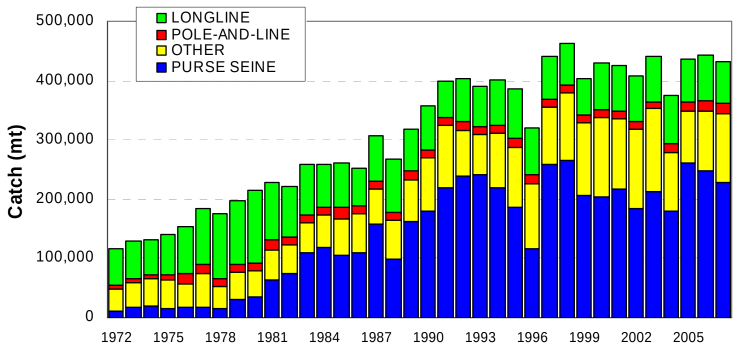

Figure 51. WCP–CA yellowfin catch (mt) by gear

Catches in recent years have been relatively stable (400,000–460,000 mt), although the 2004 catch (375,527 mt) was the lowest since 1996. The 2007 catch (431,814 mt) is slightly higher that the average level for the last 10 years, with slight drops in the purse seine and longline fisheries compensated by increased yellowfin tuna catches in the domestic Indonesian and Philippines "other" gears. The **purse seine** catch for 2007 (228,426 mt – 53% of the total WCP–CA yellowfin catch) was lower than the 2006 level, but still one of the highest catches over the past ten years. In recent years, the yellowfin longline catch has ranged 75,000–82,000 mt, which is well below catches taken in the late 1970s to early 1980s (90,000–120,000 mt), presumably related to changes in targetting practices by some of the large fleets and the gradual reduction in the number of distant-water vessels. The WCP–CA **longline** catch for 2007 was 69,857 mt (16% of the total WCP–CA yellowfin catch), the lowest catch since 1999.

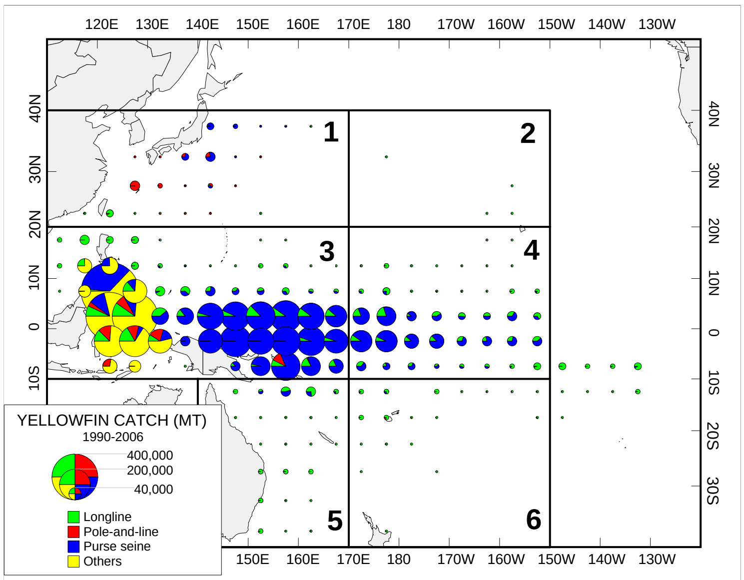

Figure 52. Distribution of yellowfin tuna catch in the WCP–CA, 1990–2006.

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

The high catches of yellowfin experienced recently in the EPO (annual catches of over 400,000 mt for 2001–2003) were not sustained in 2004 and 2005, and dropped significantly in 2006 (177,213 mt) and 2007 (171,050 mt) to a level not experienced since the mid-1980s. Declines in catches in the EPO purse-seine fishery constitute the main component of the drop in the overall EPO yellowfin tuna catch since 2003, although data for 2006–2007 are acknowledged to be preliminary.

The **pole-and-line** fisheries took 17,588 mt (4% of the total yellowfin catch) during 2007, and **'other'** category accounted for ~115,000 mt (which was 27% of the total catch for all gears). Catches in the '**other**' category are largely composed of yellowfin taken by various assorted gears (e.g. 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[13]. Figure 52 shows the distribution of yellowfin catch by gear type for the period 1990–2006 (data for 2007 are incomplete). As with skipjack, the great majority of the

[13] 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 2004 compared to what has been reported in previous years.

catch is taken in equatorial areas by large purse seine vessels, and a variety of gears in the Indonesian and Philippine fisheries.

As with skipjack tuna, the domestic surface fisheries of the Philippines and Indonesia take large numbers of small yellowfin in the range 20–50 cm (Figure 53). 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 usually higher than the longline catch Figure 54. Inter-annual variability in the size of yellowfin taken exists in all fisheries. For example, the relatively high proportion of yellowfin taken from associated purse-seine sets during 2005 corresponds to a strong recruitment, with the age class of fish taken in this year present as a “peak” of larger fish taken in the purse seine unassociated sets and longline fishery during 2006 and again in 2007. Note the strong mode of large (130–150cm) yellowfin from (purse-seine) unassociated-sets in 2002, which corresponds to the good catches experienced in the extreme east of the tropical WCPO (Figure 15–right). The purse seine fishery experienced relatively poor catches of yellowfin during 2004 and this appears to be due more to lower than normal catches of large fish from unassociated schools than catches of small fish from associated set types.

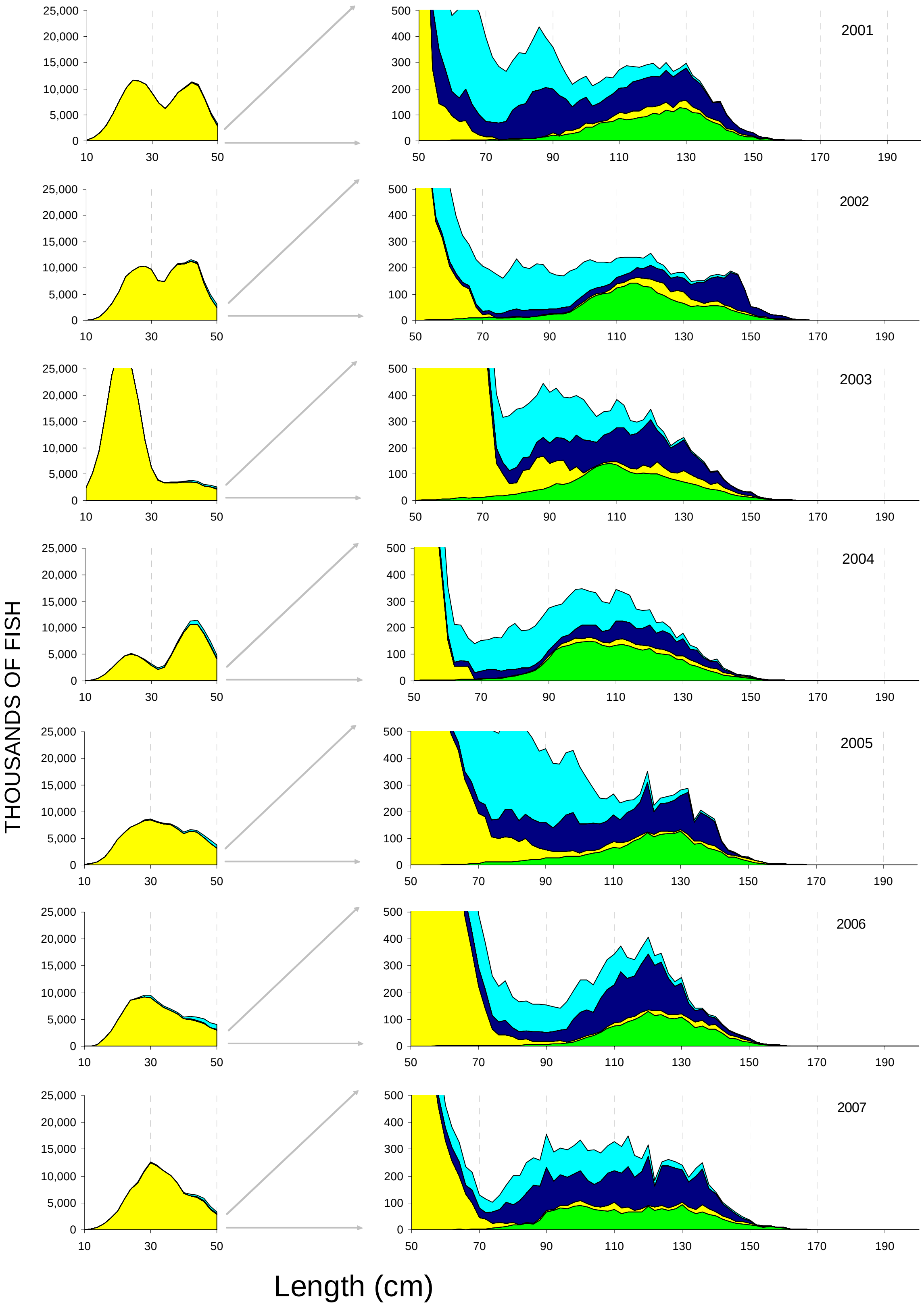

Figure 53. Annual catches (in number of fish) of yellowfin tuna in the WCPO by size and gear type, 2001–2007.

(green–longline; yellow–Phil-Indo fisheries; light blue–purse seine associated; dark blue–purse seine unassociated)

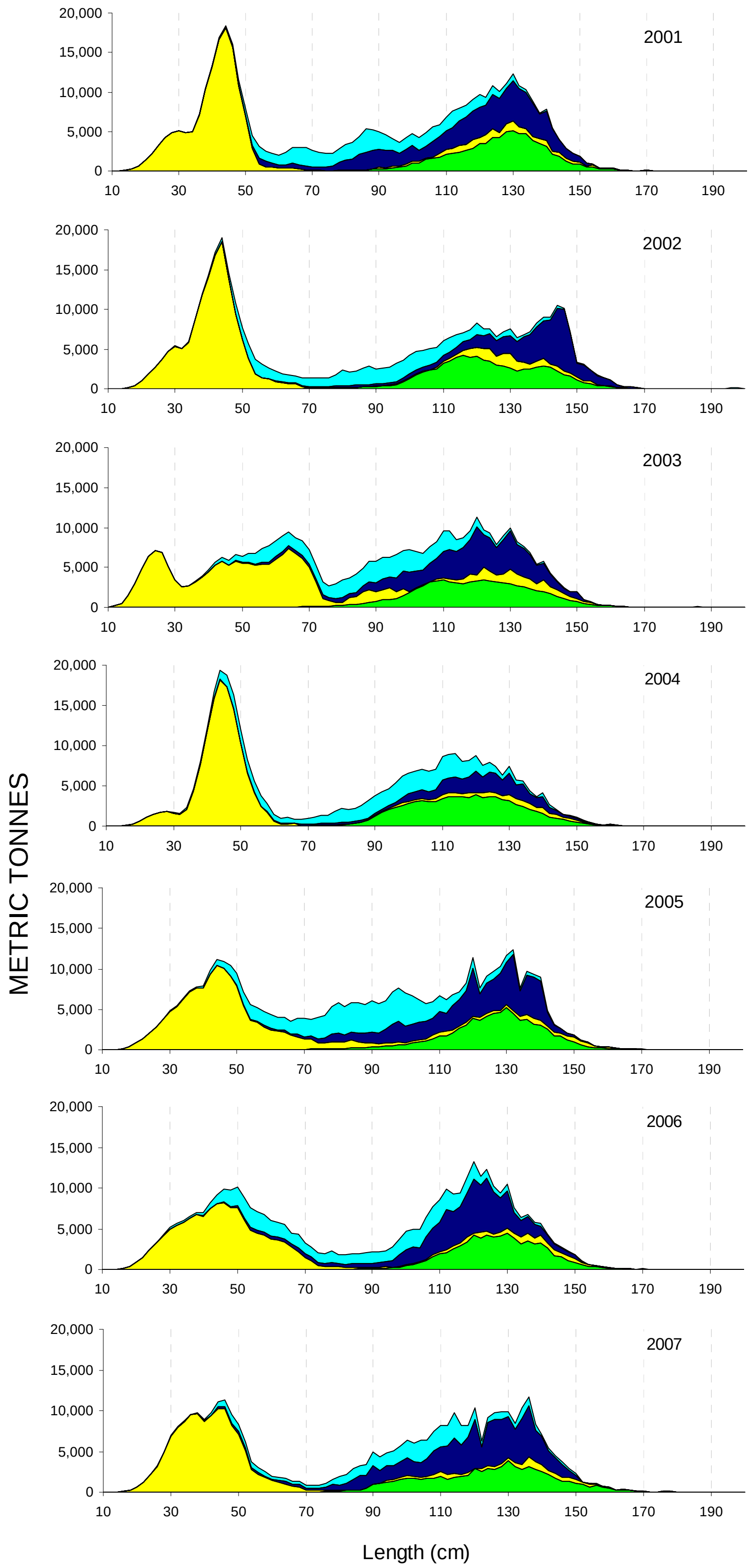

Figure 54. Annual catches (in metric tonnes) of yellowfin tuna in the WCPO by size and gear type, 2001–2007.

(green–longline; yellow–Phil-Indo 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 260,000 mt (Figure 56), with Japanese longline vessels generally contributing over 80% of the catch until the early 1990s. The 2007 bigeye catch for the **Pacific Ocean** (225,006 mt) is slightly less than the average level for the past ten years.

The **purse-seine** catch in the **EPO** (61,434 mt in 2007) continues to account for a significant proportion (71%) of the total EPO bigeye catch. The provisional 2007 EPO longline bigeye catch estimate (25,560 mt) is the lowest since 1960, reflecting, to some extent, the reduction in effort by the Asian fleets. However, the EPO catch estimates are acknowledged to be preliminary[14] and may increase when more data are available. The **WCP–CA longline** bigeye catches have fluctuated between 70,000–97,000 mt since 1999, with the 2007 catch (82,735 mt) considered slightly higher than average for this period. The provisional **WCP–CA purse seine** bigeye catch for 2007 was estimated to be 38,324 mt which is the second highest on record (Figure 55), but this estimate may change since there is a substantial amount of 2007 observer data, which is used to estimate the purse-seine bigeye catch, yet to be received and processed. The **WCP–CA pole-and-line** fishery has generally accounted for between 2,000–4,000 mt of bigeye catch annually over the past decade, although recent revisions to the estimates for the Indonesian fishery have resulted in an increase (to 6,000–9,000 mt) since 2004. The **"other"** category, representing various gears in the Philippine, Indonesian[15] and Japanese domestic fisheries, has accounted for an estimated 11,000–20,000 mt (10–13% of the total WCP–CA bigeye catch) in recent years.

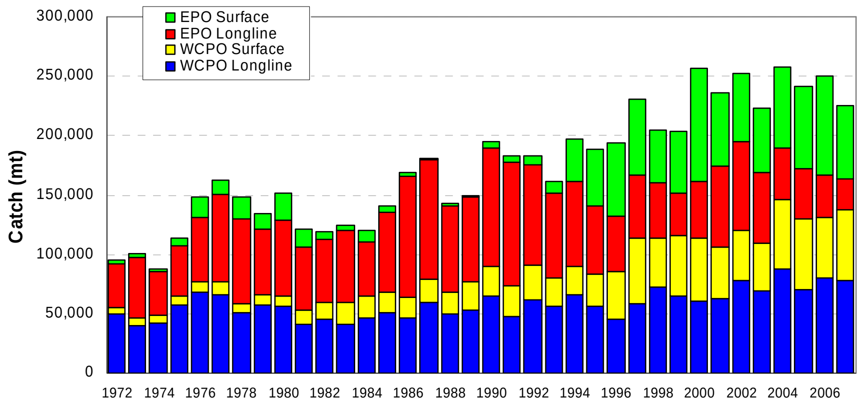

Figure 56. Pacific bigeye catch (mt) by gear
(excludes catches by "other" gears)

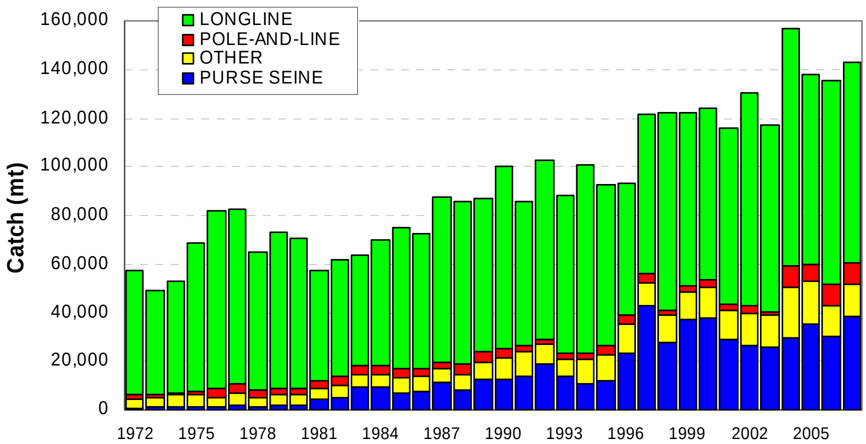

Figure 55. WCP–CA bigeye catch (mt) by gear

Figure 57 shows the spatial distribution of bigeye catch in the Pacific for the period 1990–2006 (2007 data are incomplete). The majority of the WCP–CA catch is taken in equatorial areas, both by purse seine and longline, but with some longline catch in sub-tropical areas (e.g. east of Japan and off the east coast of Australia). In the equatorial areas, much of the longline catch is taken in the central Pacific, continuous with the important traditional bigeye longline area in the eastern Pacific.

[14] Catch estimates for the EPO longline fishery for 2005-2007 and the EPO purse seine fishery for 2006-2007 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 2004 compared to what has been reported in previous years.

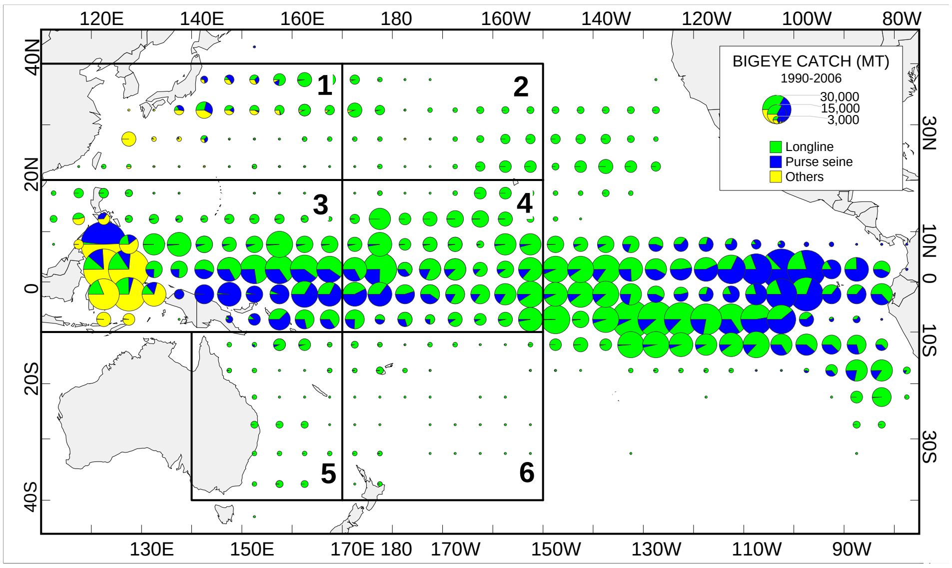

Figure 57. Distribution of bigeye tuna catch, 1990–2006.
The six-region spatial stratification used in stock assessment for the WCP–CA is shown.

As with skipjack and yellowfin tuna, the domestic surface fisheries of the Philippines and Indonesia take large numbers of small bigeye in the range 20–60 cm (Figure 58). The longline fishery clearly accounts for most of the catch (by weight) of large bigeye in the WCP–CA (Figure 59). This is in contrast to large yellowfin tuna, which (in addition to the longline gear) are also taken in significant amounts from unassociated (free-swimming) schools in the purse seine fishery and in the Philippines handline fishery. Large bigeye are very rarely taken in the WCPO purse seine fishery and only a relatively small amount come from the handline fishery in the Philippines. Bigeye sampled in the longline fishery are predominantly adult fish with a mean size of ~130 cm FL (range 80–160 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. The age class of bigeye taken by associated purse seine sets in the size range 60–70 cm during 2003 are probably represented as the clear mode of fish at size 95–100 cm in the longline fishery in 2004, and modes of larger fish in subsequent years.

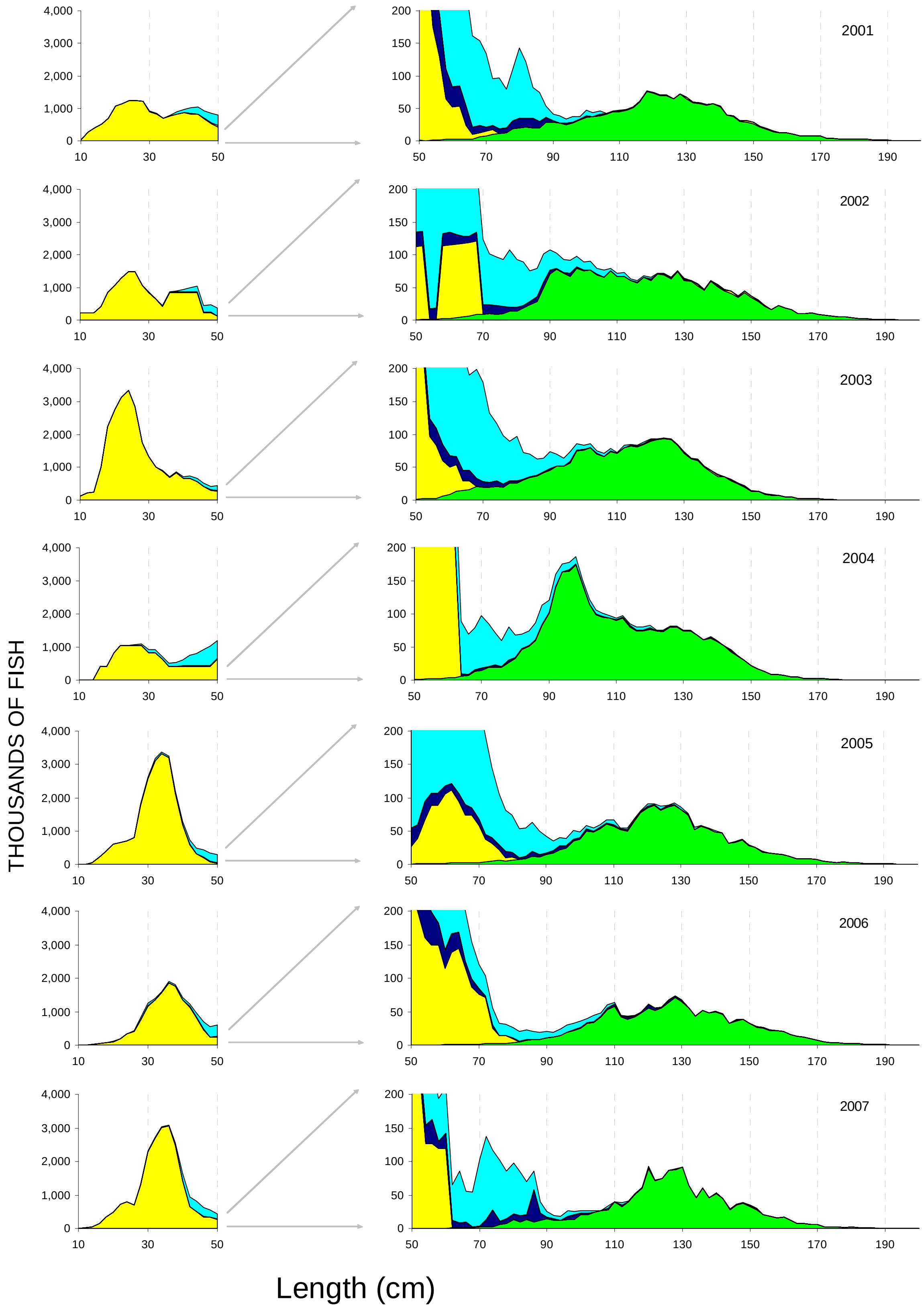

Figure 58. Annual catches (numbers of fish) of bigeye tuna in the WCPO by size and gear type, 2001–2007.

(green–longline; yellow–Phil-Indo fisheries; light blue–purse seine associated; dark blue–purse seine unassociated)

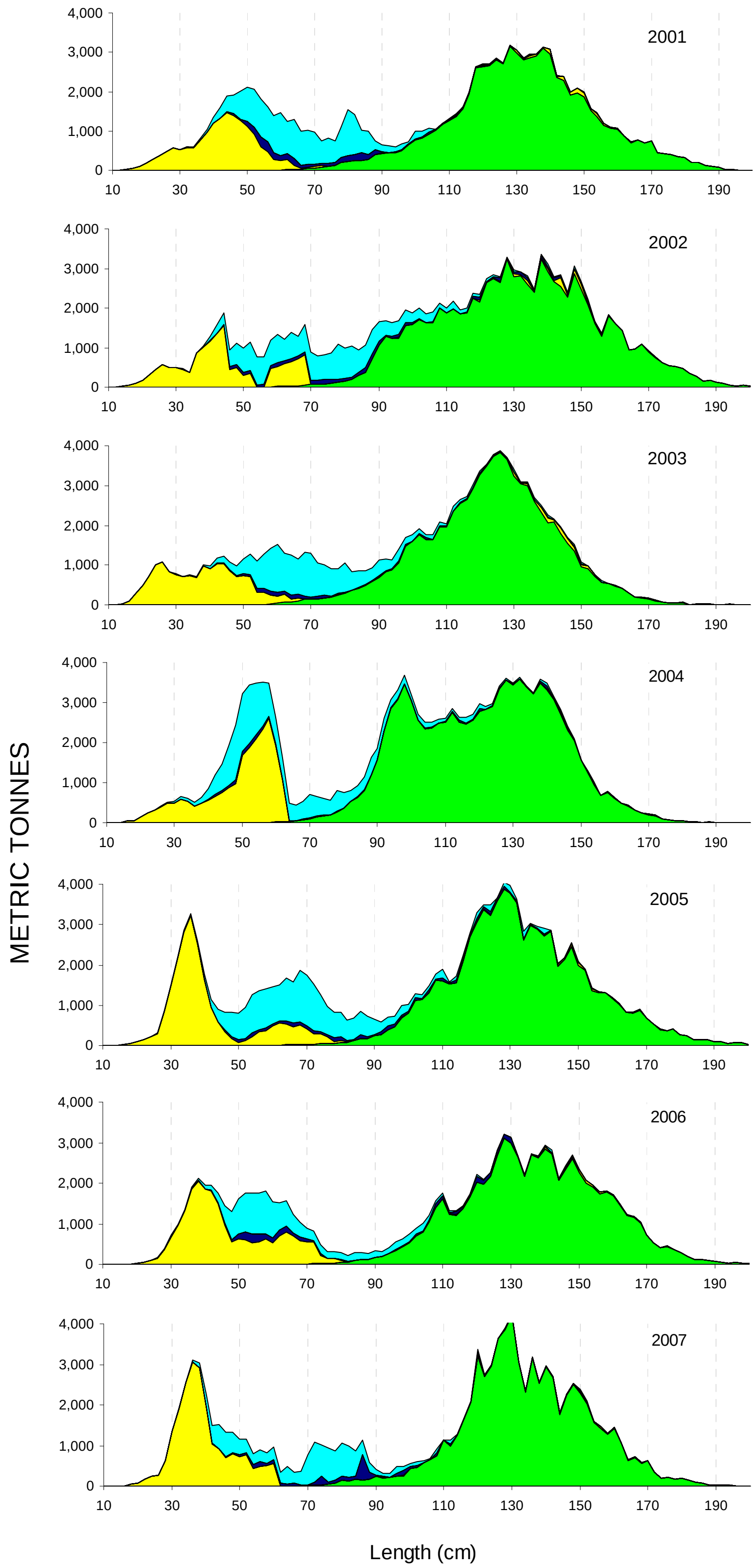

Figure 59. Annual catches (metric tonnes) of bigeye tuna in the WCPO by size and gear type, 2001–2007.
(green–longline; yellow–Phil-Indo fisheries; light blue–purse seine associated; dark blue–purse seine unassociated)

7.4 SOUTH PACIFIC ALBACORE

Prior to 2001, south Pacific albacore catches were in the range 25,000–40,000 mt, although a significant peak was attained in 1989 (48,562 mt), when driftnet fishing was in existence. Since 2001, catches have easily exceeded this range, primarily as a result of the growth in several Pacific Islands domestic longline fisheries. The **south Pacific** albacore catch in 2007 (59,495 mt,) was clearly lower that the record catch in 2006 (69,273 mt), but still higher than the average over the past ten years.

In the post-driftnet era, **longline** has accounted for most (> 75%) of the South Pacific Albacore catch, while the **troll** catch, for a season spanning November – April has been in the range 3,000–8,000 mt (Figure 60). The **WCP–CA** albacore catch includes north Pacific catches (from the 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 2007 (95,240 mt) was the lowest for more than ten years, mainly due to a continued decline of pole-and-line catches in the north Pacific, and of troll catches in the south Pacific.

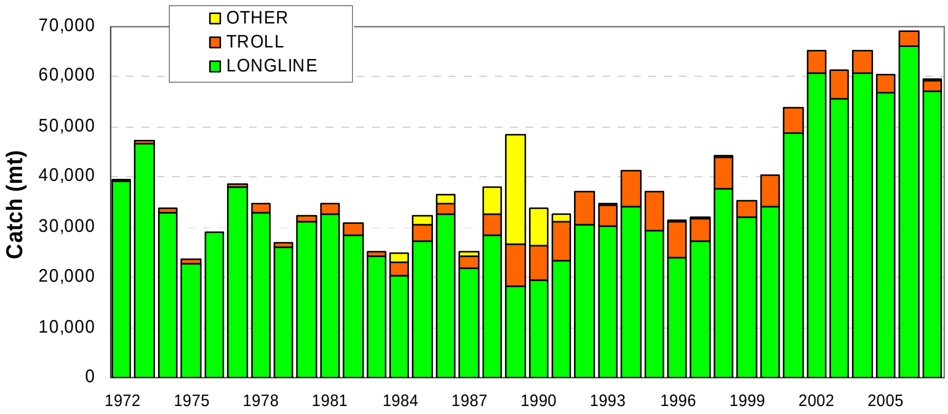

Figure 60. South Pacific albacore catch (mt) by gear ("Other" is primarily catch by the driftnet fishery.)

The longline catch is widely distributed in the south Pacific (Figure 61), but with catches concentrated in the western part of the Pacific. The Chinese-Taipei distant-water longline fleet catch is taken in all three 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.

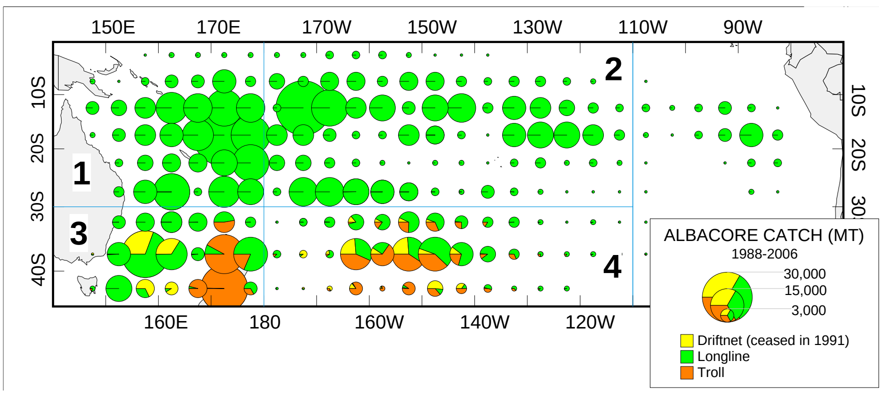

Figure 61. Distribution of South Pacific albacore tuna catch, 1988–2006.
The four-region spatial stratification used in stock assessment is shown.

The longline fishery take adult albacore generally in the size range 90–105cm and the troll fishery take juvenile fish in the range 50–80cm (Figure 62 and Figure 63). Juvenile albacore also appear in the longline catch from time to time (e.g. fish in the range 60–70cm sampled in the longline catch during 2003 and 2005).

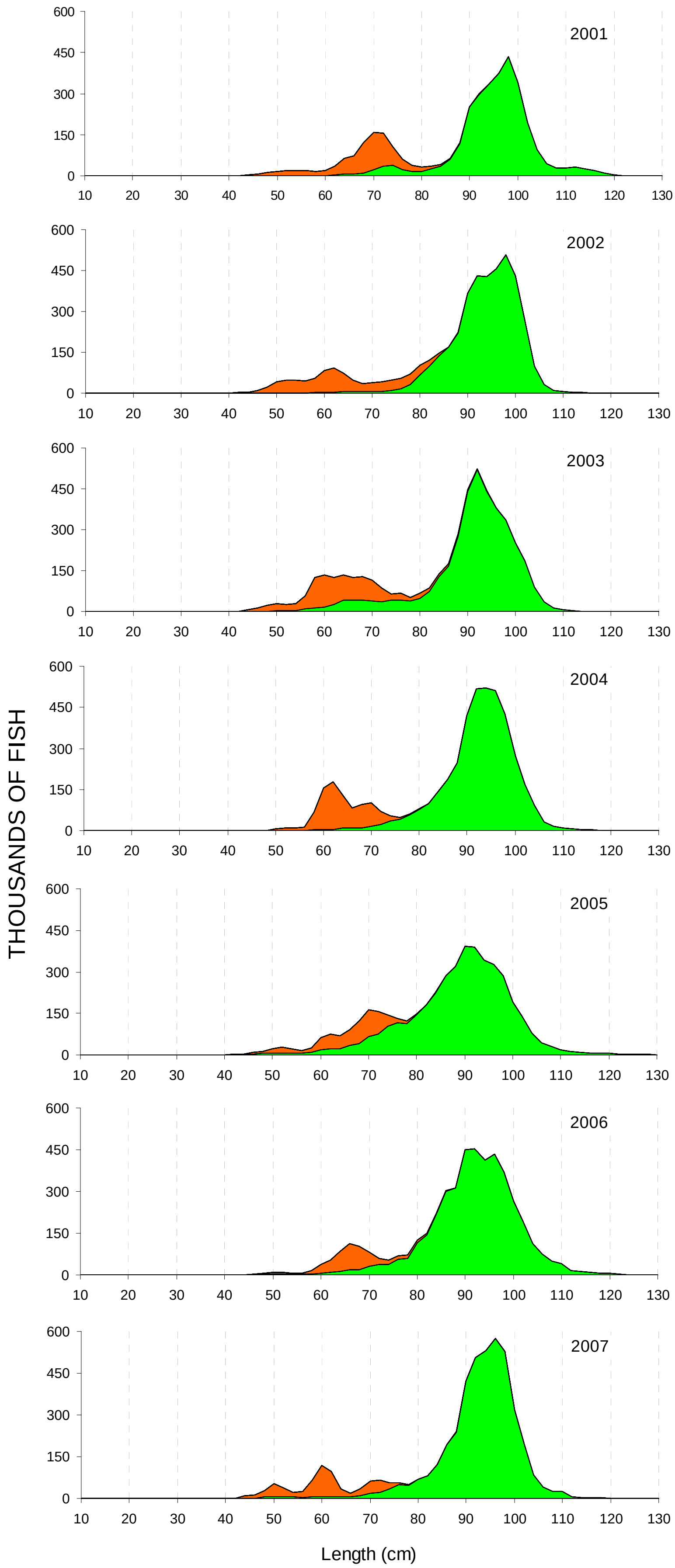

Figure 62. Annual catches (number of fish) of albacore tuna in the South Pacific Ocean by size and gear type, 2001–2007. (green–longline; orange–troll)

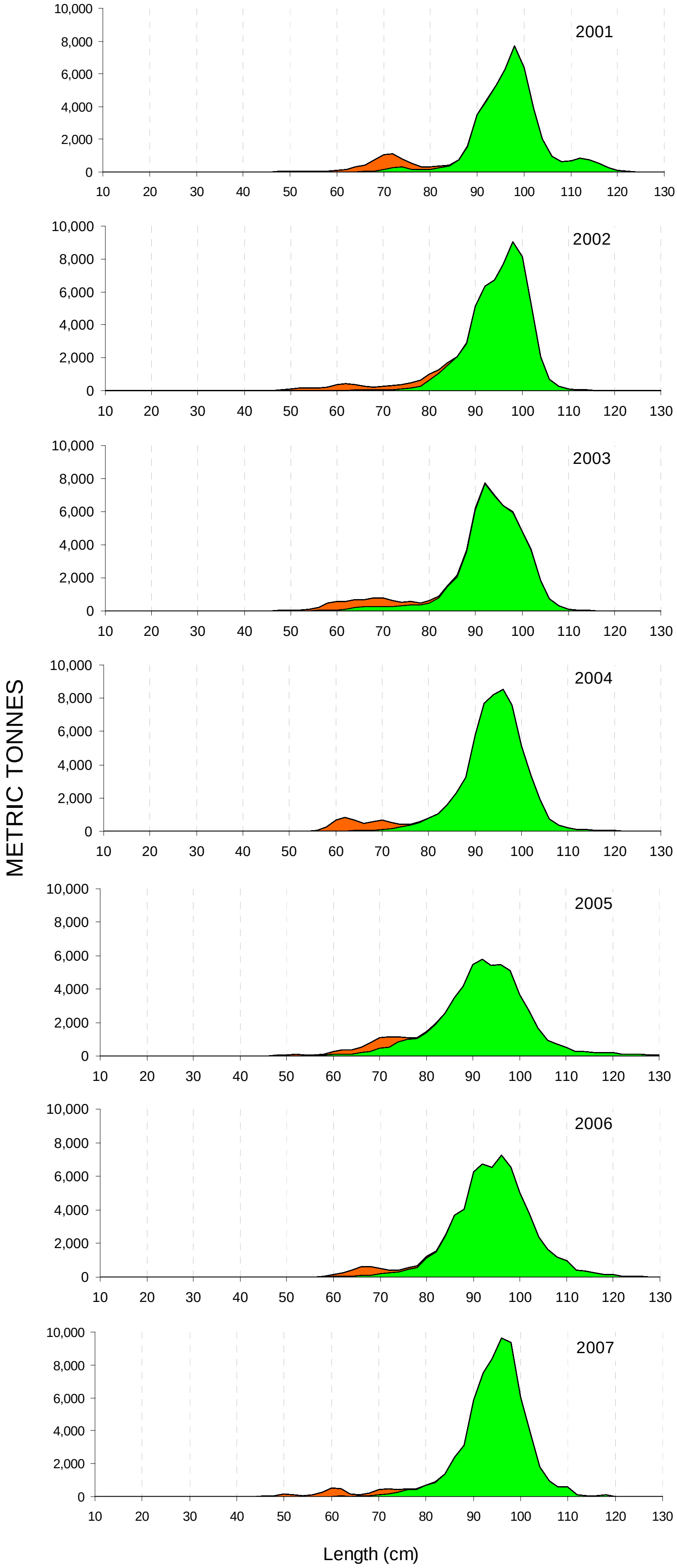

Figure 63. Annual catches (metric tonnes) of albacore tuna in the South Pacific Ocean by size and gear type, 2001–2007. (green–longline; orange–troll)

REFERENCES

Bigelow, K. & S. Hoyle (2008) Standardized CPUE for distant-water fleets targeting south Pacific albacore. **Working Paper ME–SWG WP–3**. Fourth Regular Session of the Scientific Committee of the WCPFC. Port Moresby, Papua New Guinea. 11th–22nd August 2008.

Hampton J. & P. Williams (2008) Compendium of Fishery Indicators for Target Tuna Species. **Working Paper SA–SWG WP–9**. Fourth Regular Session of the Scientific Committee of the WCPFC. Port Moresby, Papua New Guinea. 11th–22nd August 2008.

Langley, A, P. Williams & J. Hampton (2008) The Western and Central Pacific tuna fishery: 2006: Overview and status of stocks. Tuna Fisheries Assessment Report 8. Noumea, New Caledonia: Secretariat of the Pacific Community.

Lawson, T.A. (2007) Further analysis of the proportion of bigeye in 'yellowfin plus bigeye' caught by purse seiners in the WCPFC Statistical Area. Information Paper ST IP–5. Third Regular Session of the WCPFC Scientific Committee (SC3), 13–24 August 2007, Honolulu, Hawaii, USA.

Lawson, T.A. (2008) Factors affecting the use of species composition data collected by observers and port samplers from purse seiners in the Western and Central Pacific Ocean. Working Paper ST WP–3. Fourth Regular Session of the Scientific Committee of the WCPFC. Port Moresby, Papua New Guinea. 11th–22nd August 2008.

Molony, B. & K. Sisior (2008). The use of principal components analyses to assist in selecting variables to include in catch rate standardisations. **Information Paper ME–SWG IP–1**. Fourth Regular Session of the Scientific Committee of the WCPFC. Port Moresby, Papua New Guinea. 11th–22nd August 2008.

OFP (2008a) Estimates of annual catches in the WCPFC Statistical Area. **Information Paper ST–SWG IP–1**. Fourth Regular Session of the Scientific Committee of the WCPFC. Port Moresby, Papua New Guinea. 11th–22nd August 2008.

OFP (2008b) A description of observer and port sampling data collected under the US Multilateral Treaty 2006–2007. A paper prepared for the Annual Meeting of Parties to the South Pacific Regional US Multilateral Treaty March 3–7 2008, Rarotonga, Cook Islands. Oceanic Fisheries Programme, Secretariat of the Pacific Community, Noumea, New Caledonia.