REPORT OF THE SCIENTIFIC COMMITTEE

WCPFC/Comm.2/22
13 October 2004

An unedited version of the Report of the Scientific Committee which met at the headquarters of the Secretariat of the Pacific Community, Noumea, New Caledonia, 8-19 August 2005 is contained in the annex.

Annex

SCIENTIFIC COMMITTEE OF THE COMMISSION FOR THE CONSERVATION AND MANAGEMENT OF HIGHLY MIGRATORY FISH STOCKS IN THE WESTERN AND CENTRAL PACIFIC OCEAN

REPORT OF THE FIRST REGULAR SESSION OF THE SCIENTIFIC COMMITTEE OF THE COMMISSION FOR THE CONSERVATION AND MANAGEMENT OF HIGHLY MIGRATORY FISH STOCKS IN THE WESTERN AND CENTRAL PACIFIC OCEAN

NOUMEA, NEW CALEDONIA

08TH TO 19TH AUGUST 2005

ABSTRACT

This document presents the adopted report of the First Regular Session of the Scientific Committee of the Commission for the Conservation and Management of Highly Migratory Fish Stocks in the Western and Central Pacific Ocean held in Noumea, New Caledonia, from 08 to 19 August 2005. Reports of meetings of Specialist Working Groups of the Scientific Committee and the two background papers detailing the analysis conducted in response to the Resolution of the inaugural Commission meeting are appended.

ACKNOWLEDGEMENTS

The support provided by the Government of New Zealand, particularly in relation to Neville Smith's time, is gratefully acknowledged. Mr Smith's technical and logistical support to the Committee was exceptionally professional and effective. The Pacific Islands Forum Fisheries Agency and the Secretariat of the Pacific Community's Oceanic Fisheries Programme also provided valuable logistical support and technical and administrative backstopping that was a key factor in the success of the Committee meeting.

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1. OPENING OF MEETING

1.1 In accordance with the decisions made at first session of the Commission for the Conservation and Management of Highly Migratory Fish Stocks in the Western and Central Pacific[1], the first regular session of the Scientific Committee took place at Noumea, New Caledonia from 08th to 19th August 2005. Dr S-K. Soh (Republic of Korea) chaired the meeting.

1.2 The matters considered by the Scientific Committee and its specialist working groups (SWGs) included:

a) A review of the fisheries in the Western and Central Pacific Fisheries Commission Convention Area (WCP-CA);

b) A review of updated stock assessments for the major target species (bigeye, yellowfin, skipjack, South Pacific albacore) including implications for sustainability;

c) The scientific analyses requested by the Commission at its first meeting[2];

d) The data requirements of the Commission for science purposes;

e) Interaction and cooperation with the Technical Compliance Committee (TCC);

f) The future work programme for the Scientific Committee;

g) The special requirements of small island developing states and territories;

h) Budget and finance requirements for the future work of the Scientific Committee;

i) The future operation and administration of the Scientific Committee; and

j) Cooperation with other relevant organisations.

WELCOMING ADDRESSES

1.3 E. Babin, Minister for Agriculture, Livestock and Fisheries, New Caledonia and L. Pangelenin, Director General of the Secretariat of the Pacific Community welcomed the participants to Noumea and wished them well in their important work.

1.4 The Chair introduced participants, noted the current status of membership of the Commission as detailed in paper WCPFC-SC1 2005/08 and warmly welcomed the new members of the Commission. The list of participants is attached as Annex I.

ADOPTION OF AGENDA

1.5 The agenda was adopted by the Scientific Committee and is attached as Annex II.

[1] WCPFC/Commission 1/8, Paragraph 28.
[2] WCPFC/COMM.1/8 Annex II.

APPOINTMENT OF SPECIALIST WORKING GROUP CONVENERS

1.6 The following SWG Conveners were appointed for the duration of the meeting:

- Biology SWG – C-L. Sun;
- Ecosystem and Bycatch SWG – P. Dalzell;
- Fishing Technology SWG – D. Itano;
- Methods SWG – J. Sibert;
- Statistics SWG – T. Lawson; and
- Stock assessment SWG – M. Stocker and N. Miyabe.

1.7 Tonga noted that members should be encouraged to provide Conveners for the SWGs in future. However, if members were not available the current pragmatic approach of utilising non-member meeting participants could continue.

PROCESS FOR SPECIALIST WORKING GROUP AND SCIENTIFIC COMMITTEE REPORTS

1.8 The Chair noted that each SWG would produce a full report to be annexed to the main Scientific Committee report, and a summary report for inclusion in the main Scientific Committee report. The Scientific Committee report would follow the outline of the agenda.

TERMS OF REFERENCE FOR SWGS

1.9 The Scientific Committee adopted the terms of reference for each SWG and the adopted versions are incorporated into the report of each SWG.

1.10 Australia noted that in future the terms of reference of the SWGs should be generic rather than specific to a particular meeting, and suggested that it would be useful to ensure consistency of terminology across the different SWGs.

1.11 A list of the documents utilised by the Scientific Committee and its SWGs during the course of the meeting is attached as Annex III.

MEETING ARRANGEMENTS

1.12 The Chair outlined the operating times and procedures for the meeting.

1.13 J. Hampton described the SPC facilities to participants and invited them to utilise the facilities in their work as required.

1.14 A list of abbreviations and acronyms used in this report is attached as Annex IV.

2. REVIEWS OF FISHERIES

OVERVIEW OF WCPO FISHERIES

GENERAL OVERVIEW

2.1 P. Williams presented an *Overview of Tuna Fisheries in the Western and Central Pacific Ocean – 2004* (WCPFC-SC1 GN WP-1). The presentation described broadly each of the fisheries by gear and fleet, with emphasis on 2004 catches relative to those in recent years and was an introduction to the Fisheries Reports (FRs) which provide more detail on the catch and activities of each fleet.

2.2 The provisional total WCP-CA catch of tunas during 2004 was estimated at 2,021,773 mt (Figure 1), the highest annual catch recorded (the previous record was in 1998 – 2,009,546 mt). During 2004, the purse seine fishery accounted for an estimated 1,263,161 mt (62% of the total catch– the highest catch ever for this fishery), with pole-and-line taking an estimated 297,515 mt (15%), the longline fishery an estimated 225,786 mt (11%), and the remainder (11%) taken by troll gear and a variety of artisanal gears, mostly in eastern Indonesia and the Philippines.

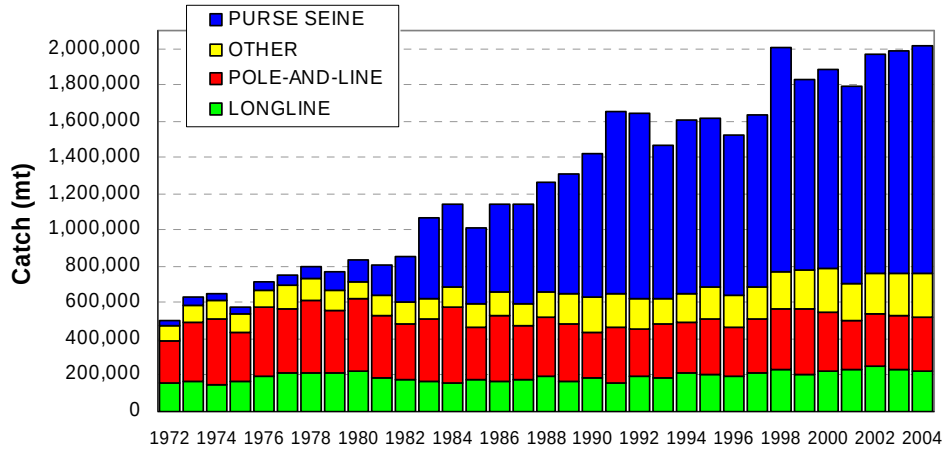

Figure 1. Catch (mt) of albacore, bigeye, skipjack and yellowfin in the WCP-CA, by longline, pole-and-line, purse seine and other gear types.

2.3 The WCP-CA tuna catch (2,021,773 mt) for 2004 represented 78% of the total Pacific Ocean catch of 2,582,774 mt, and 51% of the global tuna catch (the provisional estimate for 2004 is just under 4,000,000 mt).

2.4 The 2004 WCP-CA catch of skipjack (1,376,670 mt) and the proportion of skipjack in the total WCP-CA catch for 2004 (68%) were the highest ever (Figure 2). In contrast, the WCP-CA yellowfin catch for 2004 (413,201 mt; 20%) was relatively low compared to recent years. The WCP-CA bigeye catch for 2004 (125,940 mt; 6%) was the second highest on record, and the WCP-CA albacore (105,962 mt; 5%) catch was the lowest for four years

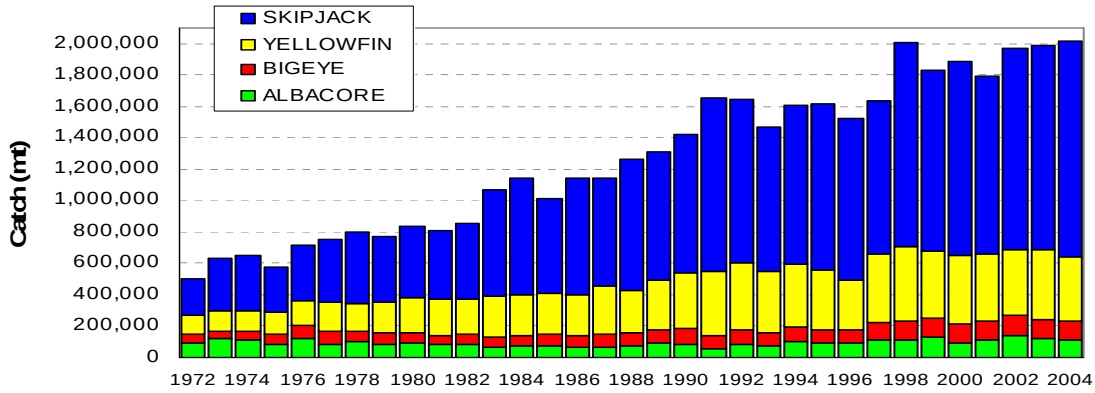

Figure 2. Catch (mt) of albacore, bigeye, skipjack and yellowfin in the WCP-CA.

2.5 The provisional 2004 purse-seine catch of 1,263,161 mt was the highest on record and maintained the catch in excess of 1,200,000 mt for the past three years.

2.6 The purse seine skipjack catch for 2004 (1,059,061 mt – 84%) was the highest on record, although the yellowfin catch for 2004 (179,310 mt – 14%) was the lowest since 1996. The estimated purse seine bigeye catch for 2004 (24,790 mt – 2%) continues the declining trend in catches since the record 1999 catch (38,327 mt), primarily due to the gradual reduction in fishing effort on drifting FADs over recent years.

2.7 The purse seine skipjack catch for 2003 (937,929 mt – 80%) was 34,000 mt less that the record for this fishery (in 2002 – 971,849 mt). The purse seine yellowfin catch for 2003 (214,535 mt – 18%) rebounded from relatively poor catches experienced in 2002 (only 174,366 mt). The estimated purse seine bigeye catch for 2003 (20,316 mt – 2%) continues the declining trend in catches since the record 1999 catch (34,634 mt), primarily due to the gradual reduction in fishing effort on drifting FADs over recent years.

2.8 The 2004 total catch for the main purse seine fleets (FSM Arrangement, Japan, Korea, Chinese Taipei and USA - approximately 800,000 mt) was slightly higher than in 2003, but more than 50,000 mt less than in 2002. Chinese-Taipei has been the highest producer in the tropical purse seine fishery since 1996. The 2004 provisional catch estimate (198,240 mt) for this fleet was similar to the level taken in 2003, but less than 50,000 mt compared to 2002, mainly due to several vessels changing flag at the end of 2002. Catches by the Japanese and Korean purse seine fleets have been stable for most of this time series.

2.9 The number of Pacific-island domestic vessels continued to grow in 2004 and is now at its highest level ever; this category is made up of vessels fishing under the FSM Arrangement and domestically-based purse seine vessels operating in Papua New Guinea and Solomon Islands waters. The FSM Arrangement fleet fish over a broad area of the tropical WCP-CA - the increase in annual catch by this fleet since 2000 corresponds to the increase in vessel numbers, and coincidently, mirrors the decline in USA purse seine catch and vessel numbers over this period.

2.10 As in recent years, the Korean purse seine fleet continued to concentrate on unassociated, free-swimming schools during 2004 (~60% of all sets by this fleet). In contrast, log sets were the most predominant set type used by the Japanese, FSM Arrangement and Chinese-Taipei fleets during 2004, and drifting FAD sets for the USA purse seine fleet. During 2004, the total number of associated sets (log and FAD sets) in the WCP-CA purse seine fishery exceeded the number of unassociated sets for the first time since 1999. The increase in associated sets is typical of El Nino years, when natural floating objects (i.e. logs) are more prevalent and tuna schools associated to floating objects appear to be more available to the purse seine gear.

2.11 The ENSO-neutral state of 2003 continued into the first half of 2004 in WCP-CA and then moved to a weak El Nino state in the second half of 2004. There was a significant westwards shift in purse seine effort during 2003 (compared to previous years) and fishing activity was again concentrated in the western areas (PNG, FSM and the Solomon Islands) during 2004. Fishing activity in the first quarter of 2005 remained concentrated in this area with no significant change from the ENSO-neutral state as yet observed.

2.12 The 2004 skipjack CPUE for unassociated sets for all of the major fleets was clearly lower than in recent years (the lowest in five years for the Korean and Chinese-Taipei fleets). In contrast, the skipjack CPUE for associated sets for most fleets increased in 2004, and skipjack CPUE for all set types was therefore similar to the level in 2003. The exception was the USA fleet, which experienced very low skipjack CPUE for drifting FAD sets, contributing to a drop in the overall skipjack CPUE for 2004.

2.13 Yellowfin CPUE for nearly all fleets and set types dropped in 2004, and were generally on par with the level of 2002, which was acknowledged to be a year of unusually low yellowfin catches. The exception was the yellowfin CPUE for USA fleet on drifting FAD sets, which was the highest for five years. This fleet fished in a different area (further to the east and south) than the Asian fleets during 2004 and, for one reason or another, this resulted in a different species composition (i.e. skipjack to yellowfin) in the catch taken primarily from drifting FAD sets than that experienced by the Asian fleets.

2.14 The 2004 catch estimates for most 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. 270,000–300,000 mt). Skipjack tends to account for the vast majority of the catch (84% in 2003), while albacore; taken by the Japanese coastal and offshore fleets in the temperate waters of the north Pacific (12% in 2003), yellowfin (4% in 2003) and a small component of bigeye (1% in 2003) make up the remainder of the catch. The Japanese distant-water and offshore (152,748 mt in 2003) and the Indonesian fleets (122,820 mt in 2003) typically account for most of the WCP-CA pole-and-line catch. The Solomon Islands fleet (10,797 mt in 2003) continues to recover from low catch levels experienced in recent years (only 2,778 mt in 2000), but is still far from the level (of over 20,000 mt annually) experienced during the 1990s.

2.15 The provisional WCP-CA longline catch (225,786 mt) for 2004 was around 26,000 mt lower that the highest on record, which was attained in 2002 (231,968 mt). The WCP-CA albacore longline catch (65,865 mt – 30%) in 2004 was lower than in recent years and primarily due to a drop in catches by a number of key fleets. The provisional bigeye catch (84,394 mt – 37%) for 2004 was the second highest on record, and the yellowfin catch (70,757 mt – 31%) was the lowest since 1999. The yellowfin catch (61,384 mt) in 1999 was the lowest for nearly 30 years, and is understood to be related to the age class showing poor recruitment into the purse seine fishery in 1996.

2.16 The provisional 2004 troll albacore catch (4,623 mt) was around 500 mt less than in 2003, although this will not be finalised until the USA troll fleet catch for 2004 is made available. As has been the case in the past, the fleets of New Zealand (3,373 mt) and USA (1,205 mt in 2003) account for most of the albacore troll catch, with minor contributions coming from the Canadian and Australian fleets.

2.17 In the discussion that followed the presentation, it was suggested that maps showing the distribution of the purse seine bigeye catch by set type would be a useful addition to the report for next year.

ECONOMIC CONDITION OF THE FISHERY

2.18 C. Reid presented *Overview of Tuna Fisheries in the Western and Central Pacific Ocean, Including Economic Conditions – 2004* (WCPFC-SC1 GN WP-1). Bangkok skipjack prices remained

volatile in 2004. The Bangkok price (c&f) for 4-7.5lb skipjack started the year at US$820-850/mt and fell through most of the 1st quarter, troughing at around US$650/mt in mid-March. From this low the Bangkok price then embarked on a rapid upward movement through to late August when it peaked at around US$1170/mt, 80 per cent higher than the mid-March level. According to FFA data at this level the price was the highest seen in six years. From mid-September through to end of 2004 the 4-7.5lb price fell rapidly finishing the year marginally above its mid-March lows at around US$680/mt. The average price for purse seine caught skipjack at Yaizu over 2004 was 93JPY/kg (US$862/mt), 14 per cent higher (22 per cent for US$ prices) than the average price for 2003 of 82JPY/kg (US$708/mt). While Bangkok skipjack prices were volatile in 2004 the running 12 month average price of skipjack (4-7.5bs, c&f) in Bangkok has been on a reasonably steady upward trend since mid-2003 when it stood at around US$660/mt. In late 2004 the running 12 month average price of skipjack in Bangkok had risen to US$890/mt and continued to rise through to mid-2005 reaching around US$910/mt in May/June, its highest level since March 1999.

2.19 Yellowfin for canning prices in Bangkok rose significantly in the first half of 2004. The Bangkok price (c&f) for 20lbs and up sized fish rose from US$970-1000Mt in early January to US$1450-1500/mt in late June. According to FFA data the Bangkok price from late June to early August of US$1450-1500/mt was the highest seen since March 1998. From August to November prices declined before increasing marginally in December but finished the year at significantly higher levels than at the start of the year. The Bangkok price for 20lbs and up sized fish at the end of December was US$1250/mt. Over 2004 the average Yaizu price for purse seine caught yellowfin was 142JPY/kg (US$1313/mt) down 14 per cent (8 per cent in US$ terms) on 2003. After declining throughout much of the 2nd half of 2003 and 1st of 2004 – the first time a prolonged decline has been seen since prices reached decade lows in May 2000 - the 12 month moving average price of Bangkok yellowfin (20lbs and up) trended up throughout the last 3 quarters of 2004 and the 1st half of 2005. The 12-month moving average price as at June 2005 stood at around US$1370/mt the highest level seen since September 1998.

2.20 The estimated delivered value of the purse seine tuna catch in the WCP-CA for 2004 is US$1,158 million. This represents an increase of US$195 million or 20 per cent on the estimated delivered value of the catch in 2003. This increase was driven a US$245 million (35 per cent) increase in delivered value of the skipjack catch, which was estimated to be worth US$934 million in 2004, resulting from a 26 per cent increase in the composite delivered price and a 7 per cent increase in catch. This was partially offset by a US$46 million (19 per cent) decline in the value of the yellowfin catch, which was estimated to be worth US$198million in 2004, resulting from a 17 per cent decline in catch and a 2 per cent decline in the composite delivered price.

2.21 During 2004 the Yaizu price of pole and line caught skipjack in waters off Japan averaged 191JPY/kg (US$1763/mt) an increase of 6 (14) per cent on 2003. The Yaizu price of pole and line caught skipjack in waters south of Japan averaged 153JPY/kg (US$1419/mt) during 2004, an increase of 10 (17) per cent on 2003.

2.22 As catch estimates for the Japanese pole and line fleet for 2004 were not available at the time of writing of this report no catch value estimates were derived for 2004. The estimated delivered value of the total catch in the WCPFC pole and line fishery for 2003 is US$324 million. This represents a decline of US$9 million or 3 per cent on the estimated value of the catch in 2002. The estimated delivered value of the skipjack catch in the WCPFC pole and line fishery for 2003 is US$243 million. This represents an increase of US$16 million or 7 per cent on the estimated value of the catch in 2002 and resulted from a 7 per cent increase in the composite delivered price with catch levels remaining steady.

2.23 In 2004 fresh yellowfin prices at 10 major Japanese wholesale markets rose by 2 per cent to 1007JPY/kg, while frozen yellowfin prices fell by 3 per to 703JPY/kg. Longline caught yellowfin prices (ex-vessel) landed at Yaizu rose by 4 per cent to 431JPY/kg, average fresh yellowfin prices (ex-vessel) at selected Japanese ports rose by 13 per cent to 639JPY/kg and fresh yellowfin import prices

(c.i.f.) were steady at 714JPY/kg. While prices for imported fresh yellowfin in JPY were steady the appreciation of the JPY against the US$ saw prices in US$ increase by 7 per cent to US$6.60/kg. Following a significant rise in the price (c.i.f.) of imports of fresh yellowfin from the Oceania region in 2003 (up 8 per cent to 837JPY/kg and in US$ terms up 17 per cent to US$7.22/kg) prices declined by 2 per cent in 2004 to 818JPY but rose in US$ by 5 per cent to US$7.56/kg.

2.24 Prices at 10 major Japanese wholesale markets in 2004 averaged 1,191JPY/kg for fresh bigeye, down marginally on 2003, and 911/kg for frozen bigeye, up 6 per cent. Frozen bigeye prices (ex-vessel) at selected major Japanese ports rose by 5 per cent in 2004 to 652JPY/kg while fresh bigeye prices (ex-vessel) declined by 12 per cent to 880JPY/kg. Fresh bigeye import prices (c.i.f.) were steady at 784JPY while frozen bigeye import prices (c.i.f.) rose 10 per cent to 654JPY/kg. In US$ terms frozen bigeye import prices rose nearly 18 per cent to US$6.05 while fresh bigeye import prices rose 7 per cent to US$7.26/kg. As with fresh yellowfin in 2003 there was a substantial increase in the price (c.i.f.) of fresh bigeye imports from the Oceania region with prices increasing by 15 per cent. In 2004 prices rose a further 2 per cent to 973JPY/kg. In US$ terms prices rose by 25 per cent in 2003 and 10 per cent in 2004 averaging US$9.00/kg in 2004.

2.25 In 2004 the average price (f.a.s.) of USA imports of fresh albacore declined by 24 per cent to US$3.11/kg, while fresh bigeye import prices increased 3 per cent increase to US$7.18/kg and fresh yellowfin import prices rose 4 per cent rise to US$6.36/kg.

2.26 Bangkok frozen albacore market prices (10kg and up, c&f) rose steadily through much of 2004 continuing the upward trend in prices seen since March 2002 when the price of 10kg and up sized fished stood at around US$1700/mt. Having commenced 2004 at US$2200-2250/mt the price of 10kg and up sized fished increased through to the end of the 3rd Quarter reaching US$2400-2450/mt in late September where it remained through to the end of the year.

2.27 The estimated delivered value of the longline tuna catch in the WCPFC area for 2004 is US$1,059 million. This represents an increase of US$85 million or 9 per cent on the estimated value of the catch in 2003. This increase was driven a US$84 million (18 per cent) increase in value of the bigeye catch, which was estimated to be worth US$541 million in 2004, resulting from of a 9 per cent increase in the composite delivered price and an 8 per cent increase in catch. The delivered value of the yellowfin catch was marginally higher in 2004 at US$367 while the delivered value of the albacore catch declined marginally to US$147 million. For both albacore and yellowfin catch levels fell, by 14 and 5 per cent respectively, but this decline was offset by an increase of similar magnitude in the delivered composite price for each species.

2.28 A brief discussion ensued with regard to changes in skipjack and yellowfin targeting by the purse seine fleets. It was noted that previously when the premium paid for yellowfin was substantially greater than normal, anecdotal evidence indicated that the targeting of yellowfin did increase. It was also noted that that of bigeye tuna by purse seines was not presented and such information would be useful to the commission to identify areas of bigeye productivity. Bigeye tuna catch was not reported since the catch is calculated as a proportion of the combined yellowfin and bigeye catch.

OVERVIEW OF EASTERN PACIFIC OCEAN FISHERIES

2.29 R. Allen summarised *Tunas and billfishes in the Eastern Pacific Ocean in 2004* (WCPFC-SC1 FR WP-3). The preliminary estimate of total catch of tuna in the eastern Pacific Ocean (EPO) in 2004 was 634,000 mt. This was down from catches during the previous three years in which the total catches exceeded 750,000 mt. During 2001-2003, catches of yellowfin were exceptionally high (exceeding 400,000 mt) supported by high recruitment in 1998 and 1999. Subsequently recruitment returned to typical levels seen during 1983-1997 and the 2004 yellowfin catch was 274,000 mt. Since 1993, skipjack catches has increased with the development of the fishery using FADs. Before 1993,

annual catches well mostly less than 150,000 mt, and since 1993 have regularly exceeded that amount. The 2004 estimated catch was 197,000 mt. The preliminary estimate of 2004 bigeye catch was 108,000 mt. The total bigeye catch has fluctuated around 100,000 mt since 1985, but its composition changed dramatically after the development of the use of FADs by purse seiners. Before 1993, almost all the catch was taken by longline; subsequently purse seining has taken about half the catch, and of the preliminary 108,000 mt in 2004, 69,000 mt was taken by purse seine.

2.30 There are management measures in place for three stocks in the EPO, yellowfin, bigeye, and northern albacore. The yellowfin assessment indicates that the stock may be lower than the level that would provide the average maximum sustained yield (AMSY) and the fishing mortality rate (F) during 2002 and 2003 was greater than the level that would provide the AMSY (FAMSY). The bigeye stock is now significantly lower than the level that would provide the AMSY and FAMSY is 57% of recent fishing mortality. The assessment of bigeye as an EPO stock was consistent with the results of a Pacific-wide assessment.

2.31 The 2004 Resolution on Conservation provides a 6-week closure for purse seining and catch limits for longline fishing countries. The effects of those measures have been sufficient to slow the decline of the bigeye stock, but are insufficient to allow the stock to recover to MSY levels.

2.32 The assessment of North Pacific albacore was based on the assessment carried out at the19th meeting of the North Pacific Albacore Working Group. It is likely that the stock size is below the level that would provide the AMSY. The IATTC agreed that members should ensure that fishing mortality on the stock is not increased.

2.33 A comment was made that a combined EPO and WCPO assessment should be done for bigeye tuna since the current 150ºW division is thought the middle of the stock. It was noted that such a combined area assessment was done and taken into consideration for management recommendations.

FISHERY REPORTS FROM MEMBERS AND OBSERVERS

AUSTRALIA

2.34 P. Ward and R. Campbell summarised *Australia Tuna Fishery Report* (WCPFC-SC1 FR WP-13). Domestic longlining off eastern Australia has declined, with the number of active vessels falling from 134 to 121 in 2004. Longline fishing effort also declined, from a peak of 12.5 million hooks in 2003 to under 10 million hooks in 2004. The decreased activity is attributed to high operating costs (driven mainly by high oil prices and the high cost of squid baits), the strength of the Australian dollar and reduced catch rates of swordfish in inshore areas, around seamounts.

2.35 The catch of swordfish decreased further to 1808 mt in 2004, and is now down 40 percent from the record high of 3080 mt obtained in 1999. This reduction is despite the fishery's expansion into high seas areas where high swordfish catch rates are being maintained. About 15% of the longline effort is now reported from outside the zone. The proportion of swordfish taken on the high seas has progressively increased to almost 40%.

2.36 Smaller proportions of other target species are taken from outside the Australian Fishing Zone because those species are also the target of smaller longliners operating closer to ports. The catch of yellowfin tuna in 2004 was around 2340 mt, which was a substantial decline from the 2003 peak catch of over 3600 mt. The catch of bigeye tuna (902 mt) was also less than the peak catch (1315 mt) reported in 2001; and the 468 mt of striped marlin was down on the 2001 level (795 mt). There is renewed interest in albacore tuna, with several longliners targeting the species for the canning market.

2.37 Striped marlin continued to feature in recreational and charter gamefish catches in 2004, but in fewer numbers than in the late 1990s. Recent years have been excellent for the heavy tackle fishery for large black marlin off Cairns. Good numbers of blue marlin were also reported by gamefishing tournaments.

2.38 Very few skipjack tuna were taken by our small purse seine and pole-and-line fleet off southern New South Wales. Marginal profitability combined with inter-annual variability in catches makes this an opportunistic fishery.

2.39 A Fisheries Management Plan is now being implemented. It includes the individual allocation of fishing rights in the form of hook-days. Mandatory measures have also been introduced to mitigate seabird bycatch, including weighted swivels, tori lines and night setting in certain areas. Auxiliary management options for halting the continued decline of swordfish within the Australian zone are also being considered.

COOK ISLANDS

2.40 J. Mitchell summarised *Cook Islands Fishery Report* (WCPFC-SC1 FR WP-20). The size of the longline fleet has increased from 19 in 2002, to 46 in 2004. The fleet is split between a fresh fish fishery in the south, based in Rarotonga, and a frozen albacore fishery in the north, based in Pago Pago. Total catches have increased from around 1000mt in 2002, to 3000mt in 2004, although the last two years have seen a decline in overall CPUE for this fleet. This trend has continued into 2005. The highest percentage of the catch has consisted albacore tuna, followed by yellowfin and bigeye tuna and swordfish. Onshore developments include port development, an improved fisheries database, a new high seas VMS, and the introduction of strong fisheries legislation.

EUROPEAN COMMUNITY

2.41 R. Sarralde summarised *Fisheries Report of EU-Spain for the Year 2004* (WCPFC-SC1 FR WP-16). The European purse seine fleet (EC-SPAIN) operate in the Pacific since 1978. This fleet has been made up of five large tuna purse seine vessels whose fishing activity has been primarily carried out in the EPO although they have operated taking some sporadic catches in the WCPO since 1999. The hold volume of these vessels is 11997 m3 (ranging from 1881 m3 to 3161 m3). Preliminary data for 2004 suggests nominal catches of 5,517 mt in total (yellowfin tuna 1,196 mt, bigeye tuna 842 mt and skipjack tuna 3,479 mt) in areas of the WCPFC. These vessels have 100% coverage of on-board observers in keeping with the Agreement on the International Dolphin Conservation Program managed by the IATTC. One descriptive document (WCPFC-SC1 FT WP-2) has been presented about a project on tuna acoustic selectivity using echosounder and sonar and a new FAD designs to reduce by-catches species.

2.42 Concerning the Spanish surface longline fleet, there was no fishing activity in the western and central zones of the Pacific Ocean prior to 2004. During 2004 two experimental fishery activities began, targeting swordfish with the surface longline gear in areas of the WCPFC. Eight Spanish longline flag vessels were taking part in this experimental fishery. The gear used by these 8 vessels cited was the 'American style' (Florida style modified) surface longline, with an average of 1055 hooks per set. The overall catches held on board, in tons of round weight, taken by all 8 vessels fishing to the west of 130ºW were: swordfish 692.5 mt, blue shark 1291.4 mt, shortfin mako 238.3 mt, tunas 88.8 mt, billfish 38.2 mt and others species 1.2 mt. Opportunistic tagging and release activities were also carried out during both experimental activities. Around 400 different individuals were tagged and released: 148 swordfish, 145 shortfin mako, 11 blue shark, 47 *Carcharhinus* spp., 39 tunas and 19 billfishes. In addition, biological samples were collected for use in future studies on reproduction, sex ratios, genetic analyses, etc.

2.43 Concern was raised with regards to the accuracy of high blue shark catch rates off Australia that are not observed in the Australian longline fishery however it was reported that blue shark catch

rates were from observer data. An inquiry was made with regards to the location and gear configuration in areas of high swordfish catch rates. It was reported that longlines were targeting swordfish but spatial data was not on hand. It was pointed out that high swordfish catch rates in recent years are common across all oceans and is the result of changes in targeting practices and should not be interpreted as an increase in population. It was noted that EC-Spain swordfish catch was higher that that of the New Zealand domestic fleet and if further collaboration could be pursued to aid in stock assessment. It was confirmed that the vessels in the WCPO were part of the experimental fleet operating in the EPO.

FEDERATED STATES OF MICRONESIA

2.44 B. Thoulag presented a summary of *FSM Tuna Fisheries Report* (WCPFC-SC1 FR WP-7). The number of domestic and foreign fishing vessels licensed annually to fish within the FSM EEZ ranged from 340 to 400 vessels annually over the last decade. For 2004, the total number of vessels licensed was 399, slightly more than in 2003 (389 vessels).

2.45 There are currently six FSM-flagged purse seine vessels fishing in the WCP-CA and this fleet took an estimated 26,958 mt during 2004. This fleet mainly fished in the equatorial region of PNG waters and the high-seas pockets adjacent to Nauru and FSM waters.

2.46 The 2004 FSM longline total catch for all species in the WCP-CA, was reported to be 849 mt. The total catch comprised of 520 mt of bigeye (~82%), 207 mt of yellowfin (14 %), and 54 mt (~4%) of other species caught as by-catch. The total FSM longline catch for 2004 was approximately 20% higher than the 2003 catch. Most of the fishing effort by this fleet was concentrated in the Republic of the Marshall Islands EEZ, and specifically the Clearwater longline fleet, which is based out of Majuro (in Republic of the Marshall Islands).

2.47 The total catch by all fleets in the FSM EEZ during 2004 was estimated to be 137,436 mt, though this is considered to be an underestimate. The breakdown of total catch by gear type was: purse seine 132,997 mt; longline 3,425 mt; and pole and line 1,014 mt. The total 2004 catch was only 66% of the 2003 total catch in the FSM EEZ (207,514 mt).

2.48 The Japanese purse seine fleet, comprising 34 active vessels, took a total of 55,409 mt in the FSM EEZ during 2004, the Chinese-Taipei purse seine fleet took a total of 30,500 mt and the Korean purse seine fleet took a total catch of 21,021 mt.

2.49 The total catch by the four longline fleets in the FSM waters for the 2004 period (3,747mt) which was only ~47% of the 2003 total catch (7,892mt). The Japanese longline fleet has been the most dominant fleet within the FSM waters over the last seven years, although the 2004 total catch for this fleet is provisional, as there remain logsheets for several months in 2004 yet to be processed.

FIJI

2.50 S. Tuilaucala summarised *Fiji Tuna and Billfish Fisheries* (WCPFC-SC1 FR WP-12). The Fiji fishing zone has provided good catches of albacore and other pelagic species. This area has attracted foreign fishing activity since the early 1950s. Fijian participation in the commercial tuna fishing then picked up in the mid 1970s, then mainly focusing on pole-and-lining. Since the inception of the Taiwanese and Korean longline activity in the 1980s, longlining has become the predominant fishing method tuna fishing in Fiji.

2.51 The 2004 fishing season saw the licensing of 84 longliners. This together with the Fiji based unlicensed fishing vessels, caught a total of 19,617mt of fish, of which 16,708mt were tuna species.

2.52 The species composition of the tuna catch is primarily made up of albacore (typically more than 75%), followed by yellowfin, then bigeye. The nominal CPUE for the tuna species in 2004 were

1.3 fish per 100 hooks for albacore, 0.4 fish per 100 hooks for yellowfin, and 0.2 for the bigeye tuna. The 2004 non-target species catch totalled 2909mt, an improvement of the 2003 catch.

2.53 In 2004, Fiji exported 66% of sashimi grade tuna to Japan and America. The remaining 34% was exported to China and other countries. Fiji's billfish are also exported mainly to the USA, buying close to 43% of the total billfish exports.

2.54 Besides the USA, the non-target species is exported to China, Thailand, New Zealand and Japan. Albacore and skipjack are either processed at the local cannery (PAFCO) or exported to Pago Pago. The Pacific Fishing Company (PAFCO) receives its raw materials directly from the domestic and foreign vessels unloading at the Levuka port or indirectly through Freezer Containers from the local fishing companies.

2.55 Onshore developments include the establishment of a new fish-processing factory bringing the total number of processing factories in Suva to 5 and the construction of a fisheries jetty. Monitoring developments include improvements to Fiji's MCS systems i.e. the maintenance of the Observer, Licensing and Enforcement, and Data management sections. As a result, Fiji was able to increase its logsheet data coverage to 98%, an increase of 4% from 2003.

FRENCH POLYNESIA

2.56 C. Ponsonnet summarised *Tuna fisheries in French Polynesia in 2004* (WCPFC-SC1 FR WP-21). Tuna fisheries in French Polynesia are divided into two components: a small-scale coastal fishery (around 300 boats) and an offshore long line fishery (75 boats). The coastal fishery comprises two type of boat: the poti marara (6-8 m in length made of wood or fibreglass) and the bonitiers (10-12 m in length, mainly made from wood). Although the size of the poti marara fleet shows some fluctuations among years, this fleet seems to have reached a stable level and the individual fishing effort will probably remain quite steady in the future. It is noteworthy that there are also a large number of non-professional poti marara whose fishing effort and catches are difficult to estimate. The bonitiers' fleet has steadily decreased and it is likely that this trend will continue in the future. Catches by the coastal fleet for 2004 are estimated at 2,140 mt. Skipjack is the main species captured (1,024 mt), followed by yellowfin (509 mt) and dolphin fish (232 mt).

2.57 The development of the longline fishery started in the early 1990s. After a rapid increase, the size of the fleet remained quite stable for several years. However, the fishing effort steadily increased consistent with the increase in mean vessel size. In accordance with the fishery development policy of the government of French Polynesia, the size of the longline fleet has increased since 2003. In two years, the number of longline boats increased by 39 % and the number of hooks set has increased by 61 %. Unfortunately, in the same time, the overall CPUE fell by 56 % (36 % in 2004), mainly due to a drop in albacore CPUE (-72 % on this period, - 57 % in 2004). It is noteworthy to highlight the increased yellowfin tuna CPUE in 2004 (+ 43 %). In consequence, the overall longline catches fell by 30 % in two years (- 21 % in 2004) and the catches of albacore dropped by 53 %, similar to the albacore catch reported in 1996. In 2004, the overall catches of the longline fleet were 5,159 mt, which included 2,164 mt of albacore, 1,042 mt of yellowfin (second record) and 495 mt of bigeye tuna. Regarding these recent trends in CPUE, the French Polynesia government has decided to postpone the further development of the longline fleet until CPUEs recover.

2.58 It was noted in discussion there was no apparent explanation for the decline in albacore catch for 2004.

JAPAN

2.59 K. Uosaki presented a summary of *National Tuna Fisheries Report of Japan as of 2005* (WCPFC-SC1 FR WP-5). Longline, pole-and-line and purse seine fisheries are used to catch tunas and billfishes in the WCP-CA. For the longline fishery, the total number of longline vessels in 2002 was

1,447, which are 29 vessels less than that of 2001. The number of longline vessels of the largest size class (over 200 GRT) was 484 in 2002 though these vessels mostly operated out of the WCP-CA. In the case of pole-and-line boat, total number of pole-and-line vessels in 2002 was 403 (115 vessels or 22% less than that in 2000). The number of vessels of the largest size category (over 200 GRT) was 47 in 2000 and was 48 in 2002 while the number of vessels of the other size categories decreased during 2000-2002. For the purse seine vessels, the number of vessels of over 200 GRT, which operate in the equatorial waters, was 36 and showed no change after 1995. The number of vessels of 50-200 GRT, which operate to catch tunas in near shore Japan north of 20˚N, has slightly decreased from 23 in 2000 to 18 in 2002.

2.60 Total catch in 2003 for all gears combined, including coastal fisheries, were 35,000 mt for bigeye, 51,000 mt for yellowfin and 318,000 mt for skipjack, and the catch of these three species amounted 403,000 mt. During 2000-2004, the bigeye catch was relatively stable ranging from 32,000 mt to 37,000 mt, but yellowfin catch showed declining trend from 70,000 mt to 41,000 mt. The skipjack catch showed no apparent trend ranging from 372,000 mt to 438,000 mt.

2.61 Total catch of tuna and billfish in 2003 by the longline (>20 GRT) was 50,000 mt, corresponding 92% of the catch in 2002. Bigeye catch decreased from 24,000 mt in 2002 to 21,000 mt in 2003. Albacore catch also slightly decreased but yellowfin and swordfish catches was equivalent to those in previous year. Total catch of the pole-and-line fishery in 2003 was higher than those in previous years amounting at 153,000 mt. Catches of skipjack, yellowfin and bigeye tunas in 2003 were 115,000 mt, 2,000 mt and 1,000 mt, respectively. The skipjack catch increased 115,000 mt and was 127% of that in 2002. On the other hand, the albacore, yellowfin and bigeye catches were lower than those in 2002. Total catch of the purse seine fishery has stabilised to nearly 200,000 mt in recent years. The majority of the catch has been skipjack, which accounted for more than 70% of the total catch in recent years. Total catch in 2004 was 174,000 mt, 22,000 mt and 4,500 mt for skipjack, yellowfin and bigeye, respectively.

2.62 There was some clarification with regards to the large decline in longline catch by the fleet east of 180ºW. It was further reported the there are two classifications of longline vessels, large and medium and medium vessels are not authorised by law to fish past 180ºW therefore catch does drop dramatically.

KIRIBATI

2.63 T. Riinga summarised WCPFC-SC1 FR WP-24. With respect to fleet structure there is at present one locally flagged purse seine vessel. This is between Otoshiro Company and Kiribati government hence the name KAO (Kiribati and Otoshiro). Catch data for this fishery will be made available in the country report. At this stage data is still being retrieved from Fisheries office Kiribati.

2.64 With respect to catch by gear type, purse seine fishery mainly by DWFNs is the dominant fishery catching more than longline and pole and line. The highest catch for all gears was observed in 2001 ~ 300,000 mt declining to ~50,000 mt in 2004. Bigeye tuna is the dominant species for the long line fishery for the years 2002, 2003 and 2004 representing 49, 41 and 48 percent of the total catch respectively. Highest catch for longline fishery was in 2001(~80,000 mt) with category 'others' dominating the total catch. Year 2004 recorded the lowest catch for the longline fishery (~8,000 mt). Purse seine catches were dominated by skipjack for the period 1999-2004. Highest catch was in 2002 with a total catch of more than 260,000 mt with catch in 2004 dropping to ~50,000 mt. Pole and line fishery was mainly by the Japanese. High catches were recorded for 1999 at 1,800 mt dropping to ~600 mt in 2004 with little catch during the intervening years.

2.65 At this stage, Kiribati and Otoshiro unloads mostly at the tuna cannery in Pago Pago. With respect to foreign vessels fishing in Kiribati EEZ, we have no information on their final market destination. Transhipment activities started in May 2005 and activities are summarised in WCPFC-SC1 FR WP-24. Port sampling regained momentum in Kiribati during the early part of this year

following sampling training carried out by one SPC OFP staff during the same period. Port sampling by both observers and some fisheries staff has continued since then.

2.66 The Kiribati observer program started in 2001. There were 36 qualified observers for Kiribati following 2 training workshops at Tarawa and Christmas Island. At present less than 50% observers are still with the programme. Despite the reduction in number of observers, there has been steady increase in the number of observer trips for distant water fishing nations. There is a plan to increase number of trips to reach 20% observer coverage as well as an improvement in the quality of the data collected.

MARSHALL ISLANDS

2.67 Not presented but the following is a summary of WCPFC-SC1 FR WP-14. The tuna fishing operation in the Republic of the Marshall Islands for 2004 experienced a comeback for the purse seine fleet. However, the pole and line fleet, catching relatively the same species, dropped to a nearly zero level of operation. The longline fishery experienced a mixed level of comeback for the year, with bigeye as its dominant catch, a continued decline in the Japanese fleet (large freezer vessels), and an increasing number of locally based foreign vessels.

2.68 The longline catch from the EEZ of the Republic of the Marshall Islands is dominated by bigeye and yellowfin accounting on average for 52% and 39% of the total reported catch from 1995 to 2003. Between 1980 and 2003 there was a considerable shift in the species composition of the catch, with an increasing proportion of bigeye and a corresponding decline in the proportion of yellowfin. The 2004 figures were 18% yellowfin compared to 69% bigeye.

2.69 Annual pole-and-line catches of skipjack tuna averaged about 8,500 mt over the 1980–2002 years, although overall average catch is influenced by changes in the fleet size over the period. The catch history is also characterised by high inter-annual variability, with exceptionally high catches occurring in 1983, 1987, 1998, and 2001. Efforts declined in late 2002, and by 2004, the fleet, resulting in a catch of just less than 30 tons, expended only one day of effort.

2.70 Purse seine fishing effort peaked in 1998 following the introduction of the Japanese, Korean, and Taiwanese vessels to the fishery. Over subsequent years, fishing effort has fluctuated around lower levels. Annual catches of skipjack have generally followed a similar trend to fishing effort; peaking in 1998 at about 50,000 mt; subsequently averaging about 20,000 mt in 1999 and 2000; and, 30,000 mt in 2001 and 2002. Catch records for 2003 showed a drop in catch and effort in-zone for the fleet with just over 3,000 tons of mixed catch, with a big increase in 2004 totalling just under 16,000 tons of mixed fish. Skipjack accounted for 93% of the purse seine catch in 2004.

THE REPUBLIC OF KOREA

2.71 D-Y. Moon summarised *Korean Tuna Fisheries in the western and central Pacific Ocean* WCPFC-SC1 FR WP-2. In spite of the decreasing trend of fishing fleet size, annual catches of tuna by the Korean tuna fishery remain relatively constant at over 200,000 mt after 1990 until recent years. In general, the majority of tuna catches by the Korean fleet have been taken from the Pacific of which the Western and Central Pacific area accounted for over 90% of total Pacific catches. During the past 5 years, WCP-CA catches by the Korean fleet fluctuated from 210,000 to 260,000 mt and averaged 230,000 mt. Total tuna catch in the WCP-CA in 2004 was 216,556 mt from 190 tuna vessels, among which 183,490 mt and 33,066 mt were caught from 28 purse seiners and 162 longliners, respectively. Four major species comprised over 95% of total WCP-CA tuna catch in 2004, among which 152,126 mt was for skipjack, 41,362 mt for yellowfin, 18,001 mt for bigeye and 1,163 mt for albacore. Although yellowfin and bigeye are the second most important species in quantity, 21% and 10%, respectively, both species represent higher commercial value than skipjack as they are caught in longline fishery and sold in the sashimi market. Billfishes were incidentally caught in both purse seine and longline fisheries and among them; blue marlin was dominant in the catches. During the period

1999-2003, about 40,000-50,000 mt of longline-caught tuna and 60,000-90,000 mt of purse seine-caught tuna were exported annually. The amount of exports by the Korean longline and purse seine fleet accounted for 70-82% and 39-47% of the total fleet catch, respectively. The remainder was consumed in the domestic market by either sashimi or cans.

2.72 Korea initiated the development of an observer program for distant-water fisheries including tuna fisheries in 2002. In 2004, a total of 3 trained observers were deployed to monitor Korean tuna longline and purse seine fisheries, of which two cruises were conducted in the Pacific Ocean. Since concerns of sea turtle bycatch in longline fisheries have been raised in various international meetings, the Korean government funded an experiment with circle hooks to investigate if circle hooks can solve this international problem of sea turtle mortality. The experiment will be conducted by National Fisheries Research and Development Institute (Republic of Korea) scientists aboard a commercial Korean longliner operating in the Eastern Pacific during July and August 2005, in collaboration with a USA scientist from the National Marine Fisheries Service Honolulu Laboratory. National Fisheries Research and Development Institute (Republic of Korea) is currently reconstructing a database system for handy manipulation and analysis of fisheries data by fishery scientists. Old data files will be revisited and reviewed for the correction or verification of the existing statistics. To solve practical problems that fishermen usually encounter when they record bycatch species, National Fisheries Research and Development Institute (Republic of Korea) is compiling a fishermen's guide to bycatch species for the tuna longline and purse seine fisheries.

2.73 Further clarification was received that the shift observed in 2004 westward of the longline fleet was likely in response to oceanographic changes such as El Nino. Furthermore it was reported the decline in fleet size was the result of economic streamlining given increasing costs and reduced revenues. It was also noted that the purse seine fleet fishes in areas where FAD fishing is common but the fleet itself generally uses unassociated sets. It was indicated that FAD sets generally return smaller catches.

NAURU

2.74 T. Amram presented a summary of *Nauru Tuna Fishery Report* (WCPFC-SC1 FR WP-18). Nauru has no major commercial fleet operating in the WCP-CA, although there are two 12-metre longline vessels operated by Nauru Fisheries and Marine Resources Authority, with operations restricted to the EEZ of Nauru. The fleet is yet to be fully operational and is still undergoing trial fishing operations to determine the viability of operating a longline venture in Nauru and have yet to embark on a fully commercial scale

2.75 Nauru licenses a total of 144 purse-seiners in 2004 from the following countries: Japan, Korea, Chinese-Taipei, Vanuatu, China, USA, New Zealand and FSM Arrangement. Total catch in the Nauru EEZ during 2004 was estimated at 57,356 mt; around three times the catch of 2003 (19,646 mt). The longline fishery is insignificant compared to the purse seine fishery and is currently exploited by the two small inshore longliners operated by the Nauru Fisheries and Marine Resources Authority. The catches from the two vessels has been erratic due to continuous mechanical breakdown, however the breakdown since 2003 is as follows: bigeye tuna - 8.9 mt, yellowfin tuna - 4.8 mt and others species - ~6 mt.

NEW CALEDONIA

2.76 R. Etaix-Bonnin summarised *New Caledonia – Annual Report on Tuna fishing and related activities* (WCPFC-SC1 FR WP-15). In 2004, 29 domestic tuna longliners were licensed to fish in the New Caledonian EEZ of which 27 were active - their mean length is 20 metres. Only two vessels were classified as factory vessels with loining facilities on-board. Since early 2001, no foreign vessels have been licensed to fish in the EEZ. From January this year, a VMS has been set up to track every fishing vessel operating in the EEZ. This system is currently being tested, when it is totally implemented, it will represent a source of information to help identify unregulated fishing in the EEZ.

2.77 In terms of fishing effort, 2004 was similar to 2003 with 6,000,000 hooks fished and 500 fishing trips in total. The catch statistics are mainly compiled from landings and logsheet data. The South Pacific regional longline logsheet is now used by all fishing companies to report catches by their vessels. The overall catch reported for 2004 is slightly larger than that of 2003 (2,616 metric tonnes compared to 2,466 metric tonnes). Much of the activity occurs within the EEZ (2,484 metric tonnes in 2004).

2.78 Seasonality is an important feature of tuna fishing in the EEZ of New Caledonia, particularly regarding albacore: much lower catches of this species were reported from March to May last year. Within the ZoNéCo programme, a project is currently being carried out to address the question of seasonality. It aims at analysing the variability of certain environmental and biological parameters of the tuna habitats in New Caledonia's EEZ, in order to better understand and predict tuna movements.

2.79 Under ZoNéCo experimental fishing trips totalling 8,100 hooks fished were also carried out from November 2003 to October 2004, using hook-timers and pressure-temperature sensors to provide more information about the vertical distribution of tuna. Two different fishing strategies were tested during these campaigns "shallow" (targeted depths: 250-300 metres) and "deep" (targeted depths: 400-500 metres). Yellowfin, marlins and sharks are mainly caught when the temperature is above 20 °C, bigeye and opah when the temperature is under 20 °C.

2.80 In 2004, the port samplers in New Caledonia undertook 375 samplings of off-loadings, (representing 75% of all the fishing trips). A total of 47,030 fish were measured and comprised the following species breakdown: albacore (71%), yellowfin (19%), bigeye (1%), marlins (1%) and other commercial species (8%).

2.81 Eleven observer trips were conducted during 2004. Since the beginning of the project in early 2002, 222 longline sets have been observed totalling 433,180 hooks.

2.82 Complete data regarding markets have not yet been submitted to the New Caledonia socio-economic observatory. However, some recent trends are available – there has been a general decrease in exports to the Japanese sashimi market, and there has been an increase in sales for canning.

2.83 The New Caledonian tuna fleet has developed from the early 2000s and is now well established and stable - it is unlikely that the number of vessels will increase sharply in the near future. Fishing strategies may change, however, with more vessels targeting albacore since loining facilities are now available in New Caledonia.

NEW ZEALAND

2.84 S. Harley summarised *New Zealand Domestic Tuna Fisheries in 2003 and 2004* (WCPFC-SC1 FR WP-1). New Zealand tuna fisheries are based on the principal market species: albacore, bigeye, Pacific bluefin, southern bluefin, skipjack and yellowfin tunas. A range of gear types including purse seine, troll, longline, and occasionally pole-&-line and handline are used to catch these species.

2.85 Four New Zealand flagged purse seine vessels have fished under bilateral arrangements in the EEZs of Pacific Island States and in high seas areas of the equatorial western and central Pacific Ocean since 2000. These vessels also now fish part of the year within New Zealand fisheries waters targeting skipjack together with 5-7 smaller capacity domestic-based purse seiners.

2.86 The remainder of the tuna fleet consists of around 300 domestically owned and operated vessels (mostly 15 to 25 m) that fish for tunas using troll and longline gear, some of them switching between gear types with the season or indeed operating part of the year in non-tuna fisheries. There was a decline in vessel numbers using the troll (25%) and longline (40%) methods between 2002 and 2004. A small fleet of foreign owned and operated longline vessels on charter to New Zealand fishing

companies operate in the EEZ almost exclusively targeting southern bluefin tuna. Unites States purse seine vessels fish occasionally in New Zealand waters under treaty arrangements.

2.87 Skipjack, nearly all taken by purse seine, has comprised the greatest part of the New Zealand catch of all tuna species, both inside (5-10,000 mt) and outside (10-15,000 mt) the EEZ. Outside the EEZ 2-3,500 mt of yellowfin and bigeye is taken by purse seine.

2.88 Inside the New Zealand EEZ, albacore is the second most important component of the tuna catch and is taken mostly by troll gear (3-4,000 mt), but also by longline. Longline catches of around 3,000 mt arise mostly from target fishing for bigeye and southern bluefin tunas, but the greatest part of the catch consists of albacore and swordfish. Striped marlin is the main target species of a well-established recreational sport fishery in northern New Zealand. While billfish are also regularly a non-target catch on commercial tuna longlines, no marlin species can be kept (whether alive or dead) when caught.

2.89 As of 1 October 2004, New Zealand introduced several longline caught species into its Quota Management System. These were bigeye, yellowfin and Pacific and southern bluefin tunas, moonfish, Ray's bream, and porbeagle, mako and blue sharks. The Quota Management System introduction has led to a rationalisation of the domestic fleet and this is expected to continue with a move towards more efficient vessel use.

2.90 Concurrent with these Quota Management System introductions detailed biological studies of the sharks and non-tuna bycatch has been undertaken and this is summarised in WCPFC-SC1 GN IP-2. Work is also being undertaken on a swordfish assessment with Australia; albacore catch monitoring and CPUE analyses for troll and longline fisheries.

2.91 Further clarification was provided with regards to the large decline in swordfish catch from 2003 to 2004 (a reduction in effort by ~40%). It was further noted that the reduction in fleet size essentially resulted from the adoption of a quota system in which part-time fishers chose to leave the fishery.

NIUE

2.92 B. Pasisi presented *Niue's Fishery Report* (WCPFC-SC1 FR WP-24). Niue's fishery waters (~450,000 km2) have only been fished reasonably lightly and sporadically by longline vessels of foreign distant water fishing fleets under license access arrangements in the past. The highest number of vessels licensed in any one year has been 48, with catches in the order of several hundred metric tonnes. The offshore tuna fishery consists of three components, a small artisanal boat and canoe fishery, small developing sport fishery, and the newly developing commercial domestic longline fishery. Tuna resources are considered by Niue as a major natural resource available to support significant economic development opportunities in the fisheries sector.

2.93 Niue does not have a fleet operating in the WCP-CA, however it currently has 13 vessels licensed to fish under charter arrangement. The latter vessels, ranging in size from 10-29 metres, fish into the new joint venture fish processing facility (Niue Fish Processors Ltd). The offshore tuna fishery is managed under a tuna management and development plan. The number of licenses and larger vessels under charter is expected to increase to 20 over the next year, with smaller local boats not yet limited. No catch has been taken in the commercial fishery over the last two years resulting from the development of a new joint venture processing plant, and a discontinuation of foreign access licensing.

2.94 Four smaller longliners have commenced fishing since May 2005 and preliminary data available indicate the deployment of 57,000 hooks and an estimated catch rate of around 58kg/100 hooks. Over the three-month period May – July the estimated total catch of these vessels has been around 33 tonnes. This is expected to increase significantly as larger vessels licensed arrive. The new

processing plant can process up to 6000mt of fish per annum. Fresh fish (bigeye and yellowfin) is currently exported to New Zealand and the U.S.A., with frozen albacore going to the canneries in Pago Pago. A new air service (Reef Air) has also been established under joint venture to freight fish out of Niue, and significant wharf and harbour development is in the advanced planning stages. Port sampling and observer programmes are in place and have commenced.

PAPUA NEW GUINEA

2.95 L. Kumoru summarised *Fisheries Report – Papua New Guinea* (WCPFC-SC1 FR-WP10). Papua New Guinea's 2.4 million km2 EEZ is one of the largest and more productive in the western and central Pacific Ocean. In certain years around 10% of the global catch of the main market species of tuna is taken this EEZ.

2.96 The Tuna fishery is the largest of Papua New Guinea's fisheries and represents a balance of both Domestic industry development and Foreign (DWFN) access arrangements. The tuna vessels operate under various arrangements and categories such as domestic locally based foreign and foreign access. Since 1999, the development of the tuna fishery has been guided by the National Tuna Fishery Management Plan, which establishes an overall management structure and an application framework for the longline, purse seine and pole –and- line fisheries, including license limits and total allowable catches. The PNG purse-seine fishery operates within the guidelines of several important regional and sub-regional arrangements such as the PNA, Palau and FSM. Under the current government's export-driven economic growth strategy, license to fish by foreign and domestic purse seine is linked to commitment to onshore investment especially in the form of tuna processing.

2.97 A total of 203 vessels had access to fish in PNG waters in 2005, of which 153 were purse-seine vessels, 42 domestic tuna longline, 9 domestic shark longline and 42 PNG associated purse-seine vessels with the remaining being the foreign purse-seine vessels. Catch by PNG associated purse-seine vessel in PNG waters for years 2003 and 2004 was 107,000 mt and 101,000 mt respectively. The catch by these vessels in the WCP-CA was 195,000 mt in 2004, an increase of 40,000 mt from the 2003 catch. The overall catch in PNG waters by all vessels in 2004 was 309,000 mt, which was 60,000 mt less than the 2003 catch. There was a slight increase in the catch by the longline vessels with an increase in the albacore component.

2.98 Tuna longline CPUE for all species was steady in the last 4 years although there was an increase in the albacore CPUE in the last two years. For purse-seine fishery CPUE was higher for vessels fishing unassociated sets than those fishing predominately on FADs.

2.99 PNG has 87 trained observers who made 168 trips totalling 6,407 sea-days in 2004, of which 77% of the trips were on purse-seine vessels. PNG has 100% observer coverage on all purse-seine vessels involved in the mothership operations in PNG waters. Other activities such as trial fishing and FAD deployment operations also have 100% observer coverage. There are 22 port samplers stationed through out the country and they are assisted by observers whilst not out at sea. A total of 45 purse seine and 379 longline unloadings were sampled in 2004.

2.100 PNG is also involved in by-catch reduction exercises through various projects including, work on teaching fishermen and observers on how to safely release longline caught turtles as well as the use of circle hooks. Other exercises include the review of the current management plans to reflect Ecosystem based fisheries management Principles.

2.101 Tuna products such as frozen tuna are sold to the Philippines, Japan and Chinese Taipei whilst chilled tuna from longline is exported to Japan and Australia. Tuna loins to EU and USA, tuna canned to EU and shark products mainly to Chinese Taipei.

2.102 PNG has Fisheries project agreements with a couple of investors that are yet to be implemented. It is hoped that at full implementation PNG would see another three or four more fish processing plants of capacities more than 100mt/day come into stream in the next 5-6 years.

PHILIPPINES

2.103 Not presented but the following is a summary of WCPFC-SC1 FR WP-8. The Philippines is a major tuna producer in the WCP-CA, both in terms of providing food for its large population and catches by wide-ranging industrial fleets. It is both a coastal and flag state with respect to the Convention The fishery has both municipal and commercial components (defined with respect to vessel size - < or >3 GRT). The total fleet targeting both oceanic and coastal tunas comprises handline bancas, ringnet vessels, small and larger purse seiners, domestic longliners, distant water longliners and a range of small artisanal vessels; actual numbers of vessels are not well documented in some cases

2.104 The annual catch of oceanic tunas in Philippine waters, estimated by the Bureau of Agricultural Statistics, ranged between 190,000 and 272,000 mt during 2000-2004, and continues to trend upwards, having increased by around 70,000 mt in that time. Data on catch by gear are not readily available and are currently estimated by SPC OFP from the most recent breakdown available (1996). Uniquely in the WCP-CA, the catch of coastal (neritic) tunas rivals the catch of oceanic tunas in importance. Estimated billfish catches have been in the range 10,000 mt to 13,500 mt. The total estimated catch of tunas and billfish in the Philippines EEZ by Philippines vessels has been in the range 339,000 – 497,000 mt in recent years, with oceanic tunas contributing over 50% of this catch. The majority of catches are made in southern waters. No fishing by foreign vessel is permitted in the EEZ but considerable IUU fishing is believed to occur; unloading by foreign longline vessels is permitted at one port, where around 5,000 mt of tuna have been unloaded annually.

2.105 Philippine flag vessels also take catches outside the EEZ, and within the WCP-CA – purse seine (and longline) vessels in the Indonesian EEZ under an access arrangement, purse seine catches in the PNG EEZ by both bilateral access and PNG-based vessels (~ 90,000 mt total), ring net and handline catches (not well documented in terms of catch and area fished) and distant water longline catches (though not during 2004). A provisional estimate of the total catch of oceanic tunas in the WCP-CA during 2003 by Philippine vessels suggest it may be as high as 400,000 mt, with the estimated within-zone catch possibly including some landings by vessels fishing beyond the EEZ.

2.106 The Philippines is a major processor of oceanic tunas, particularly canning (250,000 mt p.a.) for primarily export markets, but also exports frozen smoked, fresh chilled and frozen tunas (total value US$ 150 million plus). Several major fishing ports are undergoing renovation.

2.107 Recognising deficiencies in the current statistical data, the Indonesia and Philippines Data Collection Project (IPDCP), developed by PrepCon, is providing funding to address these problems, and work involving Bureau of Agricultural Statistics and Bureau of Fisheries and Aquatic Resources commenced in early 2005. The Philippines is now a member of the WCPFC, and is in the process of instituting some important tuna management initiatives for the fishery.

SAMOA

2.108 T. Mulipola summarised *Samoa Tuna Fisheries Report 2005* (WCPFC-SC1 FR-WP22). The tuna longline fishery remains the mainstay of the Samoa economy in spite of the recent persistent low catches. The tuna fishery fleet structure is based primarily on domestic longline fishing boats (10 m to more than 15 m). The fleet declined dramatically to about 40 active vessels during 2004 from 200 vessels in 2000. Similarly, the total number of hooks deployed declined from about 10 millions in 2000 to 5 millions in 2004.

2.109 The total estimated catches of the fishery in 2004 was about 1935 mt. Albacore was the main targeted species, which accounted for about 64% of the total landed volume. The other tuna species of yellowfin and bigeye were accounted for 22% and 5%, respectively. Non-target species consisted of about 9% of the total catch last year.

2.110 The catch rate for 2004 was also very similar to 2003, approximately 40 kg/100 hooks. Over the past 5 years, the average rate of catch for all species has fallen by approximately 34%, and by about 54% since the late 1990s. In June-July of 2005, a significant increased in the monthly average catch rate was noted.

2.111 The total fish export for 2004 totalled to 1,873 mt or about 96% of the total annual landing. Albacore was the dominant species accounting for 83% of the total volume and mainly exported to the two fish canneries in Pago Pago, American Samoa. Due to limited airfreight capacity, a relative small amount (10%) was exported for the fresh chilled market in Hawaii.

2.112 Catch and effort data are continually gathered from monitoring programmes such as port sampling, logsheets, export certification and market surveys. A national observer program will be initiated shortly after a capacity development workshop in which capability requirements will be enhanced. The observer programme will further verify catch and effort data refining the quality of information needed.

2.113 Some onshore developments occurred during 2004 was the development and launching of the second Tuna Management and Development Plan 2005-09. The plan was the result of the extensive consultation process among relevant stakeholders in which they have identified relevant actions and key projects to guide the management and development of the tuna fisheries in Samoa. Financial assistance from FAO to strengthening food security via fisheries resulted in the deployment of 5 additional FADs during 2004.

2.114 The Government of Japan has kindly agreed to support fisheries development in Samoa by financially assisting the extension of the wharf for fishing boats and the renovation of the fish market and the main Fisheries office. This major project will start in early January 2006.

2.115 Finally, a dialogue on the northern boundary delimitation against American Samoa was initiated and took placed in December 2004. Further dialogue is expected to further resolve the issue of boundary delimitation with American Samoa.

SOLOMON ISLANDS

2.116 S. Diake presented *National tuna status report for Solomon Islands for 2004* (WCPFC-SC1 FR WP-19). The management and development of tuna resources and its industry is presently carried out under the provisions of the 1998 National Tuna Management and Development Plan and the 1998 Fisheries Act. Fishing vessels from seven locally registered commercial tuna companies were licensed to fish for tuna in Solomon Islands fishery limits during 2004. These included 10 pole-and-line vessels from Soltai Fishing and processing Company as compare to 12 vessels in 2003, 3 purse seiners by NFD as that in 2003, 4 small purse seiners (< 100 GRT) by Global Fishing Company as compared to 3 vessels in 2003, 9 longline vessels by Solgreen compared to 12 vessels in 2003, 2 purse seiners by Warken as that in 2003 and 5 purse seiners and 2 longliner by Mako similar to that in 2003. Korean tuna longline vessels chartered by the Tuna Pacific Company although operated in Solomon Islands waters under a development agreement in 2003 and 2004, did not land their catch in Solomon Islands.

2.117 Under bilateral access agreements, purse seine, longline and long-range pole-and-line vessels from Japan, purse seine vessels from Korea and purse seine and longline vessels from Chinese-Taipei were also licensed to fish in the fishery limits of Solomon Islands during 2004. Licensed purse seine vessels under the USA Multilateral Fisheries Treaty and the regional FSM Arrangement also fished in the EEZ of Solomon Islands during 2004.

2.118 The total tuna catch estimate for 2004 by the domestic and foreign fleet for Solomon Islands fishery EEZ amounted to 87,494 mt as compared to 62,910 mt in 2003. The proportion of domestic-fleet catch in 2004 was 27,860 mt (32%) of the total catch. The total catch by species in 2004 by the domestic purse seine vessels consisted of 6,817 mt of skipjack, 9,197 mt of yellowfin and 80 mt of bigeye tuna. The total 2004 catch by the domestic pole-and-line fleet, in comparison consisted of 6,625 mt of skipjack and 257 mt of yellowfin tuna. The total tuna catch by the domestic longline fleet in 2004 consisted of 538 mt of yellowfin, 357 mt of bigeye, 267 mt of albacore and others accounting for 12 mt.

2.119 The total catch by species for the foreign licensed longline fleet in 2004 for the Solomon Islands EEZ also showed the same trend as that for the domestic fleet with yellowfin accounting for 387.3 mt, 115.9 mt of bigeye, 108.9 mt of albacore and others accounting for 5.7 mt (the total catch provided here is however incomplete and data at hand and provided here is only for Chinese-Taipei vessels). The total catch by species for the foreign purse seine vessels in 2004 for Solomon Islands EEZ consisted of 58,015.4 mt of skipjack, 11,795.4 mt of yellowfin, 372.3 mt of bigeye and others accounting for 1 mt. The compilation of catch by species for the foreign pole-and-line vessels operations in Solomon Islands EEZ for 2004 however has not been completed, hence not provided here.

CHINESE-TAIPEI

2.120 W. Ren-Fen summarised *Tuna Fisheries Status Report of Chinese-Taipei in the western and central Pacific Region* (WCPFC-SC1 FR WP-6). There are mainly three types of Taiwanese tuna fisheries operating in the WCP-CA: large tuna longline fishery, distant-water purse seine fishery and small tuna longline fishery. Active vessel numbers of these three fisheries were 137 for large tuna longline, 34 for distant-water purse seine and 1,060 for small tuna longline in 2004, respectively. All have been reduced from 2003.

2.121 The 2004 large tuna longline catches of albacore, bigeye and yellowfin tunas were 13,307, 16,888 and 9,018 mt, respectively. Of which, albacore catch has slightly decreased from 2003, while bigeye and yellowfin catches have increased substantially. Increase in catches of tropical tuna species is, among other reasons, mainly due to the shifting of fishing ground of deep longliners from EPO to WCPO when their bigeye quota reached in the IATTC waters. The shifting of fishing ground is demonstrated from distribution of fishing days from VMS. The bigeye catch is expected to decline in 2005 due to a regulation of fleet size reduction which has already resulted in a decrease of 15 deep longliners.

2.122 Catch of distant-water purse seine was about 198,000 mt in 2004, which is at the lowest level among the recent five years due to a continuous decrease in active fishing vessels. The fishing ground of purse seine fishery has been affected significantly by the environmental condition, and has shifting westwards in 2003-04 from 2001-2002.

2.123 Average catches of small tuna longline vessels landed in domestic ports in the past 5 years was about 28,748 mt. Catch estimates of tropical tunas of small tuna longline vessels landed in WCPO foreign ports was about 6,500 mt in 2004.

2.124 Some plans have been made to improve the statistical system. Total catches of some major species (mainly the albacore) have been reviewed and revised, to reflect the actual fishery situation. Extra logbook information is to be collected and the aggregated catch and effort data will be recompiled following the recommendation of ISC. Collection of fishery independent data will be enhanced, as planned: except domestic port sampling program, the program is to be expanded to foreign landing ports in 2005. The number of observers will be increased from 2 in 2004 to more than 5 in 2005, to collect fishing information both on target species and bycatch species and to collect biological samples. All the large tuna longline and distant-water purse seine have equipped with VMS. Data from VMS could be used for verifying logbook information to improve the data quality.

2.125 Further clarification was provided with regards to the estimation of bigeye tuna catch by purse seine vessels. It was indicated that landing composition from ports in Japan was utilised to estimate bigeye tuna catch.

TOKELAU

2.126 The tuna fisheries of Tokelau include two elements. The first is the small, but important artisanal fishery, with catches made from small boats, largely for local consumption. Domestic fisheries development in Tokelau is severely constrained by market access and lack of infrastructure, and the Government is committed to a development strategy that will provide opportunities for Tokelauans to participate in small-scale commercial tuna fishery development. Offshore activity in the tuna fishery is dominated by foreign fishing vessels of distant water fishing nations and neighbouring Pacific Island States. Vessels licensed in recent years include New Zealand and United States purse seiners, and a small number of Samoa-based longliners. Levels of fishing by these vessels and licensing revenues have fluctuated substantially.

2.127 Tokelau is in the process of developing its tuna management capacities. Key initiatives include strengthening the capacities of the Natural Resources and Environment Unit of the Directorate of Economic Development and Environment; preparation of a National Tuna Development and Management Plan; establishment of a new licensing system and statistical database; and the installation of a national facility for the operation of the FFA VMS.

TONGA

2.128 S. Matoto presented *Tonga Fisheries Report* (WCPFC-SC1 FR WP-9). Tonga's domestic longline fleets are based in the capital Nuku'alofa. Prior to 2002 fishing was carried out in the waters around Tongatapu (the most southern island of the Tonga group where Nuku'alofa is located). Currently all waters beyond Tonga's 12 nm zone are utilised by the fishery. In 2003 and 2004, the total number of longline fishing vessels registered to fish in Tonga waters was 33 and 22, respectively.

2.129 Fishing effort steadily increased by 2000 but declined in 2003-2004 due to a decline in catch rate. Historically, fishing vessels undertook a relatively small number of sets before returning to port. During the past two years, vessels have travelled further away from port and have undertaken more sets. Historically, yellowfin catches have been high in January-May period and subsequently decreased over the September-December period.

2.130 The total catch by the Tonga longline fleet reached a peak in 2001 and 2002 (~1,900 mt for each year). The total catch for this fleet in 2004 was only 522 mt, due to continued reduced effort and low tuna catch rates.

2.131 The tuna industry employs around 500 people. Until 2004, the tuna fishery was the highest revenue-earning fishery for Tonga. A decline in exports of both yellowfin and bigeye occurred during 2004, as less than half the volumes of tuna exported in 2002, were exported in 2004.

CANADA

2.132 M. Stocker presented the summary *Canadian albacore tuna fisheries in the north and South Pacific Ocean in 2004* (WCPFC-SC1 FR WP-4). The Canadian jig fishery is comprised of two fleets. The coastal fleet operates within and near the Canadian and United States fishing zones in accordance with zone and port access privileges under the Canada/USA Albacore Tuna Treaty. Vessels in this fleet, mostly 35 to 60 feet in length, concentrate their fishing effort primarily from the southern California coast to the northern tip of Vancouver Island and, in some years, as far north as off the west coast of the Queen Charlotte Islands. The catch is primarily bled and blast frozen with some vessels holding fresh caught fish in ice or frozen brine. The catch from the coastal fleet is sold either into U.S. or Canadian plants where the fish are sold in the canned tuna market or the fresh-frozen sashimi

market. The Canadian high seas fleet is comprised of larger jig vessels (most greater than 60 feet) with crews typically of two to four fishermen that remain at sea for trips of several months. These vessels, most of which are equipped with large freezers, operate primarily from west of the dateline to the Canadian zone in the north Pacific. Offshore fishing in the north Pacific on the Midway and Wake Islands grounds usually starts in late May or June and, weather and tuna abundance permitting, lasts through late fall as the vessels follow albacore towards the North American coast. Offshore vessel catches are also sold into the canned market, although the majority is bled and blast frozen then sold into the fresh-frozen sashimi market. There are a number of small processors that have established special niche markets for albacore. The product is either smoked (hot or cold) or loined and sold directly to consumers.

2.133 The 2004 catch estimates are still preliminary. The distribution of total north Pacific Canadian catch between FAO Statistical Areas was based on the distribution of reported catch from logbooks. Logbooks have been received from 98% of a fleet of 193 vessels fishing in 2003, and 90% of a fleet of 218 vessels fishing in 2004. The total estimated Canadian catch in the north Pacific for 2004 was 7,796 mt, compared to 6,735 mt in 2003. Most of this catch (98%) was taken in FAO Area 67. Catches in 2004 in Area 61 and Area 77 were 44 mt and 132 respectively.

2.134 In recent years, a few Canadian flag vessels have fished southern albacore stocks below the equator during the November to March seasons. These vessels fished primarily in an area that extends from 130°W to 165°W and 30°S to 45°S. They have landed their catch at ports in American Samoa, Fiji, French Polynesia (Pape ëtë) and Canada. Based on analyses of transhipment records and discussions with skippers, Canadian landings in this fishery from its inception in 1987/88 to 1994/95 are estimated to have ranged from 136 to 351 mt per season. The estimated catch for the 2003/2004 fishing season was 63 mt.

UNITED STATES OF AMERICA

2.135 B. Skillman summarised *U.S. Fisheries for Highly Migratory Species in the Western and Central Pacific Ocean, 2000-2004* (WCPFC-SC1 FR WP-17). The five USA fisheries for highly migratory species are the purse seine fishery that targets skipjack and yellowfin tuna, the longline fishery fishing for bigeye tuna and swordfish, the distant-water troll fishery targeting albacore, the troll and handline fishery targeting a variety of tunas, marlins, and other pelagic species, and the pole-and-line fishery for skipjack tuna. These fisheries combined produced a total catch of 84,401 mt in 2004 (WCPFC-SC1 FR WP-17 Table 1). This was a decrease of 21% from the previous year and the lowest catch observed in the five-year period. Catch of highly migratory species by all U.S. fisheries, except for the troll and handline fishery, decreased in 2004. The purse seine fishery is the largest U.S. fishery for highly migratory species, accounted for 80% of the total catch in 2004, and was responsible for most of the overall decline. The longline fishery contributed 16% of the total catch. The catch in 2004 consisted predominantly of skipjack tuna (57%), yellowfin tuna (20%), and bigeye tuna (12%) (WCPFC-SC1 FR WP-17 Table 2). Lower total catch in 2004 is due to lower catches of skipjack tuna, which dropped 24% from the previous year.

2.136 The U.S. purse seine fleet decreased from 33 vessels in 2000 to 21 vessels in 2004 (WCPFC-SC1 FR WP-17 Table 3). The total catch was 67,419 mt. This catch represents the lowest vessel participation and catch since the fleet began fishing under the South Pacific Tuna Treaty in 1988. The purse seine catch was composed of skipjack tuna (71%), yellowfin tuna (22%), and bigeye tuna (7%). There were 165 U.S. longline vessels fishing in the WCPO in 2004 (WCPFC-SC1 FR WP-17 Table 4). Total longline catch was 13,099 mt; down 11% from the previous year. The California and Hawaii-based longline fisheries accounted for 69% of the total catch while the American Samoa fishery made up the remaining catch. The largest components of the catch were bigeye tuna (34%), albacore (22%), yellowfin tuna (12%), and swordfish (9%). The distant-water troll fishery for albacore in the South Pacific occurs seasonally from December and lasts through March. The number of vessels fishing decreased from 14 in the 2002-2003 season to 11 in the 2003-2004 season. Catches decreased 41% from 1,678 mt in the 2002-2003 season to 995 mt in the 2003-2004 season (WCPFC-

SC1 FR WP-17 Table 5). The main area fished during the 2003-2004 season was east of New Zealand between 35°S to 45°S and 135°W to 155°W (WCPFC-SC1 FR WP-17 Figure 7). Small-scale and artisanal troll and handline fisheries operate in waters off the State of Hawaii, the Territory of American Samoa, the Territory of Guam, and the Commonwealth of the Northern Mariana Islands. The fishery is composed of relatively small vessels with the total number estimated at 2,037 in 2004. The Hawaii-based troll and handline fishery accounted for 85% of the total catch. The catch was predominantly yellowfin tuna (25%), mahimahi (*Coryphaena hippurus*) (23%), bigeye tuna (18%), and skipjack tuna (8%). The Hawaii-based pole-and-line fishery declined to only 2 vessels in 2004.

FISHERY REPORTS FROM REGIONAL FISHERIES ORGANISATIONS

FOOD AND AGRICULTURE ORGANISATION OF THE UNITED NATIONS (FAO)

2.137 J. Majkowski of FAO outlined FAO's activities of relevance to the Scientific Committee. He briefly described the objectives, activities and the outcome of from FAO's Project on the Management of Tuna Fishing Capacity: Conservation & Socio-Economics, referring to WCPFC-SC1 GN IP-7. Then, J. Majkowski presented a proposal of a Methodological Workshop on the Management of Tuna Fishing Capacity on the Basis of Stock Status, Data Envelopment Analysis and Industry Surveys (see Document GN IP-6), which is being organised by the Project in collaboration with the tuna bodies, FFA, SPC OFP and tuna fishing industry. IATTC Headquarters in La Jolla, CA, USA in May 8 to 12, 2006, will host this.

2.138 The Meeting was informed that the FAO Fisheries Department maintains three global sets of tuna catch data, which are available from FAO's Fisheries Global Information System (FIGIS). He pointed out that FIGIS and information on tuna continues to expand. This year, FAO has updated a review of global state of marine fish resources, publishing it as FAO Fisheries Technical Paper 457. This publication includes sections on (i) tuna resources, fisheries and their management and (ii) all fish resources in the area of Pacific islands.

2.139 The Meeting was informed ski that in March this year, FAO organised:

a) The Meeting of Committee on Fisheries (COFI);

b) The Ministerial Meeting on Fisheries; and

c) The 4th Meeting of Regional Fisheries Bodies.

2.140 At COFI, it was proposed to hold a joint meeting of the secretariats of tuna bodies and their Members in Japan in 2007.

2.141 On behalf of FAO and particularly its Marine Resource Service, J. Majkowski thanked all international organisations involved in tuna research, fisheries and their management, including SPC OFP and WCPFC for their contributions of data, other information and expertise to FAO.

2.142 In response to a question regarding the difficulties in defining fishing capacity, the FAO delegate informed the meeting that the upcoming workshop in La Jolla (May 8th to 12th 2006) would provide information additional to that contained in document GN IP-6. The meeting in Japan in 2007 will provide the opportunity to address such issues as well as the meeting in La Jolla.

FORUM FISHERIES AGENCY (FFA)

2.143 A representative of the FFA indicated that the FFA was looking forward to participating in the future work of the Committee. He noted that one recent development relevant to the Committee was

the approval by the Global Environment Facility of the Pacific Islands Oceanic Fisheries Management Project. The project includes a Scientific Assessment and Monitoring Enhancement Component of the Project. This Component will be executed by SPC and will have a budget of US$5 million over 5 years covering 3 main areas – fishery monitoring, stock assessment and ecosystem analysis. The primary emphasis of the fishery monitoring and stock assessment activities is assisting Pacific Island Countries to meet the requirements of the Convention with respect to scientific data and analysis. The primary emphasis of the ecosystem analysis activities is enhancing understanding of the dynamics of the Western Tropical Pacific warm pool pelagic ecosystem, and providing ecosystem-based scientific information and advice to the Commission and to Pacific Island countries.

THE INTERNATIONAL SCIENTIFIC COMMITTEE FOR TUNA AND TUNA-LIKE SPECIES IN THE NORTH PACIFIC OCEAN (ISC)

2.144 G. Sakagawa outlined ISC activities relevant to the Scientific Committee. The ISC is an international science organisation that was established in 1995. It's purpose has been to:

a) Enhance scientific research and cooperation for conservation and rational utilisation of the tuna and tuna-like species which inhabit the North Pacific Ocean during all or part of their life cycle; and

b) Establish the scientific groundwork so at some future time a multilateral regime for the conservation and rational utilisation of the region's pelagic fish stocks maybe created.

2.145 Membership in the ISC is open to all coastal States and fishing entities of the North Pacific region, as well as States and entities whose vessels fish for tuna or tuna-like species in the region. Canada, China, Chinese Taipei, Japan, Korea, Mexico, the United States, the IATTC, PICES, SPC OFP, and FAO are members.

2.146 The 5th meeting of the ISC was held in Tokyo, Japan on March 28-30, 2005. Participants from Canada, China, Chinese-Taipei, Japan, Korea, Mexico, the United States and international organisations, IATTC and SPC OFP, were present. In the plenary session, several administrative matters were addressed, including:

a) Formal induction of the North Pacific Albacore Workshop into ISC as one of the ISCs Working Groups;

b) Changing the name of the ISC from Interim Scientific Committee to the International Scientific Committee for Tuna and Tuna-like Species in the North Pacific Ocean;

c) Agreeing to meet annually at least for the next few years (next meeting in La Jolla, CA, 23-27 March 2006);

d) Postponing establishment of an ISC Secretariat until functional issues are resolved;

e) Drafting of an MOU for formalising a relationship between the ISC and the WCPFC;

f) Reviewing work plans of Working Groups; and

g) Electing G. Sakagawa, Chairman and J-R. Koh, Vice-chairman of the organisation.

2.147 The ISC also reviewed stock status information for albacore, bigeye tuna and yellowfin tuna for 2004. It concluded that exploitation of these stocks is at high levels and fishing mortality need to be reduced or not increased further.

2.148 For albacore it noted that recent recruitment has been strong, resulting in high current stock biomass with spawning stock biomass (SSB) of 165,000 mt. However, as overall productivity levels for the stock decline to levels more typical of earlier years, modest reduction in current F would be required in order to maintain SSB above safe minimum levels experienced in the past.

2.149 For bigeye tuna, the ISC agreed with the conclusions reached by scientific bodies that performed the stock assessments and noted the need to reduce fishing mortality from current levels. That is, in the western-central Pacific Ocean, the bigeye tuna stock is not yet overfished, but with a high probability that overfishing is occurring. In the eastern Pacific Ocean, overfishing is occurring and the stock is overfished with the SSB well below the level required for MSY.

2.150 The yellowfin tuna stocks in both the western-central and eastern Pacific are at high biomass levels and are at or just beyond the state of full exploitation, and not yet in an overfished state. Any future increases in fishing mortality, however, would not result in any long-term increase in yield, but run the risk of moving the stock to an overfished condition. Fishing mortality should, therefore, not be increased further, especially for the juvenile age group.

2.151 During discussions reference was made to the agreed 'Scientific Structure for the Commission' outlined in the final report of PrepCon (WCPFC/PrepCon/45), which should be consulted in determining the role of the ISC. It was pointed out that the scheme for the flow of scientific advice and information from the ISC to the WCPFC would have two paths. The first is outlined in Annex III of the PrepCon final report, and only applies to those areas within the scope of the Northern Committee whose role is to…make recommendations on the implementation of such conservation and management measures as may be adopted by the Commission for the area north of the 20° parallel of north latitude and on the formulation of such measures in respect of stocks which occur mostly in this area (Convention Article 11(7)). The second, relates to any other scientific information or advice from the ISC, and it would be provided to the WCPFC following the structure outlined in Annex II of the PrepCon final report, that is following as appropriate the pathway for member research or the pathway for Commission-directed contracted research.

2.152 There were some concerns that the scope of the ISC (species that spend all or part of their life cycle in the North Pacific Ocean), could lead to an unnecessary duplications in efforts, as this would include three of the four main tuna species assessed through the Scientific Committee, and most of the members of the ISC are already members or cooperating non-members of the WCPFC.

3. SPECIALIST WORKING GROUPS

REPORT OF THE FISHING TECHNOLOGY-SPECIALIST WORKING GROUP (FT-SWG)

3.1 The FT-SWG reviewed the past work of the Fishing Technology Working Group that functioned within the Standing Committee on Tuna and Billfish structure (SCTB14 – SCTB17). Over 100 technologies related papers that had been contributed to the SCTB are listed in WCPFC-SC1 FT WP-3.

3.2 The FT-SWG reviewed recommendations for research priorities and directives from the PrepCon Working Group II that identified the need for " further development of methods to standardise effort, including better use of vessel operational details, environmental data and archival tagging data". The FT-SWG also reviewed a recommendation to " …review developments with respect to fishing vessel, gear and operational procedures to characterise changes in fleets and gear and

to provide data to inform a range of topics such as the standardisation of CPUE, and evaluating changes in fishing efficiency".

3.3 The FT-SWG adopted the Terms of Reference (TOR) that had been circulated prior to the meeting to guide their activities during the meeting. In review of these draft TORs, the group recommended that revised TORs for the FT-SWG should be directly linked to principles and directives of the PrepCon, Commission and the Convention.

3.4 Noting the crosscutting nature of the FT-SWG, it was recognised that the work of the FT-SWG should be formally linked to activities of other SWGs of the Scientific Committee and also the TCC.

3.5 Recognising that advances in fishing technology or methodology that improve vessel efficiency move rapidly between ocean basins, the FT-SWG agreed that close links with other regional fishery management organisations and the tuna industry should be fostered and maintained. A draft TOR for the FT-SWG was developed reflecting these recommendations and is attached to this report for further consideration by the Scientific Committee. The FT-SWG recommended that these TORs should define the future work programs if endorsed by the Scientific Committee and Commission.

3.6 The FT-SWG reviewed and discussed four working papers and five information papers on gear selectivity, targeting issues, technical solutions to bycatch reduction, training materials to improve data quality, the estimation and refinement of estimates of effective longline effort, and issues related to fishing capacity.

3.7 Following presentation and discussion of these papers, the FT-SWG developed a work plan for 2006 and a medium-term work plan to be submitted for Scientific Committee for consideration. The short-term work plan includes: work to expand data inputs to assist standardisation of fishing effort; the characterisation of current and historical operational details at the fleet level; improving technical and behavioural knowledge of fish aggregation devices and associated species; identification of technically based initiatives to increase targeting and reduce bycatch; and the development of training materials useful to improve the quality of fisheries data. The medium-term work plan broadly reflects the revised TOR of the FT-SWG. Recommendations for parties to implement the work or suggestions to contract special projects were provided.

3.8 After review of papers submitted to the FT-SWG meeting and in consideration of recent assessments for stocks of the main target species in the Pacific Ocean, the FT-SWG developed specific work program recommendations to examine and review efforts toward the measurement and monitoring of fishing capacity.

3.9 The FT-SWG recommended that D. Itano (USA) convene the FT-SWG in 2005-2007[3].

3.10 The full report of the FT-SWG, including its agenda, is attached as Annex V.

3.11 The Scientific Committee recommended that the TOR and future workplan detailed in Annex V be adopted for the FT-SWG in 2005/06.

REPORT OF THE METHODS SPECIALIST WORKING GROUP (ME-SWG)

3.12 Changes to the MULTIFAN-CL (MFCL) assessments for 2005 were discussed in detail. The most important of these changes were to the spatial structure used for the bigeye tuna and yellowfin tuna assessments and the related changes to the methods used to standardise longline fishing effort.

[3] From the close of the first regular session of the Scientific Commmittee in 2005 through to the close of the third regular session of the Scientific Committee in 2007 – a two-year term.

These changes were introduced in response to discussions during the SCTB17 meeting in 2004. The new regions are more closely aligned with natural ecological regions and catch distributions, and the new effort standardisation method introduces region-specific weighting. The resulting MFCL model estimates more realistic distributions of biomass. The ME-SWG considers the changes to the regional structure and effort standardisation to be important improvements to the assessment. Other model changes included re-parameterisation of selectivity using a cubic spline function, a more generic prior for the stock-recruit relationship steepness parameter, inclusion of stock-recruit relationship in computation of unexploited population, and addition of recent fishery data – 2003 and 2004 for longline, 2004 for purse seine. The ME-SWG considers these changes to be routine changes that improve model performance, increase parsimony and keep the information base as current as feasible.

3.13 The ME-SWG considered the methods used for the management option analysis. This analysis was constrained by the time and resources available to address the management options and by the TOR provided by the Commission. The ME-SWG noted:

a) Scientific questions are best answered when they are posed in operational terms. In order for the Scientific Committee to provide the best possible scientific advice to the Commission, the Scientific Committee and the Commission should work together to clarify management objectives, for example a working definition of sustainability and the relative importance of short-term changes in catch and long-term changes in biomass;

b) The selection of the most recent year (2003) as the reference year for catches to take into projections introduces a potential bias in interpreting the projections and can be considered to be a source of structural uncertainty. An average over several years (e.g. 2001-2003) may be a more appropriate basis for comparison;

c) Statistical and structural uncertainties in the projections were not considered because of time constraints. The results should be presented to managers with a strong caveat that deterministic results might be very different from actual outcomes; and

d) It was recognised that MFCL might not be the best platform with which to undertake this type of analysis. The advantages of using MFCL are that it ensures that the projections are consistent with the assessments and that the variance structure could potentially be applied to the projections. However, alternative models might allow easier exploration of spatial management options on a relevant scale.

The ME-SWG concluded that the relative performance of the management options were correctly identified by the analysis, but that the quantitative impacts on the fishery and the tuna stocks are highly uncertain.

3.14 New features and applications of the spatial ecosystem and population dynamics model (SEAPODYM) were discussed. The current model treats bigeye tuna, yellowfin tuna and skipjack tuna populations and their supporting ecosystem in the entire Pacific Ocean from 1952 through 2005. The ME-SWG was impressed by the general similarity between the trends in biomass estimated by SEAPODYM and MFCL, but it is concerned about the problems of assigning realistic values to the SEAPODYM model parameters. The ME-SWG also discussed the introduction of variable spatial resolution in the SEAPODYM model, which appears to increase its accuracy, and the preliminary results of implementing a maximum likelihood approach to estimation of model parameters. The ME-SWG is encouraged by the apparent feasibility of optimal parameter estimation in SEAPODYM and supports further work on this problem.

3.15 The two models discussed by the ME-SWG represent two completely independent approaches to estimating trends in predator biomass. The MFCL approach is completely driven by fisheries data, and its complexity derives from the statistical challenges presented by such data and a relatively large number of parameters estimated from data. In contrast, the SEAPODYM approach is an attempt to

construct a population of predators from a consideration of basic ecological principles, and its complexity derives from subtle interactions among horizontal and vertical gradients in the habitat operating through a relatively small number of theoretically derived parameters of trophic transfers. The ME-SWG considers that the apparent convergence in model results to be an important scientific advance and supports further parallel development of these two approaches.

3.16 The ME-SWG also heard a report (WCPFC-SC1 ME WP-3) on the analysis of the SPC public domain 5° x 5° longline catch and effort data. The analysis revealed the difficulties in simple interpretations of the historical CPUE record. An important conclusion of this analysis is that longline catchability changed sharply during the between 1950 and 1970. Causes of these changes are not clear but are probably related to changes in fishing practices and shifts in fishing areas within the 5° x 5° regions. The ME-SWG concluded that access to operational level data is absolutely necessary to interpret historical changes in the longline fishery.

3.17 The ME-SWG recommended that R. Campbell (Australia) convene the ME-SWG in 2005-2007.

3.18 The full report of the ME-SWG, including its agenda, is attached as Annex VI.

3.19 The Scientific Committee recommended that the TOR and future workplan detailed in Annex VI be adopted for the ME-SWG in 2005/06.

REPORT OF THE STATISTICS SPECIALIST WORKING GROUP (ST-SWG)

3.20 The status of data collection, compilation and dissemination was reviewed. Progress has been achieved with the collection of tuna fisheries catch/landings data in the Philippines. Under the Indonesia and Philippines Data Collection Project, a review of the tuna fisheries and the current statistical system in the Philippines was conducted in July 2004, and the Philippines Tuna Fishery Data Collection Workshop was held in October 2004 to review recommendations from the review and to plan port sampling and surveys. In January 2005, the Bureau of Agricultural Statistics recommenced surveys of tuna landing ports, and the Bureau of Fisheries and Aquatic Resources recommenced port sampling, with IPDCP funds. IPDCP activities in Indonesia will commence once sufficient funds have been contributed.

3.21 A review of the available information on tuna fisheries in Vietnam was funded by the SPC OFP and conducted in March 2005 (WCPFC-SC1 ST IP-5). Estimates from the study suggest that the annual catch of oceanic tuna species may be of the order of 40,000 mt, primarily skipjack and yellowfin and bigeye.

3.22 Regarding the compilation of data, the coverage by operational level catch and effort data held by the SPC OFP for 2003 is 51.2%, the highest level ever achieved. Coverage by port sampling data for 2003 is 5.1%. Coverage by observer data for 2003 is 4.8%, while coverage for 2004 is slightly higher, 5.8%. Figure 3 illustrates the trends in coverage from 1970 to 2004; the coverage for recent years may increase as more data become available.

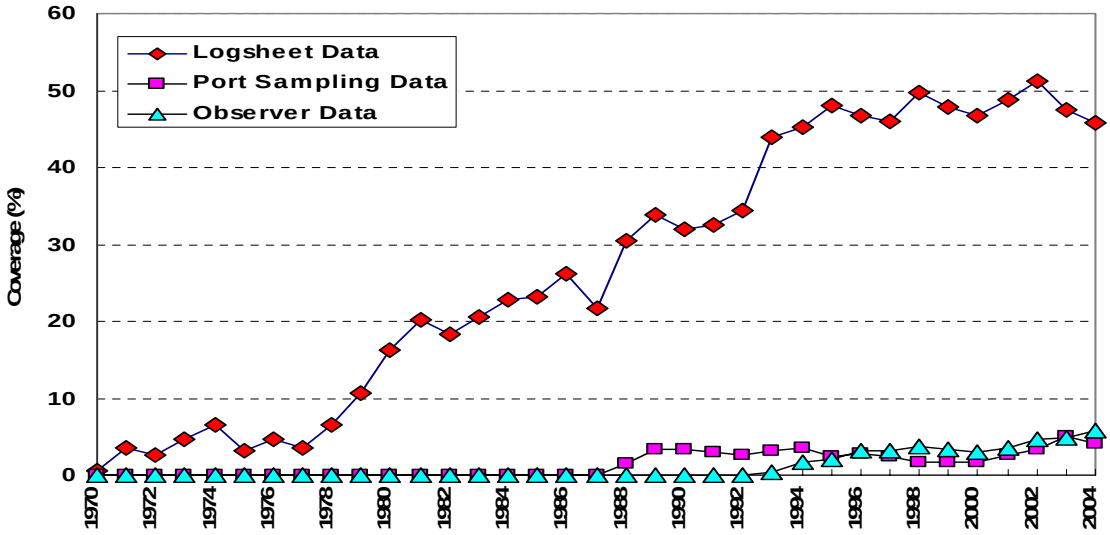

Figure 3. Coverage of tuna fisheries in the WCP-CA by logsheet catch and effort data, port sampling data and observer data compiled by the SPC OFP.

3.23 The principle gaps in coverage by operational level catch and effort data include the domestic fisheries of the Philippines and Indonesia, the distant-water longline fleets of Korea and Chinese Taipei, and the longline, pole-and-line and purse seine fleets of Japan on the high seas.

3.24 The main task of the ST-SWG at its inaugural session was to draft recommendations to the Commission on:

a) Scientific data to be provided to the Commission;

b) Standards for the provision of operational catch and effort data to the Commission; and

c) The principles and procedures for the dissemination of scientific data by the Commission.

These recommendations are presented in detail in the full ST-SWG report (Annex VII).

3.25 Observer programmes were discussed, including the collection of scientific data, coverage rates, sampling protocols and standards for observer data collection forms. However, the ST-SWG did not have sufficient time at its inaugural meeting to discuss these issues fully and it was therefore considered premature to make a recommendation to the Commission in this regard. Nevertheless, it was agreed that the Scientific Committee should consult with the TCC concerning the priorities and objectives of the regional observer programme.

3.26 Two studies concerning the species composition of the catch taken by purse seiners were presented. A two-variable model, with school association and year, was used to determine factors for adjusting catch estimates for the misidentification of bigeye as yellowfin based on observer data. A comparison of the species composition of catches by purse seiners determined from observer and other types of data was also conducted. The proportion of skipjack in purse-seine catches determined from observer data was found to be 55.4%. This value is inconsistent with proportions of skipjack determined from logsheet data, records of unloadings, port sampling data and Final Out-Turn Reports, which ranged from 72% to 78%. Comparisons of the observer data with the port sampling data indicated that there were higher quantities of (>80 cm) yellowfin and bigeye in the observer samples than in the port samples. The cause of bias, and whether it is related to observer data or the other types of data, is not known. Further work should identify the cause of the problem and unbiased sampling protocols should be developed, with reference to sampling schemes used by other RFMOs.

3.27 The ST-SWG recommended that K. Duckworth (New Zealand) convene the ST-SWG in 2005-2007.

3.28 The full report of the ST-SWG, including its agenda, is attached as Annex VII.

3.29 The Scientific Committee recommended that the TOR and future workplan detailed in Annex VII be adopted for the ST-SWG in 2005/06.

REPORT OF THE BIOLOGY SPECIALIST WORKING GROUP (BI-SWG)

3.30 The group addressed six presentations of papers dealing with the biology of the four main tuna species, in particular bigeye. In discussions the BI-SWG noted that there is a need to carry out further studies and collect more accurate information regarding the following topics:

a) Sexual maturity, spawning behaviour, and growth rates;

b) Fish behaviour induced by the presence of FADs and other floating objects (in this regard, the use of sonic tagging technology was suggested);

c) Inter-specific relationships (competition, predation); and

d) Fundamental biological parameters for non-target species such as billfish and sharks.

3.31 In general, previous statements by the SCTB regarding the need to incorporate biological information in the Commission's databases must be highlighted. The future work plan should focus on data allowing refinement of the stock assessments, such as sex ratios at size, size frequencies, size-at-age, growth parameters and natural mortality at age. In this regard, the need for wide tagging operations in the Pacific was noted.

3.32 The BI-SWG recommended that C-L. Sun (Chinese-Taipei) convene the BI-SWG in 2005-2007.

3.33 The full report of the BI-SWG, including its agenda, is attached as Annex VIII.

3.34 The Scientific Committee recommended that the TOR and future workplan detailed in Annex VIII be adopted for the BI-SWG in 2005-2006.

REPORT OF THE STOCK ASSESSMENT SPECIALIST WORKING GROUP (SA-SWG)

3.35 The SA-SWG reviewed standardised CPUE indices for bigeye and yellowfin (WCPFC-SC1 SA WP-8) and stock assessments of bigeye (WCPFC-SC1 SA WP-2), yellowfin (WCPFC-SC1 SA WP-1), skipjack (WCPFC-SC1 SA WP-4) and South Pacific albacore (WCPFC-SC1 SA WP-3).

3.36 The assessments integrated all available information into coherent analyses consistent with other information on the biology and fisheries of these major tuna species. While future improvements in the assessments can be achieved, the SA-SWG concluded that the stock status statements (paragraphs 4.7 – 4.14) are supported by the data and the analyses at this time.

3.37 The SA-SWG reviewed:

a) Estimates of sustainable catch and effort levels for target species and the impacts on stocks of potential management measures for bigeye, yellowfin and South Pacific albacore; and

b) Five and ten year projections of total biomass and spawning stock biomass for bigeye and yellowfin under various catch and effort scenarios as requested by the WCPFC (WCPFC-SC1 SA WP-10). The results of these analyses are presented in paragraphs 5.6 – 5.11. Additional comments on this work can be found in the report of the ME-SWG (Annex VI).

3.38 The SA-SWG received presentations on standardised CPUE time series of the New Zealand albacore troll and longline fishery (WCPFC-SC1 SA WP-5), and preliminary work on South-West Pacific swordfish assessment.

3.39 The SA-SWG recommended that N. Miyabe (Japan) and M. Stocker (Canada) co-convene the SA-SWG in 2005-2007.

3.40 The full report of the SA-SWG, including its agenda, is attached as Annex IX.

3.41 The Scientific Committee recommended that the TOR and future work program detailed in Annex IX be adopted for the SA-SWG in 2005-2006.

REPORT OF THE ECOSYSTEM AND BYCATCH SPECIALIST WORKING GROUP (EB-SWG)

3.42 The key item for discussion was the estimates of the mortality of non-target species with an initial focus on seabirds, turtles, sharks and marine mammals. This presentation and accompanying paper (WCPFC-SC1 EB WP-1) were based on observer data held at the SPC OFP, and were used to define three longline fisheries and a single purse-seine fishery in the Western and Central Pacific. Molony presented the estimates of catches and mortalities for these fisheries, noting the uncertainties arising from the low observer coverage. Recommendations from WCPFC-SC1 EB WP-1 included increasing observer coverage rates for most fleets, improving the rate of identification to the level of species and rates of observers reporting condition and fate of captured animals, all of which would also assist in the generation of more robust estimates of mortality.

3.43 Other topics covered in the EB-SWG included billfish resources, fishing gear performance such as new longlining techniques to avoid bycatch, the effects of longline soak time on catches of target and bycatch species, and a review of bycatch measures and initiatives in the USA. There were extensive discussions about the long-term impacts of pelagic fisheries on pelagic fish stocks in the Pacific, with participants offering differing perspectives on how pelagic fish communities responded to exploitation. There were a range of presentations on ecosystem modelling, including delineating ecosystem boundaries as a preliminary to ecosystem based fishery management and the development of ecosystem indicators for fishery management. Other modelling initiatives looked at the trophic dynamics of tunas, and the application and performance of ecosystem models such as SEPODYM and ECOPATH.

3.44 Recommendations arising from work requested by the Commission included:

a) Improvement of observer coverage of Western and Central Pacific pelagic fisheries by increasing coverage rates, centralising and expanding observer data collection, designing specific observer programs to address specific objectives, and improving the identification and reporting of catch to species level and recording of fate and condition;

b) Carrying out an ecological risk analysis in order to prioritise species of sea turtles, sharks and seabirds and non-target fish species for future research;

c) Reviewing the potential for stock assessment of shark species in UNCLOS Annex 1; and

d) Studying interactions between newly developing fisheries and non-target species.

3.45 Recommendations arising from contributed papers were:

a) With respect to non-target catch, further testing of the deep-setting longline techniques to validate the method and to see if the technique is useful for deep daytime swordfish fishing;

b) With respect to non-target catch, derive accurate information on key biological parameters for billfishes (age-estimates, growth rates, sizes-at-age, maturity schedules, movements and habitat preferences, stock structure, identification and reporting of catch to species level);

c) With respect to ecosystem indicators, potential ecosystem indicators should be developed and monitored, with examination of the spatial variability of each indicator and consideration of the boundaries over which to measure and report indicators;

d) Monitoring of ecosystem indicators should be carried out, with reporting through the Scientific Committee; the Commission can then consider how to base management action on information from fisheries, socio-economic and ecosystem indicators; and

e) Ecosystem reference points for management purposes should be developed.

3.46 Research recommendations with respect to ecological modelling included:

a) Scaling up of understanding of basic biology in order to develop ecological models;

b) The uncertainty in ecological models remains large and additional experiments are needed, e.g. to determine tuna swimming speeds and assimilation efficiencies;

c) Parameterisation of ecological models by statistical optimisation is also an important approach;

d) Ecosystem models should be used to explore management scenarios and the effects of climate variability and change; and

e) Improved data on the diet of target and non-target species will improve the parameterisation of ecosystem models.

3.47 The EB-SWG recommended that P. Dalzell (USA) and P. Ward (Australia) convene the EB-SWG in 2005-2007.

3.48 The full report of the EB-SWG, including its agenda, is attached as Annex X.

3.49 The Scientific Committee recommended that the TOR and future workplan detailed in Annex X be adopted for the EB-SWG in 2005-2006.

4. STATUS OF THE STOCKS

4.1 Stock status statements, as requested by the Commission, were prepared for yellowfin, bigeye, skipjack and South Pacific albacore tuna. The Scientific Committee reviewed the stock status summaries and considered the management implications of the assessments. These considerations

were added to the stock status statements that appear below. The complete stock status summaries are included in the report of the SA-SWG (Annex IX).

4.2 The Scientific Committee noted that advice from the Commission was required to confirm the utility of the structure and content of the stock status summaries.

4.3 The Scientific Committee recognised that the stock assessments used to provide advice on the status of the WCP-CA stocks are subject to uncertainty in the inputs and model specification and structure. Quantification of the uncertainty associated with stock assessments is complex and is a high priority for future research. Nonetheless, the following advice on stock status and management implications has been formulated on the basis of the best available scientific information.

4.4 There have been continual improvements in assessment methodology and the Scientific Committee acknowledged the ongoing need for development, testing and review of assessment methods. Several processes are in place to ensure that these development, testing and review activities continue including the work of the ME-SWG, peer review through cooperation with other organisations involved in stock assessment and formal peer review and publication in the international scientific literature.

4.5 In the 2005 stock assessments, and in the statements below, $F_{current}$ and $B_{current}$ refer to the average fishing mortality and biomass over the period 2001-2003 respectively. The final year for which complete fishery data are available (2003) is included in the average.

4.6 It should be noted that these stock assessments have been done in the context of the impact of fishing on the target stock, with the potential impacts on other catch components considered qualitatively. The Scientific Committee noted that for at least two gear types, longline and purse seine setting on floating objects (FADs and logs), there is a potential for considerable impacts on non-target species even if the target stock is not being adversely affected.

ADVICE TO THE COMMISSION

BIGEYE TUNA

4.7 **Stock status**: The 2005 stock assessment is generally consistent with the result of the 2004 assessment, although the point estimates of the reference points are slightly more pessimistic. In particular, while the 2004 assessment indicated that overfishing was possibly occurring ($F_{current}/F_{MSY} \sim 1$), the 2005 assessment indicates that overfishing is likely occurring ($F_{current} / F_{MSY} > 1$ for the base case and three of five sensitivity analyses). Both assessments indicate that the stock is presently not in an overfished state ($B_{current}/B_{MSY} > 1$) because of high levels of estimated recruitment since 1990. The assessment indicates that the equatorial regions are the most highly impacted, while fishery impacts in the peripheral temperate regions are not large.

4.8 **Management implications**: The Scientific Committee recommends that fishing mortality for bigeye tuna is reduced from $F_{current}$. If future recruitment declines to levels closer to the long-term average, a further decrease in total catch and effort is likely to be necessary in order to maintain the stock at sustainable levels. Spatial patterns of fishing impacts remain uncertain, but some areas in the equatorial WCPO are more heavily impacted and in these areas more urgent management actions may be required.

YELLOWFIN TUNA

4.9 **Stock status**: The 2005 stock assessment is more pessimistic than the 2004 assessment as a result of methodological improvements in the interpretation of catch rate data and the relative

abundance of yellowfin tuna across regions. Overfishing is probably occurring in the yellowfin stock in the WCPO ($F_{current} / F_{MSY} > 1$ in the point estimates from the base case and all sensitivity analyses), but the stock is probably not in an over-fished state ($B_{current} / B_{MSY} > 1$, except in sensitivity analyses involving continuous increases in fishing efficiency). The assessment indicates that the equatorial regions are the most highly impacted, while fishery impacts in the peripheral temperate regions are not large.

4.10 **Management implications**: The Scientific Committee recommends that fishing mortality for yellowfin tuna be reduced from $F_{current}$ in order to maintain the stock at sustainable levels. Spatial patterns of fishing impacts remain uncertain, but fishing impacts in the western equatorial WCPO have been increasing over recent years and more urgent management actions may be required for this area.

SKIPJACK TUNA

4.11 **Stock status**: A stock assessment was undertaken for skipjack during 2005 and is the first since 2003. The 2005 stock assessment indicates that for the skipjack stock in the WCPO overfishing is not occurring ($F_{current} / F_{MSY} < 1$), that the stock is not in an overfished state ($B_{current} / B_{MSY} > 1$) and that exploitation is modest relative to the stock's biological potential.

4.12 **Management implications:** The catches in 2004 were the highest on record. These high catches are sustainable unless recruitment falls persistently below the long-term average. However, any increases in purse-seine catches of skipjack may result in a corresponding increase in fishing mortality for yellowfin and bigeye tunas.

SOUTH PACIFIC ALBACORE

4.13 **Stock status:** A stock assessment was undertaken during 2005 and is the first since in 2003. An examination of catch trends in 2005 indicated that total catches of albacore were relatively stable over the period from 1960 to 1995, but that they have increased in recent years. . The key conclusions of the stock assessment were similar to 2003, i.e. that overfishing is not occurring ($F_{current} / F_{MSY} <1$) and the stock is not in an overfished state ($B_{current} / B_{MSY} >1$). Overall, fishery impacts on the total biomass are low (10%), although considerably higher impacts occur for the portion of the population vulnerable to longline.

4.14 **Management implications**: Current catch levels from the South Pacific albacore stock appear to be sustainable and yield analyses suggest increases in fishing mortality and yields are possible. However, given the age-specific mortality of the longline fleets, any significant increase in effort would reduce CPUE to low levels with only moderate increases in yields. CPUE reductions may be more severe in areas of locally concentrated fishing effort.

OTHER SPECIES

4.15 Stock assessments were not carried out in 2005 for highly migratory species in the WCP-CA other than the four major tuna species. However, preliminary work has been carried out towards an assessment for swordfish in the southwestern Pacific and this work should be finalised for Scientific Committee review in 2006. There is also an assessment for striped marlin underway for the same area.

5. MANAGEMENT INFORMATION

5.1 At the inaugural Commission meeting a Resolution on "Conservation and Management Measures" was passed. This resolution requested certain scientific analyses to inform future management decisions. Two papers, prepared by the SPC OFP and outside collaborators, were prepared in response to the Resolution (WCPFC-SC1 SA WP-10 and WCPFC-SC1 EB WP-1, Annex

XI). This information was reviewed by the Scientific Committee and is summarised and discussed below.

ESTIMATES OF SUSTAINABLE CATCH LEVELS AND SUSTAINABLE EFFORT LEVELS FOR BIGEYE, YELLOWFIN AND SOUTH PACIFIC ALBACORE

5.2 Sustainable catch and effort estimates relative to the period 2001-2003 for bigeye, yellowfin and South Pacific albacore are provided in Table 1.

5.3 Sustainable catch levels are estimated under two assumptions concerning recruitment. First, the MSY estimates reflect recruitment at long-term average levels. Second, the maximum yield estimates are based on recent (1994-2003) average recruitment. F_{MSY} was chosen as an indicator of sustainable effort, as implied by Article 5, paragraph (b) of the Convention.

5.4 Effort reductions across all fisheries in which bigeye and yellowfin are caught to about 80% of 2001-2003 average levels are predicted to reduce fishing mortality to F_{MSY} levels. The equivalent long-term average catch levels consistent with F_{MSY} are estimated to be 67% and 65% of 2001-2003 average bigeye and yellowfin catches, respectively. Over the short-term, assuming maintenance of recent above-average recruitment conditions, catches of 95% (bigeye) and 77% (yellowfin) of 2001-2003 average catches would be consistent with F_{MSY}.

5.5 The South Pacific albacore assessment shows that current levels of catch and effort are sustainable. While future increases in albacore catch are likely to be sustainable, estimates of MSY are highly uncertain because of the extrapolation of catch and effort well beyond any historical levels. Projections demonstrated that longline exploitable biomass, and hence CPUE, would fall sharply if catch and effort were increased to MSY levels. Therefore, the economic consequences of any such increases should be carefully assessed beforehand.

Table 1. Estimates of F_{MSY} relative to "current" average F, MSY based on long-term average recruitment (95% confidence intervals shown in parentheses), and maximum yield based on recent (1994–2003) average recruitment. MSY and maximum yield4 are also shown relative to the current catches. Current F and catch for bigeye and yellowfin tuna are represented by the 2001–2003 averages; for South Pacific albacore, average F and catch in 2000–2002 were used.

Stock	F_{MSY} relative to "current" F	MSY with long-term average Recruitment	MSY relative to current catch	Maximum Yield Recent average (1994–2003) Recruitment	Maximum yield relative to current catch
Bigeye tuna (WCPO)	0.81	66,040 (62,222-69, 858)	0.67	93,300	0.95
Yellowfin tuna (WCPO)	0.82	262,400 (229,790-295, 010)	0.65	312,200	0.77
South Pacific albacore	19.10	183,000 (73,100–292, 300)	3.55	156,700	3.04

FIVE AND TEN YEAR PROJECTIONS FOR BIGEYE AND YELLOWFIN

5.6 Table 2 describes the model scenarios simulated to address paragraphs 1(b) and 1(c) of the Resolution. Scenarios 1-2 represent alternative views of the status-quo and are used for comparison;

[4] 'Maximum yield' is conditional upon a particular recruitment level and is not necessarily 'sustainable', whereas MSY assumes a particular stock-recruitment relationship and is by definition sustainable.

scenarios 3-6 seek to address 1(b) from the Resolution (excluding the time/area closures); scenarios 7-8 seek to address 1(c) from the Resolution, without specifying the management measures to be used; and scenarios 9-12 seek to address 1(b) from the Resolution relating to time/area closures.

Table 2. Summary of projections undertaken[5].

Scenario	Model Regions	Restricted Fisheries	Reductions	Number of Projections	Description
1	All	All	Current catches	1	Status-quo under 2003 catches
2	All	All	Current effort	1	Status-quo under 2003 effort
3a 3b 3c 3d	3, 4	14-17	15% catch reduction 30% catch reduction 15% effort reduction 30% effort reduction	4	Purse seine reductions in tropical regions (all set types)
4a 4b 4c 4d	1-6	1-13	15% catch reduction 30% catch reduction 15% effort reduction 30% effort reduction	4	Longline reductions in all areas
5a 5b 5c 5d	3	18-19	15% catch reduction 30% catch reduction 15% effort reduction 30% effort reduction	4	Indonesia/Philippines reductions
6a 6b 6c 6d	All	All	15% catch reduction 30% catch reduction 15% effort reduction 30% effort reduction	4	Reductions in all fisheries
7	3, 4	14, 16	No reduction in total purse seine effort, but effort transferred from log/FAD to school sets	1	Transfer future effort from log/FAD sets to school sets in each of regions 3 and 4 (14 to 15 and 16 to 17) to represent a restriction on log/FAD fishing
8	3, 4	14, 16	Reduce catchability of log/FAD sets by 50%	1	Represents some (as yet) undetermined measure to reduce the catchability of BET and YFT from log/FAD sets by 50%
9i 9ii 9iii 9iv	3	14, 15	No effort quarter 1 No effort quarter 2 No effort quarter 3 No effort quarter 4	4	A quarterly closure to log/FAD purse-seine fishing in western equatorial Pacific – effort transfer to school set fishery in western equatorial Pacific
9Ai 9Aii 9Aiii 9Aiv	3	14	No effort quarter 1 No effort quarter 2 No effort quarter 3 No effort quarter 4	4	A quarterly closure to purse-seine fishing in western equatorial Pacific – effort transfer to eastern equatorial Pacific in each set-type category
10i 10ii 10iii 10iv	4	16, 17	No effort quarter 1 No effort quarter 2 No effort quarter 3 No effort quarter 4	4	A quarterly closure to log/FAD purse-seine fishing in eastern equatorial Pacific – effort transfer to school set fishery in eastern equatorial Pacific
10Ai 10Aii 10Aiii 10Aiv	4	16	No effort quarter 1 No effort quarter 2 No effort quarter 3 No effort quarter 4	4	A quarterly closure to purse-seine fishing in eastern equatorial Pacific – effort transfer to western equatorial Pacific in each set-type category
11i 11ii 11iii 11iv	3	4-6	No effort quarter 1 No effort quarter 2 No effort quarter 3 No effort quarter 4	4	A quarterly closure to longline fishing – effort transfer of distant-water fishery (4) to equivalent fishery in eastern equatorial Pacific (7)
12i 12ii 12iii 12iv	4	7-9	No effort quarter 1 No effort quarter 2 No effort quarter 3 No effort quarter 4	4	A quarterly closure to longline fishing – effort transfer of distant-water fishery (7) to equivalent fishery in western equatorial Pacific (4)

[5] Refer to Annex 1 of WCPFC-SC1 SA WP-10 for a map and definition of fisheries.

5.7 Bigeye and yellowfin stock projections based on 2003 fishery conditions were undertaken over a ten-year time horizon to assess the impacts of potential management measures. It should be noted that the distribution of purse seine effort in the WCPO during 2003 was not typical of that seen in previous years. The projections did not include statistical uncertainty. One source of major structural uncertainty, future recruitment was tested (recruitment determined by the long-term stock recruitment relationship, and recruitment equivalent to the 1994-2003 average).

5.8 It was noted that there were trade-offs between future biomass levels and average catches among the scenarios. This trade-off is illustrated in Figure 4. The vertical dashed line represents the situation where the adult biomass in 2014 is equivalent to the estimated MSY level and the horizontal line represents the average annual catch under 2003 levels of effort. Scenarios to the right of the vertical line are predicted to result in adult biomass greater than MSY levels and those above the horizontal line are predicted to result in increased average annual catches. For example, for bigeye scenario 7 (transfer of purse seine effort from logs and FADs to unassociated schools) is predicted to result in adult biomass above the MSY level and increased average annual catches compared to the prediction under current effort (scenario 2).

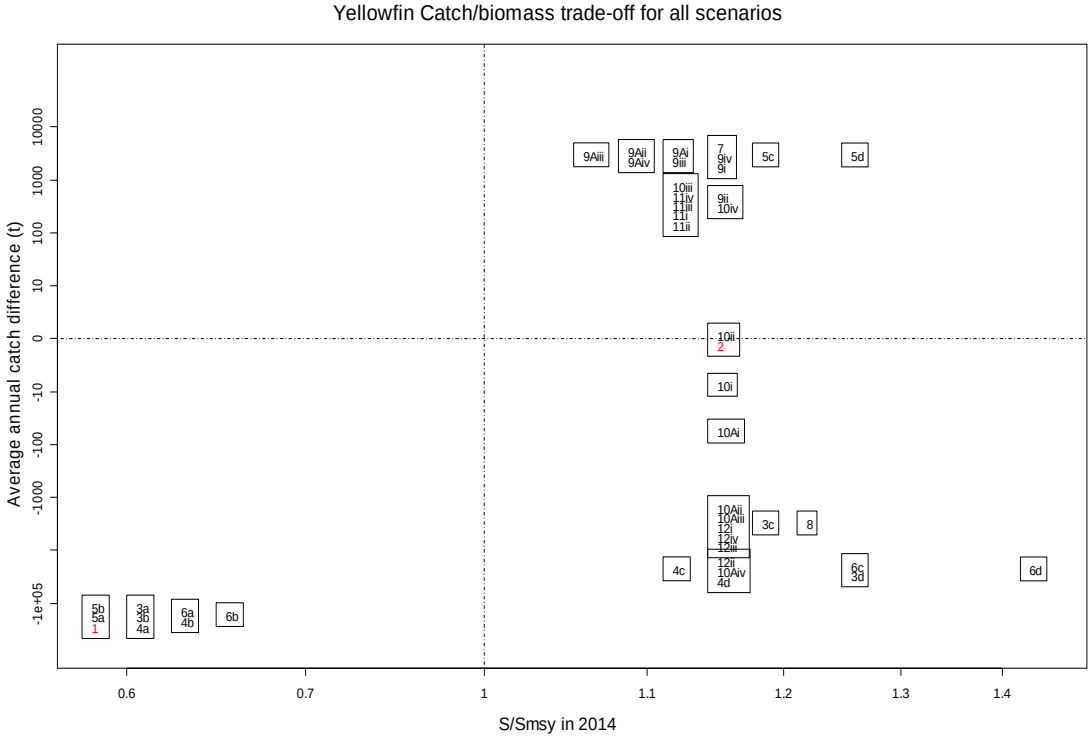

Figure 4: Trade-off between adult stock biomass levels in 2014 and average annual catch (compared to 2003 levels) for bigeye (top) and yellowfin tuna (bottom) under the assumption of long-term average recruitment. See Table 2 for a description of the different scenarios. Note that the scales are not linear.

5.9 The main conclusions of the projections were:

Bigeye tuna

a) The 2003 catches (scenario 1) are not sustainable under the long-term average recruitment. The population in the western equatorial Pacific is rapidly depleted and quickly reaches a point where there are insufficient fish to enable the specified catches to be taken. Under the recent (1994-2003) average recruitment hypothesis, the 2003 catches are sustainable, with both total and adult biomass remaining above their MSY levels. However, catches are not

sustainable in some regions, as the resource in the western equatorial Pacific declines drastically even under these favourable recruitment conditions;

b) The 2003 effort (scenario 2) produces total population biomass approaching the MSY level under long-term average recruitment and exceeding it under recent (1994-2003) average recruitment conditions. Results are slightly more optimistic for adult biomass;

c) Overall, reductions in catches or effort simultaneously in all fisheries (scenario 6) resulted in the strongest increases in total and adult biomass. All reduction scenarios resulted in adult biomass levels greater than their respective MSY levels under both recruitment hypotheses;

d) Restrictions on longline catch and effort (scenario 4) have a greater positive impact on adult biomass than reductions in other fishery types. This is because longliners target adult fish, and reductions in their catch or effort have an immediate impact on the adult population. It is also because the longline fishery is the largest component of the fishery, and as such, proportional reductions in longline catch or effort would be expected to have a greater impact on bigeye tuna biomass than the same proportional reductions in smaller fisheries;

e) Switching purse seine effort from log and FAD sets to unassociated school sets (scenario 7) was associated with the largest increase in biomass of the purse seine measures investigated. Under this scenario, total and adult biomass moved above their MSY levels under both recruitment hypotheses (the only purse seine measure to have this result). The simulated 50% reduction in log/FAD purse seine catchability (scenario 8) also showed positive results, but not to the extent of scenario 7;

f) Of the scenarios simulating some form of quarterly closure of purse seining in the western equatorial Pacific (scenarios 9 and 9A), the scenarios in which the closure pertained to log/FAD sets, with that effort being redirected to unassociated school sets in the same region (scenario 9), was more effective than a closure of all western equatorial Pacific purse seining with redirection of the effort to the eastern equatorial Pacific region (scenario 9A). In fact, scenario 9A resulted in 2014 biomass levels both less than the MSY levels and less than those obtained under the status quo (scenario 2). For the same set of measures in the eastern equatorial Pacific regions (scenarios 10 and 10A), there was little difference between set types versus regional redistribution of effort;

g) There was little difference in biomass outcomes with regards to which quarter of the year the purse seine seasonal closures were applied (scenarios 10 and 10A); and

h) For the quarterly longline closures in the equatorial Pacific (scenarios 11 and 12), the eastern equatorial Pacific closures resulted in better biomass outcomes. In the eastern equatorial Pacific, a quarter 1 closure resulted in the greatest biomass gains, followed by closures in quarter 2, 3 and 4. There was little difference among the quarters for seasonal closures in the western equatorial Pacific.

Yellowfin tuna

a) The 2003 catches are not sustainable under any of the catch-based scenarios investigated (scenarios 1, 3-6a,b). In these projections, yellowfin in the western equatorial Pacific is drastically depleted. All of the effort-based scenarios investigated (scenarios 2, 3-6c,d, 7-12) were found to result in biomass levels above their MSY levels, including the 2003 effort;

b) Overall, 30% reductions in catch or effort simultaneously in all fisheries (scenarios 6b and d) resulted in the strongest increases in total and adult biomass;

c) Reductions in purse seine catch or effort (scenario 3) and Indonesia and the Philippines

(scenario 5) effort resulted in better biomass outcomes than reductions in longline effort (scenario 4);

d) Perhaps surprisingly, reductions in effort in the Indonesia and the Philippine domestic fisheries (scenario 5) did not result in appreciably better biomass outcomes than the corresponding purse seine reductions. This is probably because much of the Indonesia and the Philippine catch consists of small fish for which natural mortality is assumed to be relatively high;

e) Switching purse seine effort from log/FAD sets to unassociated school sets (scenario 7) resulted in a slight improvement in biomass. However, the effect is not as strong as seen for bigeye because the effort re-directed into purse seine school sets continues to catch yellowfin but very little bigeye. The 50% reduction in log/FAD set catchability (scenario 8) resulted in better biomass outcomes for yellowfin compared to scenario 7; and

f) Management measures simulating quarterly closures with various transfers of fishing effort (scenarios 9, 9A, 10, 10A, 11 and 12) were not found to improve biomass over the status quo outcome (scenario 2).

5.10 A feature of the catch-based projections for both bigeye and yellowfin was the continued drastic decline in abundance in the western equatorial Pacific. The exceptionally high levels of purse seine catch and effort in the western equatorial Pacific in part caused this in 2003, which were used as the basis of the projections.

5.11 The relative performance of the different management scenarios was robust to the two future recruitment assumptions investigated. Future recruitment is a major source of uncertainty in projection results.

EFFECTS ON STOCKS OF MEASURES TO MITIGATE CATCH OF JUVENILE BIGEYE AND YELLOWFIN

5.12 Several of the projection scenarios simulated measures to mitigate the catch of juvenile bigeye and yellowfin. These included reductions in catch and effort of the purse seine and Indonesian and Philippines fisheries (scenarios 3 and 5), transfer of purse seine effort from log and FAD sets to unassociated school sets (scenario 6) and various area-season closures of the purse seine fishery (scenarios 9, 9A, 10, and 10A).

5.13 Transfer of effort from log and FAD sets to unassociated school sets resulted in gains in adult biomass as well as an increase in overall catch because of fishery interactions effects (i.e. the reduced catch of juveniles resulted in gains to both the population and the longline catch over the ten-year time horizon).

ESTIMATES OF THE MORTALITY OF NON-TARGET SPECIES

5.14 WCPFC-SC1 EB WP-1 presented estimates of the total numbers of individuals captured and the total number of mortalities of birds, mammals, sharks and turtles the central region (15ºN–31ºS)[6] of the WCPFC area, using observer data available at SPC. Four fisheries were defined below;

[6] This analysis did not consider longline fisheries north of 15°N and south of 31°S. Significant longline fisheries do operate in these parts of the WCP-CA.

Fishery	Location	Characteristics
Tropical shallow longline (TSL)	15 N – 10 S	Less than 10 hooks between floats (HBF)
Tropical deep longline (TDL)	15 N – 10 S	10 or more hooks between floats (HBF)
Temperate albacore longline (TAL)	10 S – 31 S	
Purse-seine		Consideration of five set types

5.15 The Scientific Committee reviewed WCPFC-SC1 EB WP-1 and notes the following:

a) Observer coverage rates are extremely low: in this case 0.47%-3.36% of the total effort in each fishery (annual average observer coverage rates). This makes it very difficult to provide mortality estimates that are representative of the whole fishery;

b) Observer coverage rates are not representative of the distribution of total effort within each fishery, especially for the longline fleets, and introduces potentially significant biases into the estimates; and

c) Identification was rarely to species level, except for sharks.

5.16 For these reasons, the estimates in WCPFC-SC1 EB WP-1 should be seen as preliminary. This strongly emphasises the need for a representative observer programme across all fisheries if more accurate estimates of catch and mortalities of non-target species are to be obtained. The Scientific Committee also notes that additional analyses are required if the impact of fishing on species of special interest is to be assessed.

Birds: Most bird catches were reported from the TAL fishery.

Mammals: Most mammals were released alive by all fisheries. The highest mammal catches were reported from the TSL and purse seine fisheries.

Sharks: Total annual catches of sharks were much higher than for the other taxa (sea turtles and seabirds) examined due to the existence of dedicated shark longline fisheries and opportunistic catches of sharks and fining. As a result, it was assumed that most catches of sharks resulted in mortalities. Most shark catches were estimated for the TSL fishery, with increasing catches in recent years. Most sharks observed were identified to species and blue sharks; silky sharks, oceanic whitetip sharks and pelagic stingrays dominated catches. Observers recorded more than 40 shark taxa.

Turtles: The highest catches were estimated to occur in the TSL fishery. The highest turtle mortalities were estimated for the TDL fishery.

Other comments: Mammals, sharks and turtles were more likely to be incidentally captured in sets upon floating objects (i.e. associated sets), especially sets on logs and FADS, compared to sets on unassociated schools. Mammals and turtles were more likely to be incidentally captured in the region of the western equatorial Pacific. The large number of shark species and the lack of information to identify target and non-target species of sharks for each of the four fisheries complicated analyses of shark data.

5.17 Other sources of data for these four taxa do exist and should be centralised in order to better estimate total catches and mortalities of all taxa throughout the entire WCP-CA.

ADDITIONAL ANALYSIS REQUIRED

5.18 The Committee recommended that some additional enhancements to the stock projection analysis might be undertaken in future. These included:

a) The incorporation of uncertainty in various population state variables, future recruitment and catchability through stochastic simulation would provide a means of evaluating the robustness of the relative performance of potential management measures;

b) The specification of management objectives, particularly with respect to desired levels of stock biomass, would provide a more explicit basis for comparing potential management measures;

c) Future stock projection analyses should use a multi-year average fishery condition (such as 2001-2003 in the case of the current analysis) as a base for the projections. This would reduce the risk of bias resulting from projections based on an atypical year;

d) An examination of the effects of purse-seine measures on skipjack catches; and

e) Assessment of specific combinations of the management options evaluated in the present study can be undertaken on request.

ADVICE TO THE COMMISSION

5.19 As requested by the Commission, the Scientific Committee has reviewed the analyses undertaken in response of the Resolution on Conservation and Management Measures. The advice on these matters is contained in paragraphs 5.2 – 5.18 above and the Commission is further referred to discussions on the Status of the Stocks (paragraphs 4.3 – 4.14). The full papers prepared in response to the request from the Commission are provided in Annex XI.

6. DATA

SCIENTIFIC DATA TO BE PROVIDED TO THE COMMISSION

6.1 The Statistics SWG developed Recommendation SC1–ST–1 on Scientific Data to be Provided to the Commission (see Annex VII), which concerns the provision of annual catch estimates, the number of vessels active, operational level catch and effort data, aggregated catch and effort data, and size composition data. The recommendation also addresses the roles of flag states and coastal states, time periods covered and schedules for the provision of data, and the WCPFC Statistical Area is defined. It also recommends that the requirements for scientific data be reviewed periodically.

6.2 The Statistics SWG also developed Recommendation SC1–ST–2 on Standards for the Provision of Operational Level Catch and Effort Data to the Commission (see Annex VII), which concerns data items that shall be reported to the Commission, the geographic area to be covered by operational catch and effort data to be provided to the Commission, the target coverage rate for operational level catch and effort data to be provided to the Commission, and procedures for the verification of operational level catch and effort data.

6.3 The Scientific Committee endorsed both as recommendations from the Scientific Committee to the Commission.

6.4 Section 3 (Operational level catch and effort data) of Recommendation SC1–ST–1 on Scientific Data to be Provided to the Commission contains text that refers to the recognition that "certain members and cooperating non-members of the Commission may be subject to domestic legal constraints, such that they may not be able to provide operational data to the Commission until such constraints are overcome" and also to the recognition that "certain members and cooperating non-members of the Commission may have practical difficulties in compiling operational data for fleets comprised of small vessels, such as certain sectors of the fisheries of Indonesia, the Philippines and small island developing States". While all delegations endorsed both of the recommendation on Scientific Data to be provided to the Commission and the recommendation on Standards for the Provision of Operational Level Catch and Effort Data, certain delegations indicated that, in regard to their ability to provide operational level catch and effort data to the Commission, these texts would be relevant.

INDONESIA AND PHILIPPINES DATA COLLECTION PROJECT (IPDCP) REVIEW

6.5 The Activities of the IPDCP commenced with the review of the tuna fisheries and the current statistical system conducted by A. Lewis from 8 to 28 July 2004 (Information Paper ST IP–6). The Philippines Tuna Fishery Data Collection Workshop was held from 20 to 21 October 2004 to review recommendations from the review and to plan port sampling and surveys (Information Paper ST IP–4). In January 2005, the Bureau of Agricultural Statistics recommenced surveys of tuna landing ports, and the Bureau of Fisheries and Aquatic Resources recommenced port sampling, with IPDCP funds. The delegate from the Philippines confirmed that the surveys, port sampling and related activities were continuing. Sufficient funds are available to fund surveys and port sampling in the Philippines during 2005 and 2006. IPDCP activities in Indonesia, primarily two years of port sampling, will commence once sufficient funds (US$ 150,000) have been contributed.

6.6 The Scientific Committee endorsed the recommendation in the final report of PrepCon Working Group II, given below, as a recommendation from the Scientific Committee to the Commission, namely that:

a) The Commission adopt the Indonesia and Philippines Data Collection Project and assume responsibility for its management as soon as possible;

b) The Commission establish the IPDCP Steering Committee to monitor project activities and developments in regard to funding, and to report thereon to the Scientific Committee. Membership of the Steering Committee should include Indonesia, the Philippines, donors, the Chairman of the Scientific Committee and the SPC OFP; and

c) Commission members and potential members contribute, as soon as possible, the balance of the funds required to implement the IPDCP.

RULES AND PROCEDURES FOR THE MANAGEMENT AND DISSEMINATION OF COMMISSION DATA

6.7 The Statistics SWG developed Recommendation SC1–ST–3 (see Annex VII), which recommends that the Commission establish an ad hoc task group to identify types of data that must be treated as confidential and to develop draft rules and procedures to govern the security and confidentiality of data collected and held by the Commission. It also recommends that text on

"Principles and Procedures for the Dissemination of Scientific Data by the Commission" be taken into consideration by the ad hoc task group.

6.8 The Scientific Committee endorsed this as a recommendation from the Scientific Committee to the Commission, noting that the ad hoc task group would consider a broad range of issues related to the security and confidentiality of all types of data provided to the Commission, including issues related to the dissemination of data for scientific purposes and for compliance purposes.

6.9 The procedure by which the ad hoc task group should be established and when the ad hoc task group should meet was discussed. It was suggested that the Executive Director be asked to convene the task group during 2006 and that membership consist of representatives of the Scientific Committee, the TCC, the SPC OFP, and interested Commission members and cooperating non-members.

OBSERVER DATA REQUIREMENTS

6.10 The Statistics SWG did not have sufficient time at its inaugural meeting to discuss scientific aspects of observer programmes, such as objectives, coverage rates, sampling protocols, standards for data collection, and the relationship between national and regional observer programmes. It was therefore considered premature to make a recommendation to the Commission with this regard. Nevertheless, the statistics SWG suggested that the Scientific Committee should initiate consultation with the TCC with regard to the priorities and objectives of the regional observer programme, as per article 12(2)(f) of the Convention.

6.11 In establishing priorities and objectives for the regional observer programme, both the Scientific Committee and TCC must give regard to article 28 of the Convention, including (but not limited to) those clauses that specify:

a) The types of data that the observer programme will collect;

b) The requirement for independent and impartial observers;

c) The requirement for coordination between regional, sub-regional and national observer programmes;

d) Coverage rates; and

e) Observer training and certification.

6.12 As an aid to this consultation, it is proposed that a review be carried out of the scientific aspects of observer programmes. The purpose of this review is to provide background information for the development of recommendations at second regular session of the Scientific Committee on the priorities and objectives of the regional observer programme, and other aspects, from a scientific perspective, and how Article 28 may best be implemented. It was suggested that the SPC OFP conduct this review, in collaboration with members and cooperating non-members with observer programmes, and with the convenors of other SWGs.

6.13 It is hoped that the TCC will establish a parallel review aimed at providing background information on the compliance aspects of observer programmes. If the TCC perform such a review in 2005/2006, then the compliance review and science reviews should be closely coordinated.

6.14 Scientific aspects of observer programmes that should be reviewed include the following:

a) Which types of scientific data it is appropriate to have observer programmes collect, and which are better collected by other means;

b) Best practice (world wide) in observer programmes for tuna fisheries;

c) The performance of the existing sub-regional and national observer programmes; and

d) Issues that might hinder full interoperability between the data collected in the proposed regional observer programme and the data collected in the existing sub-regional and national observer programmes.

6.15 The review should pay particular attention to the following aspects of the existing sub-regional and national observer programmes:

a) Their specific objectives;

b) The items of data that they collect;

c) The sampling protocols that they use;

d) The operating instructions (standing orders) given to observers, and in particular how they prioritise the use of their time;

e) The coverage rates targeted and achieved; and

f) If time allows:

i. The recruitment criteria used when selecting observers;
ii. The training given to observers; and
iii. How the performance of observers is assessed.

COOPERATION WITH THE TCC ON DATA ISSUES

6.16 The Article 12.2(f), 14.2(c) and 14.2(f) of the Convention require the Scientific Committee and the TCC to consult on the regional observer programme and on fishing gear and technology. In addition to those functions prescribed under the Convention, it would be useful to keep the TCC informed of all Scientific Committee recommendations that are relevant to its decision-making processes.

6.17 The Chair invited A. Turaganivalu, the Chair of the TCC, to provide some general comments on cooperation between the two Committees. A.Turaganivalu advised that the TCC had yet to hold its first meeting and that it was in the early stages of its work programme. However, he welcomed and was strongly supportive of the need for cooperation between the two Committees. One of the priorities for the TCC when it meets in early December 2005 will be progressing specifications and standards for the regional observer programme, which was not completed by Working Group III during the Preparatory Conference. This will include developing clear guidelines on the collection of data by observers for compliance and scientific purposes.

6.18 A. Turaganivalu also advised the Scientific Committee that recommendations made during the first regular session of the Scientific Committee that are of relevance to the TCC would be considered under a specific agenda item when it first meets. He also invited the Scientific Committee to forward matters on flag State responsibilities and conservation requirements to the TCC for its consideration.

6.19 It was agreed that:

a) The TCC be informed of the recommendations made by the Scientific Committee regarding the provision of scientific data to the Commission and standards for the provisions of operational catch level data;

b) The TCC be informed of the recommendation to establish an ad hoc group to identify types of data that must be treated as confidential and to develop draft rules and procedures to govern the security and confidentiality of data collected and held by the Commission; and

c) TOR should be developed addressing operational principles of cooperation between the Scientific Committee and the TCC.

ADVICE TO THE COMMISSION

6.20 The Advice to the Commission on data matters including recommendations for implementation of data collection is presented in paragraphs 6.1 through 6.19 above.

7. FUTURE WORK PROGRAMME

7.1 The Scientific Committee was reminded that the Convention (Art. 12) requires the Scientific Committee to recommend a Research Plan to the Commission that responded to the requirements of the Commission. The Scientific Committee considered the components of a Research Plan despite the fact that the scope of the Commission's budget to support any Plan that might subsequently be adopted was currently unknown.

7.2 The Scientific Committee discussed the summary recommendations of the research priorities identified by the SWGs that convened during the first regular session of the Scientific Committee.

SCIENTIFIC COMMITTEE WORK PROGRAMME FOR 2005-2006

7.3 The Scientific Committee recommends that full assessments be conducted for bigeye and yellowfin tuna in the WCPO in 2006. Further, the Scientific Committee recommends that full assessments for skipjack and south Pacific albacore are not required for 2006, but may be updated if resources allow. In making this recommendation, the Scientific Committee notes that there are critical biological uncertainties for south Pacific albacore, highlighted in the 2006 research priorities (paragraph 7.41), and that these should be addressed in order to inform the next full stock assessment.

7.4 The Scientific Committee agreed that although a Pacific-wide bigeye assessment was a priority in the Scientific Committee work programme, there were two options for 2006:

a) To continue research with the current Pacific-wide model in order to address the key uncertainty regarding movement rates between the WCP-CA and IATTC area; and

b) To carry out a full assessment with the same level of detail as the WCPO assessment.

7.5 The Scientific Committee agreed that while assessments should focus on target species, some prioritisation was required to ensure that non-target species also received consideration. Such species

include striped and blue marlin, swordfish (in collaboration with ISC), blue shark, oceanic white tip and silky shark.

7.6 Based on the above considerations the Scientific Committee recommends the following assessments be carried out:

a) Bigeye and yellowfin in the WCPO (full assessments);

b) Skipjack tuna (update);

c) South Pacific albacore (update);

d) Pacific-wide bigeye tuna (update);

e) Other species: pelagic sharks, marlins, swordfish, and Wahoo.

7.7 The Scientific Committee noted that additional key work items for 2006 have also been highlighted under other agenda items (paragraphs 6.1 – 6.15, 8.6, 10.13 – 10.19) and these are also detailed in the proposed Scientific Committee budget for 2006.

SWG WORK PROGRAMMES FOR 2005-2006

BIOLOGY SPECIALIST WORKING GROUP (BI-SWG)

7.8 Research with respect to biology of target and non-target species is described in the BI-SWG report (Annex VIII). This research is focused on data allowing refinements of stock assessments, such as sex ratios, size frequencies, size-at-age, maturity schedules, growth parameters and natural mortality. The Scientific Committee encourages members and observers to address these research items as a matter of priority. In pursuing such research, the Scientific Committee recommends that research with respect to bigeye tuna and yellowfin tuna is generally of the highest priority. There are critical biological uncertainties for south Pacific albacore (as noted above) that should be addressed in order to inform the next full stock assessment.

7.9 In reviewing the work programme of the BI-SWG, the Scientific Committee noted that the following items of research are the highest priority:

a) Fish (particularly yellowfin tuna and bigeye tuna) behaviour induced by the presence of FADs and other floating objects (using tagging);

b) Fundamental biological parameters for non-target species such as billfish and sharks;

c) Information regarding size at sexual maturity of albacore and bigeye using modern histological techniques; and

d) Revision of the length-weight relationships for target species based on recent empirical data.

METHODS SPECIALIST WORKING GROUP (ME-SWG)

7.10 Research with respect to stock assessment methods is described in the ME-SWG report (Annex VI). This research is focused on technical questions related to analytical methods used for fishery management.

7.11 The Scientific Committee agreed better definition of bigeye tuna vertical environment was desirable but that there were practical considerations in achieving this. It was also noted that historical

changes in longline catchability, particularly the Japanese longline fleet, was also important as was further work to improve the capacity of MFCL to deal with recruitment. In relation to the employment of different technologies to assess tuna abundance it was noted that targeted larval surveys may be informative – but would also be high cost. It was noted that appropriately designed large-scale tagging programs have potential to provide information on abundance.

7.12 The Scientific Committee also considered the need to model impacts of reduced recruitment. It was noted that the impacts of environment, recruitment changes and fishery impacts were difficult to isolate.

7.13 In reviewing the work programme of the ME-SWG, the Scientific Committee noted that the following items of research are the highest priority:

a) Improvements to the longline CPUE standardisation (including changes in catchability through time and physical factors for incorporation into the standardisation process);

b) Improvements to the recruitment indices used in modelling including development of recruitment indices independent of the model); and

c) Improvements to the spatial parameterisation of the modelling techniques.

STATISTICS SPECIALIST WORKING GROUP (ST-SWG)

7.14 Research with respect to statistics is described in the ST-SWG report (Annex VII). This research is focused on the establishment and improvement of the collection and dissemination of data for science purpose.

7.15 The Scientific Committee agreed that discussion under Agenda Item 6 in relation to the review of scientific aspects of observer programmes would also require accommodation in this list of priorities relating to the work of the ST-SWG.

7.16 The Scientific Committee considered the importance of an efficient sampling scheme for species and sizes to identify bias in CPUE. It was suggested that a proposed review of sampling protocols, as a medium term priority, would cover this issue and that port sampling be included in the review as a basis for developing a sampling programme that was integrated to the extent possible.

7.17 It was noted that the WCPO is the only ocean that uses observers to estimate species and size composition on purse seiners and that there may be considerable bias in the data generated from this at present. It was agreed that the Scientific Committee needed to recommend sampling protocols that provide reliable assessments of size and species composition information.

7.18 In reviewing the work programme of the ST-SWG, the Scientific Committee noted that the following items of research are the highest priority:

a) Better characterisation of current catch and catch composition from Indonesia, Philippines, and for Vietnam as they impact on the stocks in the WCP-CA; and

b) Review of the scientific elements observer programmes including the development of integrated regional observer and port-sampling collection of science data (e.g. size composition, species composition).

FISHING TECHNOLOGY SPECIALIST WORKING GROUP (FT-SWG)

7.19 Research with respect to fishing technology is described in the FT-SWG report (Annex V). This research is focused on the standardisation of fishing effort across all fleets particularly through

the use of appropriate vessel operational details. The Scientific Committee encouraged members and observers to address these research items as a matter of priority.

7.20 Fishing Technology-related tasks were considered on the basis of those that the FT-SWG could advance individually, in collaboration with other SWGs or tasks that required additional support. Priority tasks included:

a) Standardised terminology for technical terms for use across all SWGs;

b) Key vessel gear and operationalised details necessary for fishery specific standardisation and that the institualisation of the collection of this information by observer and port sampling programmes and on log-sheets;

c) Collate and analyse operational level data for effort standardisation that has already been collected by observer and port sampling programmes and on log-sheets;

d) Identify and institute the collection of technical data on fishing gear and methods of special interest – particularly in relation to FADs;

e) Identify the impact of FADs on fishing mortality of juvenile target species and all life phases of non-target species;

f) Improve provision of fisheries data at the species level for target and non-target species including the production of training materials to assist with species identification;

g) Efforts to define capacity and effective fishing effort.

STOCK ASSESSMENT SPECIALIST WORKING GROUP (SA-SWG)

7.21 Research with respect to stock assessment is described in the SA-SWG report (Annex IX). This research is focussed on the provision of stock status summaries for the Commission.

7.22 The Scientific Committee considered the priorities of the SA-SWG should include:

a) Review and document the technological and operational changes of the longline fisheries, especially those for the Japanese fleet, with the intention of better standardising effort in these fisheries;

b) Review processed weight to live weight conversion factors and length-weight conversion factors in those longline fisheries for which weight data were obtained and used in MFCL analysis;

c) Investigate alternative regional structure for the yellowfin tuna assessment (in light of the high proportion of the catch taken in the western equatorial Pacific); and

d) Large scale tagging experiments for the main target tuna species in the WCPO.

7.23 The Scientific Committee noted that the last item has significant financial implications and would need to be completed in a cooperative manner with other organisations to succeed.

ECOSYSTEM AND BIO CATCH SPECIALIST WORKING GROUP (EB-SWG)

7.24 Research with respect to ecosystem and bycatch is described in the EB-SWG report (Annex X). This research is focused on the review of the impact on fishing on components of the ecosystem

not targeted by fisheries; the interactions between climate and environmental factors and the target and non-target species; and, the development of ecosystem-based models.

7.25 The Scientific Committee encourages members and observers to address the following priority research items for ecosystems and by-catch:

a) Ecological modelling and indicators;

b) Stock assessments for shark and billfish (particularly silky shark and oceanic white tips);

c) An increase in observer coverage rates, including the centralisation and expansion of observer data collection and reporting and identification of species to support data collection by observer; and

d) The production of material to facilitate the identification of species by fishermen, observers, etc. with the objective of improving data quality.

RESEARCH PRIORITIES, RESEARCH PLANNING AND COORDINATION

7.26 The Scientific Committee recalled that research recommendations need to respond to the directions of the Commission and that Article 12 of the Convention, relating to the functions of the Scientific Committee, required the Scientific Committee to recommend a Research Plan to the Commission. The Scientific Committee noted that a functional Secretariat, that could service the Scientific Committee, would assist its work in future years.

7.27 The Scientific Committee reviewed the research priorities agreed at SCTB17 against the recommendations of the SWGs from the first regular session of the Scientific Committee. It was suggested that the recommendations of the SWGs, together with the recommendations of the SCTB17, could be divided into i) data collection and ii) modelling that synthesises the data. It was agreed that these could be divided into short and medium term priorities with clear definition of 2006 tasks. It was agreed that the Commission would need to prioritise research tasks within the available budget and consider what research tasks may be addressed by other means.

7.28 The Scientific Committee noted the discussion on Scientific Committee work programme for 2005/06 (paragraphs 7.3 – 7.7) and Development of a medium term research plan (paragraphs 7.34 – 7.36) was also directly of relevance to the discussion of research priorities, research planning, and coordination.

7.29 In relation to this it was noted that collaborative activities with other RFMOs and organisations such as IATTC and FAO could be developed to assist with implementation of the Research Plan.

7.30 In relation to assessment for other oceanic pelagics the Scientific Committee heard that SPC is collaborating with the Bureau of Rural Resources in Australia on an assessment for striped marlin in the South West Pacific. It was uncertain if that assessment would be completed in time for the second regular session of the Scientific Committee. It was also noted that a swordfish assessment was being undertaken by CSIRO (Australia) and NZ and research was being undertaken for north Pacific stocks by the ISC.

7.31 The Scientific Committee agreed that while assessments should focus on target species, some prioritisation was required to ensure non-target species also received consideration. Such species include striped and blue marlin, swordfish (in collaboration with ISC), oceanic white tip and the silky shark.

7.32 The Scientific Committee noted the need to coordinate with national research programmes to avoid unnecessary duplication of research efforts.

7.33 The Scientific Committee recommended that the considerations noted in paragraphs 7.26 – 7.32 above be included in the consideration of the medium term research plan.

DEVELOPMENT OF A MEDIUM TERM RESEARCH PLAN

7.34 The Scientific Committee noted that the development of a medium term research plan was difficult to progress in the absence of a Commission Secretariat.

7.35 The Scientific Committee recommended that the research priorities identified above, the work programmes of the SWGs and the medium term research plans of the SWGs be utilised by the Secretariat in the development of a medium term research plan for the Commission, with annual review by the Scientific Committee.

7.36 In consideration of a research plan that helps ensure that the Commission obtains for its consideration the best scientific information available, the Scientific Committee has identified medium-term research priorities that address current gaps in the information and knowledge of the fisheries and associated species and ecosystems in the WCP-CA. These medium-term research priorities can be partitioned into:

a) Improvements in data collection; and

b) Development and improvements in the modelling used to synthesise these data. Furthermore, under each medium-term research issue short-term priorities can be identified. The medium-term priorities and associated 2006 priorities are listed below in no particular order below.

The particular priorities and members, observers and organisations identified as being responsible for pursuing the matter intersessionally are detailed

DATA PRIORITIES FOR 2006

7.37 Improved catch and catch composition data for all fisheries for all years:

a) Indonesia, the Philippines and Vietnam (an existing WCPFC project); and

b) Examination of relationship between observer coverage rates and the accuracy and reliability of estimators of catches by the purse seine fleets (SPC OFP services).

7.38 Improved understanding and documentation of fishing technologies and operational practices, and changes over time in these technologies and practices, for all fleets:

a) Operational characterisation of the major longline fleets since 1950 (Japan, Korea, Chinese Taipei and Australia); and

b) Identification of key vessel, fishing gear (e.g. FAD design and use) and operational details necessary for fishery-specific effort standardisation (FT-SWG).

7.39 Improved understanding of the life-history parameters and the habitat preferences and associations of species in the WCPO:

a) Maturity ogives for albacore (Australia) and bigeye tuna (Chinese Taipei);

b) Weight-length relations and processed-to-whole weight conversion factors for those fisheries for which weight frequency data are used in the MFCL analyses especially for yellowfin tuna and bigeye tuna (SPC OFP, member data contributions, possible exercise in capacity building for Small Island Developing States and Territories);

c) Further archival tagging studies in areas throughout the WCPO, especially areas away from seamounts and FADs, and on a wide range of tuna ages in order to better parameterise habitat-based standardisation models (SPC OFP/GEF project); and

d) Determination of associated dynamics of target and non-target species around FADs with a view to identifying possible measures to mitigate catches of juvenile yellowfin tuna, bigeye tuna and non-target species by purse seine (ongoing work in Hawaii, expansion to other areas would require new funding).

7.40 Further development of the Regional Observer Program:

a) Review scientific aspects of observer programmes, such as objectives, coverage rates, sampling protocols and standards for data collection forms (SPC OFP services, USA); and

b) Centralisation and expansion of the observer data collection (existing SPC OFP activity, data contributions welcome).

7.41 Design and development of an Integrated Regional Port and Observer Sampling Program:

a) Examine sampling protocols for purse-seine sampling programmes to identify possible sources of bias in species composition data (USA, SPC OFP services).

7.42 Implementation of a large-scale tagging program for the main target species in the WCPO:

a) Develop a concept paper to be made available for review by the Scientific Committee and the Commission (SPC OFP services, consultation with IATTC).

MODELLING PRIORITIES FOR 2006

7.43 Further development of methods (including improved data inputs) to improve the standardisation of effort and the construction of indices of stock abundance:

a) Analysis of operational level data. (SPC OFP services, Japan);

b) Inclusion of physical factors other than SST and oxygen as proxies for habitat e.g. thermocline structure, deep-scattering layer (Australia); and

c) Expansion of studies of to ascertain hook-depths in longline fleets, especially for the Japanese fleet (possible WCPFC role in acquiring TDRs for deployment in regional/national observer programmes, Australia).

7.44 Further development of stock assessment models (including improved data inputs), and clarification of the structural and statistical uncertainties in these models:

a) Investigate alternative regional structures for the yellowfin tuna assessment. (SPC OFP services); and

b) Investigate alternative movement parameterisation in the MFCL models (SPC OFP services, USA).

7.45 Further evaluation of management options within the WCP-CA:

a) Incorporation of uncertainty in evaluation of management options (Possible SPC OFP services, subject to WCPFC request; USA); and

b) Development of alternative models (ME-SWG).

7.46 Improved understanding of the impacts of fishing and the environment on the pelagic ecosystem:

a) Undertake an ecological risk analysis in order to prioritise species of seabirds, sea turtles, sharks and non-target fish species for future research (possible SPC OFP services, subject to WCPFC request, Australia);

b) Identification of potential ecosystem indicators for monitoring impacts (SPC OFP/GEF, Australia);

c) Inclusion of albacore in the SEAPODYM model, and further work on parameter optimisation (SPC OFP, USA); and

d) Improved estimates of catches of non-target species (possible SPC OFP services, members/observers).

ADVICE TO THE COMMISSION

7.47 The Scientific Committee noted that detailed advice on several matters is contained in paragraphs 7.1 – 7.46 above.

7.48 The Scientific Committee noted that the Commission would need to decide on the scope of services to be provided by the SPC OFP in 2006 with respect to stock assessment and in particular whether a Pacific-wide bigeye tuna assessment was required.

8. SPECIAL REQUIREMENTS

8.1 In recognition of the need to bring into effect Article 30 of the Convention, the Scientific Committee discussed the special requirements of developing states and participating territories, following the proposal of Working Group II of the Preparatory Conference that the Commission should develop a long term strategy for:

a) Building fisheries data collection and analytical capacity in developing state parties and territories;

b) The development within the Commission science and data programmes of the capacity to provide advice and assistance to FFA members in respect of data and other technical areas; and

c) The establishment of a broader process of consultation and a program of cooperation to build FFA member capabilities in areas related to the Convention, including data and other technical aspects.

8.2 Attention to these special requirements addressed the objectives of assisting developing state parties and participating territories to participate fully in the work of the Commission, and to meet their obligations under the Convention, especially in respect of the provision of information.

8.3 The Scientific Committee asked the developing states parties and territories to put forward more detail on proposals with indicative budgets for consideration (paragraphs 9.8 and Table 3).

REQUIREMENTS OF SMALL ISLAND DEVEL0PING STATES AND TERRITORIES

8.4 With respect to data, the Scientific Committee recognised that the special requirements of developing state parties and participating territories included the need to:

a) Establish or expand observer programmes;

b) Establish or expand port sampling programmes;

c) Strengthen statistical and data and database management capacity;

d) Enhance national capacity to analyse and report national data;

e) Build capacity to develop, use and interpret data and economic models; and

f) Build capacity to use and interpret data in the development of management options.

8.5 With respect to scientific research, the Scientific Committee recognised that the special requirements of developing state parties and participating territories included enhancing capacities to:

a) Use and interpret stock assessment models;

b) Interpret oceanographic and meteorological data, in conjunction with fishery data;

c) Understand and apply information on the biology and lifecycles of tuna and bycatch species; and

d) Apply the ecosystem approach to fisheries management.

ADVICE TO THE COMMISSION

8.6 The Scientific Committee recommended that:

a) The Commission include these activities for support under the Special Requirements Fund:

i. Workshops, with the priority on building capacity in interpreting regional stock assessments and oceanographic data;
ii. Programme of targeted in-country assistance to support the development of domestic fisheries monitoring programmes;

iii. Commission scholarship scheme for tertiary and post graduate study and work experience at appropriate institutes and organisations through existing programmes, with emphasis on tunas and associated species; and
iv. Fellowship programmes to support technical personnel to work collaboratively at agencies such as FFA, SPC or other relevant science and policy bodies, and to support in country activities by visiting experts, particularly experts from other Commission Members.

b) The Commission endorse early and positive support for contributions to the Special Requirements Fund in response to the above needs, and requested the Executive Director to give the establishment of the Fund, its operating procedures and effective implementation a priority.

8.7 The Scientific Committee noted that the TCC might also have recommendations on these matters.

9. BUDGET AND FINANCE

9.1 The Scientific Committee considered a discussion paper on budget and finance matters. The first part related to funding of the next regular session of the Scientific Committee (SC-2). The second part related to the implications of Scientific Committee proposals for research. It was acknowledged that not all proposals would be funded but the paper proposed that the decisions on priority trade-offs would be for the Commission to make.

9.2 The Executive Director designate noted that prioritisation will be required by the Commission because a considerable part of the indicative science budget for 2006 will be taken up by funding the interim science and data arrangements with the SPC OFP activities.

9.3 The Scientific Committee discussed the budget and finance matters and reported as follows.

9.4 The Scientific Committee noted the following financial implications of proposals for 2006:

a) The stock assessment of the target species and associated data management (paragraphs 6.1 – 6.3 and 7.6);

b) The proposals on improved data collection (paragraph 6.6);

c) The additional research highlighted in the 2006 work programme (paragraphs 7.8 – 7.46);

d) The proposed ad hoc group to work on data security, confidentiality and dissemination (paragraphs 6.7 – 6.9);

e) The proposed review of scientific observer requirements for the Commissions regional observer programme and associated port sampling requirements (paragraphs 6.10 – 6.15);

f) The proposed review of the Scientific Committee structures, processes and arrangements with respect to service provision (paragraphs 10.13 – 10.19); and

g) The proposals for the voluntary fund for the special requirements of developing states and participating territories (paragraph 8.6).

9.5 The Scientific Committee reviewed the items proposed for 2006. The Scientific Committee prioritised each of the items within sub-categories for funding. Prioritisation across categories was considered a decision for the Commission.

9.6 The Scientific Committee requested the Secretariat to work with the SPC OFP to finalise a budget for these items to append to the Scientific Committee report.

ADVICE TO THE COMMISSION

9.7 The Scientific Committee recommended funding for the 2006 meeting of the Scientific Committee is included in the Commission's budget.

9.8 The Scientific Committee recommended the funding requests in Table 3 be considered by the Commission to fund the work of the Scientific Committee in 2006.

9.9 In making recommendations with respect to the stock assessment of target species the Scientific Committee noted that decisions about the species to be assessed and the scope of the assessments for those species were required from the Commission (paragraphs 7.3 – 7.6).

Table 3 - Draft budget for the Scientific Committee in 2006.

Priority	Item	Amount (US $)	Explanatory comment
Stock assessments of the target species and associated data management			
1	Stock assessment of the target species	254,500	The precise scope of this item needs the Commission to decide on which species are to be assessed and in which areas
	SUB-TOTAL	*254,500*	This figure has come from the indicative 2006 budget of the Commission
Improved data collection			
1	IPDCP – Philippines	N/A[7]	This is covered by existing funding for 2006
2	IPDCP – Indonesia	152,000	Details have been provided in previous papers
3	Review – Vietnam	15,000	
	SUB-TOTAL	***167,000***	
Additional research identified in the future work programme			
1	Regional tagging programme detailed proposal paper	20,000	Identified as the critical next step in developing a regional tagging programme to improve the stock assessments
2	TDRs	45,000	~30 TDRs for distribution to existing observer programmes for utilisation on appropriate voyages
	SUB-TOTAL	*65,000*	
The ad hoc data security, confidentiality and dissemination task group			
1	Workshop of ad hoc group to finalise standards	45,000	Approximate cost of one meeting of group
	SUB-TOTAL	*45,000*	
Review of scientific observer requirements for the Commissions regional observer programme			
1	Review of information to design future programme	N/A[8]	Critical next step and requires liaison with the TCC

[7] Transferred from PrepCon fund to Special requirements fund.
[8] Part of the general SPC OFP contract.

	SUB-TOTAL	*0*	
The review of the Scientific Committee processes			
1	Engagement of independent reviewers	35,000	Agreed as a part of the PrepCon process
	SUB-TOTAL	*35,000*	
Science and data needs to be considered for funding from the special requirements fund			
1	MFCL stock assessment model workshop	40,000	Workshop run by SPC OFP on using and interpreting MFCL for WCP-CA highly migratory stocks
2	Support for observer program training	40,000	Support for SPC based component of regional observer training program with focus on Commission standards and requirements
3	Scholarship scheme (2 per year)	40,000	Two scholarships for tertiary study, with tuition and living allowance @ US$ 20,000 p.a.
4	Attachments (SPC, FFA) and visiting experts	21,000	National scientists and statistics staff; @ US$ 3,500 each, covering travel and living costs only, 2-3 week assignments
5	Annual vessel activity report and national vessel register	9,000	Technical support, design of register and database, distribution of forms
	SUB-TOTAL	*150,000*	
	TOTAL	**716,500**	

10. SCIENTIFIC COMMITTEE ADMINISTRATION

RULES OF PROCEDURE

10.1 The Chairman, noting the tabling by the USA of draft rules of procedure for the Scientific Committee, presented some suggestions on a possible process for the further development of rules of procedure.

10.2 The Scientific Committee considered a provisional schedule for further development of rules of procedure for the Scientific Committee and the draft rules of procedure prepared by the United States.

10.3 The meeting was informed that the draft was based on rules of procedure in place for similar scientific bodies at CCSBT, ICCAT and ISC.

10.4 The Scientific Committee welcomed the draft and thanked the USA for its work on this item.

10.5 The Scientific Committee noted that the necessary expertise to consider this matter in detail was not available to many participants at the current meeting. Accordingly, the draft would require further consideration by relevant officials in participants' home countries.

10.6 The Scientific Committee recommended that participants review the draft and subsequently submit their views, in writing, to the Executive Director.

10.7 Clarification was sought relating to the possible role of the TCC in considering this draft. It was noted that it made sense to provide an opportunity for the rules of procedures of different Commission subsidiary bodies to be as harmonised as much as possible.

10.8 The Scientific Committee noted the detailed rules of procedure of the Commission and recommended that, because of their complexity, they needed to be simplified when developing the rules of procedure for the Scientific Committee.

10.9 The Scientific Committee noted the following additional items that would need to be clearly addressed in a revised draft:

a) Promoting a spirit of scientific cooperation;

b) Explicit coverage of participatory rights with respect to members, participating territories, observers and science experts (paragraphs 11.12 – 11.15);

c) Recognition of existing regional processes and structures;

d) The interaction with other relevant organisations (paragraphs 11.12 – 11.15);

e) Consensus based decision making;

f) A process for reporting deliberations where consensus is not possible; and

g) Plain language to allow all participants to be able to understand and work with the rules of procedure.

10.10 To facilitate the development of Scientific Committee rules of procedure the participants agreed that:

a) Written comments on the tabled draft are to be provided to the Executive Director by 13 Nov 2005;

b) The Executive Director will use those comments, and any discussions during the TCC on rules of procedure to prepare a draft that harmonised common elements between the Commission and its subsidiary bodies;

c) This draft would go to a drafting committee, facilitated by the Chairman of Scientific Committee in March 2006;

d) the drafting committee will be comprised of representatives from any interested participant in the Scientific Committee; and

e) The comments of the drafting committee and a revised draft would be tabled at the next regular session of the Scientific Committee.

APPOINTMENT OF VICE-CHAIR

10.11 The Scientific Committee recommended to the Commission that S. Harley (New Zealand) be appointed Vice-Chair of the Scientific Committee.

APPOINTMENT OF SPECIALIST WORKING GROUP (SWG) CONVENORS

10.12 The following SWG Conveners were appointed for the next two years:

a) Biology SWG – C-L. Sun (Chinese-Taipei);

b) Ecosystem and Bycatch SWG – P. Dalzell (USA) and P. Ward (Australia);

c) Fishing Technology SWG – D. Itano (USA);

d) Methods SWG – R. Campbell (Australia);

e) Statistics SWG – K. Duckworth (New Zealand); and

f) Stock Assessment SWG – M. Stocker (Canada) and N. Miyabe (Japan).

TERMS OF REFERENCE FOR AN INDEPENDENT REVIEW

10.13 The Scientific Committee discussed the proposed Independent Review of the science structure and function of the Commission during the initial 3-5 year transitional period.

10.14 The Scientific Committee noted that the Commission had agreed to some flexibility in terms of the timing of the review and that its purpose was to provide guidance on the next phase of developments for the science functions of the Commission.

10.15 The Scientific Committee considered that, as the Secretariat's science functions were yet to be established, a review in 2006 would be premature. It would not provide an opportunity to evaluate the effectiveness of the Commission's science function and how it relates to the Scientific Committee. The Scientific Committee agreed to recommend that the Review completion date be deferred until June 2007.

10.16 The Scientific Committee discussed the means to undertake the review, key issues for consideration during the review and delivery of the resulting report, and developed an outline of the key issues that would need to be covered in the review relating to i) science data functions, and ii) science function.

10.17 The Scientific Committee noted that the detailed notes of its deliberations should be forwarded to the Executive Director to be used in the preparation of draft TOR for the review.

10.18 The Scientific Committee noted two options for reporting on the review: i) the Scientific Committee has a role in reporting and presenting recommendations to the Commission, or ii) the report is presented direct to the Commission but made available to the Scientific Committee for comment. The Scientific Committee agreed that the second option was preferred.

10.19 Clarification was sought on decision-making processes for recommendations arising from the report and how they will be implemented. It was suggested that the Secretariat present information on this matter at the second regular session of the Scientific Committee.

FUTURE OPERATION OF THE SCIENTIFIC COMMITTEE

10.20 The Scientific Committee discussed its future operation, with the objective of improvement in it's functioning for the second regular session of the Scientific Committee, recognising that Secretariat support would be available to this second meeting. Issues considered by Scientific Committee included timing of the next regular meeting, duration, clarity of roles between SWG and the Scientific Committee, the management of concurrent sessions and rationalisation of SWG sessions.

10.21 In relation to timing Scientific Committee noted that stock assessment data should be available by the end of April 2006. This would enable stock assessment to be undertaken in May-July, that some coordination between stock assessment team and the SWGs may be beneficial at that time, communicating by email, and that the results would be submitted to the next regular session of the Scientific Committee in August 2006. This would provide sufficient time for preparation of the Scientific Committee report and circulation 60 days in advance of the 2006 meeting of the Commission. The Scientific Committee noted that current stock assessments are based on data that is two years old and the Scientific Committee agreed that this should be re-evaluated as the Commission data functions become established and should be raised during the Independent Review of science structure and function.

10.22 The Scientific Committee agreed that the duration of next regular session of the Scientific Committee should be two weeks and noted that budget constraints precluded the separation of SWG and Scientific Committee meetings. The Scientific Committee discussed ways in which the operation of the joint meetings could be made more efficient within that timeframe. The Scientific Committee agreed that the Agenda of future Scientific Committee meetings should deal with requests from the Commission first and agreed to prioritise the work of the next regular session of the Scientific Committee to be directly responsive to Commission needs.

10.23 The Scientific Committee agreed that SWGs should meet sequentially (with no concurrent sessions). Meetings of SWGs would be scheduled in order to meet specific requirements of the Commission. In some years some SWGs may not need to meet. The Scientific Committee agreed that papers should be clearly assigned to a SWG for discussion to avoid overlap with firmer guidelines on papers of practical relevance to the work of the Commission. The Scientific Committee agreed that it was important to allow time for all documentation of the SWGs to be completed before moving to the meeting of the Scientific Committee.

10.24 Lastly, the Scientific Committee considered that the presentation of national reports to the Scientific Committee could be streamlined. In this regard the Scientific Committee agreed that standardisation of the reporting format would be beneficial.

ADVICE TO THE COMMISSION

10.25 In relation to the Independent Review of transitional science structure and function, the Scientific Committee agreed to advise the Commission:

a) That the Scientific Committee recommends a new completion date for the review of June 2007;

b) That the Scientific Committee has forwarded a discussion paper to the Executive Director outlining elements for a draft TOR for the review;

c) That the Scientific Committee participants would provide advice to the Executive Director in writing by 1 April 2006 on the desirable skills and experience of those undertaking the Review;

d) That the reviewer(s) would need to attend the 2006 Scientific Committee meeting;

e) That the Scientific Committee, facilitated by the Secretariat, would finalise its input to the TOR for the Independent Review intersessionally, based on input from the Secretariat and the contractor with a view to adopting the final TOR at next regular session of the Scientific Committee.

10.26 In relation to the structure and format of the next regular session of the Scientific Committee, the Scientific Committee concluded that:

a) It's future meetings would deal with the priority requests of the Commission at the top of the agenda;

b) The Chairman, in consultation with SWG Convenors, would determine the meeting schedule, and concurrent SWG sessions would not occur;

c) The Chairman, in consultation with the Secretariat, would prepare guidelines for the preparation and presentation of national reports;

d) The Chairman, in consultation with the Secretariat and the Scientific Committee, would determine the need for each SWG to meet at every Scientific Committee; and

e) The Independent Review of science structure and function should examine the time lag for data available for stock assessments.

11. OTHER MATTERS

COOPERATION WITH THE TECHNICAL AND COMPLIANCE COMMITTEE (TCC)

11.1 The Scientific Committee discussed cooperation between the Scientific Committee and the TCC. The discussion focussed the intent of ensuring that the work of the two Committees is complementary, and that through cooperation the Committees are well placed to provide the best available scientific and technical advice to guide the Commission on conservation and management measures.

11.2 The Scientific Committee suggested that the two Committees should cooperate on the matters relating to the establishment and operation of the Commission's regional observer programme, the ad-hoc task group on data security, confidentiality and dissemination (paragraphs 6.7 – 6.9), and other relevant data issues.

11.3 The Scientific Committee noted that the issue of cooperation between the Scientific Committee and the TCC on the Regional Observer Programme had also been considered. The Scientific Committee noted that in addition to the paragraph 6.10 – 6.15 considerations, the ad-hoc task group on data security, confidentiality and dissemination should confer with the TCC on data issues. The Scientific Committee noted the presence of the Chair of the TCC, A. Turaganivalu, and that he would be able to convey the general intent and recommendations of the discussions to the TCC.

11.4 The Chair opened the item for discussion from the floor. There was general support for broad cooperation between the two Committees, specifically with respect to the sharing of data between these bodies and more generally on all relevant matters.

11.5 The Scientific Committee noted that in the medium term cooperation would be required to address a variety of data issues beyond those required for the Commission's regional observer programme. One of the most important would be operational catch data, but it was understood that this was a contentious issue and not one that could be resolved at this point. However, any data collected by Scientific Committee that was of relevance to the TCC should be shared, as should any data collected by the TCC that was of relevance to the Scientific Committee.

11.6 The Chair of the TCC noted that the central issue of consultation between the two subsidiary bodies is to provide recommendations to the Commission on the priorities and objectives of the Commission's regional observer programme. Consultation is also required in respect of fishing gear and technology. Other areas of consultation include operational data, however, it was noted that this required further scoping before it was brought to the TCC for its consideration. At this point a key issue for the TCC is establishing what types of data the Scientific Committee require and the minimum standards for this data.

11.7 The Scientific Committee recommended that:

a) It would adopt a standing agenda item addressing 'Cooperation with the TCC';

b) In order to better facilitate cooperation between the two committees the Scientific Committee would nominate a representative/s to attend the TCC meeting in December 2005; and

c) It would invite the TCC to send a nominated representative/s to future Scientific Committee meetings.

ADVICE TO THE TECHNICAL AND COMPLIANCE COMMITTEE (TCC)

11.8 The Scientific Committee noted that the TCC should be aware of the activities of the Scientific Committee with respect to data (paragraphs 6.1 – 6.19), the proposed review of scientific observer requirements for the Commission's regional observer programme (paragraphs 6.12 – 6.15) and the discussions of the Scientific Committee with respect to cooperation.

COOPERATION WITH THE IATTC AND OTHER INTERNATIONAL ORGANISATIONS

COOPERATION WITH IATTC

11.9 The Scientific Committee considered issues of cooperation between the Commission and the IATTC. The meeting noted that it was premature to discuss specific details for all relevant areas of for cooperation between IATTC and the Commission, as an MOU between the IATTC and the Commission had yet to be drawn up.

11.10 The Scientific Committee noted that the establishment of such an MOU, the responsibility of the Commission, would benefit both organisations with respect to science matters.

11.11 The IATTC requested that the WCPFC consider three important areas of immediate cooperation with the IATTC:

<u>Data Matters</u>

a) The Scientific Committee agreed that cooperation with IATTC should include the exchange of relevant science data between IATTC and the Commission, and this matter would usefully be incorporated as one of several components in an overall agreement (MOU) between the two organisations on areas for cooperation;

b) It was noted that an Agreement on the Exchange of Tuna Fisheries Data between IATTC and SPC was reached in March 2003, and that this Agreement might serve as a model for an agreement on the exchange of data between IATTC and Commission. Under the Agreement, SPC provides IATTC with catch and effort data aggregated by time-area strata covering the

Western and Central Pacific Ocean and operational catch and effort data covering trips that take place at least in part in the Eastern Pacific Ocean, and IATTC provides SPC with catch and effort data aggregated by time-area strata covering the Eastern Pacific Ocean and operational data covering trips that take place at least in part in the Western and Central Pacific Ocean. If used as a model for an agreement on the exchange of data between IATTC and the Commission, the Scientific Committee noted that the agreement would need to be modified to refer to the Commission statistical area, rather than the Western and Central Pacific Ocean;

Shark Stock Assessments

c) The Scientific Committee noted the current IATTC Resolution on the Conservation of Sharks and the text of a letter from the IATTC to the WCPFC on this matter;

d) The Scientific Committee suggested that future cooperation with the IATTC would usefully include collaboration with respect to shark stock assessments, and that this could also be covered in the future MOU between the IATTC and WCPFC. Any future involvement in this area would need to be reflected in the future work programme of the Scientific Committee;

e) The Scientific Committee recommended that the research programme detailed in paragraphs 7.6(e), 7.9(b), 7.25(b) and 7.31, once approved by the Commission, be provided to the IATTC to better foster cooperative research;

IATTC Stock Assessment Working Group matters

f) The Scientific Committee noted the report of the most recent IATTC Stock Assessment Working Group and the text of a letter from the IATTC to the WCPFC on this matter;

g) The Scientific Committee participants agreed that relevant immediate cooperation with the IATTC might include:

   i. The continuation of the Pacific-wide assessment of bigeye tuna being led by the SPC-OFP; and

   ii. A joint WCPFC-IATTC Pacific-wide tagging program for tropical tunas;

h) The Scientific Committee noted the importance in continuing the cooperation with regard to the Pacific-wide assessment of bigeye tuna. The relative priority of this work is addressed under the Scientific Committee work programme; and

i) With respect to the Pacific-wide tagging proposal, the IATTC elaborated on the broad objectives of a possible joint proposal - to study the interaction of tunas from the two main areas of the Pacific (e.g. EPO and WCPO) including movement patterns and mortality rates. The Scientific Committee acknowledged the importance of this project and the matter was discussed in detail in the Scientific Committee work programme and Annex XI.

PARTICIPATORY RIGHTS OF INTERNATIONAL ORGANISATIONS IN THE WORK OF THE SCIENTIFIC COMMITTEE

11.12 The Scientific Committee noted some confusion with respect to the status of various participants in the Scientific Committee.

11.13 The Scientific Committee suggested that the participatory rights of international organisations in the meetings of the Scientific Committee and its SWGs is an area that will need to be addressed in any rules of procedure developed for the Scientific Committee (paragraphs 10.5 to 10.10).

11.14 Specifically, the Scientific Committee suggested that the following matters be addressed in the development of rules of procedure (paragraph 10.10):

a) Whether the participatory rights of the particular organisations within the Scientific Committee and its SWGs should differ in regard to their areas of particular expertise;

b) Whether scientific experts contracted by the Commission, e.g. SPC OFP, have differential status to that of other international organisation observers within the Scientific Committee and its specialist-working group; and

c) Whether the participatory rights of particular organisations differ to that of members, cooperating non-members and other observers.

11.15 With respect to participatory rights of international organisations in the work of the Scientific Committee, the meeting noted that:

a) It was premature to make any decisions at this stage since the Scientific Committee rules of procedure had yet to be established;

b) Some organisations are specifically mentioned in the text of the Convention. Article 22 outlines the organisations that the Commission is required to cooperate with. Article 12 (4) requires representatives of SPC OFP and IATTC to be invited to participate in Scientific Committee meetings. Additionally other organisations or individuals with scientific expertise related to the work of the Commission may be invited to participate in Scientific Committee meetings;

c) It may help the work of the Scientific Committee if the WCPFC were to expedite the mechanisms regarding the participation of IATTC and other organisations, for example, in the funding of Pacific-wide tagging; and

d) There would be a need to clearly define the participatory rights of the parties specifically mentioned in the Convention text in any Scientific Committee rules of procedure.

COOPERATION WITH FAO

11.16 The Scientific Committee noted a number of areas of FAO's work that may be of relevance to the work of the Scientific Committee and the WCPFC in general. FAO has a wide range of technical expertise (within the Fisheries Department and in its regional and sub-regional offices) that may be of relevance to the work of the Scientific Committee and the SWGs. The Scientific Committee suggested that as time allows in future, the relationship between the work of FAO and its subsidiary bodies and the Scientific Committee be explored further.

11.17 With respect to active cooperation with FAO, the meeting noted that SPC OFP is already a member of the CWP. Unfortunately, the ST-SWG did not have time to consider the membership of WCPFC in the CWP at this Scientific Committee meeting, although there is no urgency to make any decision since the next meeting of the CWP will not be until 2007 and the Scientific Committee 2006 can therefore discuss and make recommendations regarding this issue.

11.18 In regards to the Commission establishing a formal link with FIGIS/FIRMS it was noted that the Commission would have to finalise its data and information dissemination policy before this could progress. It was noted that the FIRMS/FIGIS project is progressing slowing and there was no urgency in the WCPFC making any decision regarding the development of a partnership arrangement at this stage, and that discussion on this issue should be deferred to the next regular session of the Scientific Committee in 2006.

11.19 In relation to participation at upcoming FAO meetings (or other similar related international science meetings of importance to the work of the Scientific Committee), there was some discussion on how the Commission might deal with representation to meetings in general. It was suggested that representation might be covered in any of the following ways:

a) A member of the Commission, already intending attending the meeting, might be asked to be the official Scientific Committee representative; or

b) Funding from the Commission might be provided to a member to serve as the official Commission representative; or

c) Funding from the Commission might be provided for a Secretariat staff member to serve as the official Commission representative.

11.20 In discussion on this matter, the following future meetings were noted:

a) The Methodological Workshop on the management of tuna fishing capacity on the basis of stock status, data envelopment analysis and industry survey, in La Jolla in 2006;

b) Joint meeting of the Secretariats of the tuna bodies and their members, which is proposed for Japan in 2007; and

c) Future meetings of Committee on Fisheries (COFI), and associated Meeting of Regional Fishery Bodies.

11.21 The Scientific Committee noted that the SPC OFP and FFA will attend the Methodological Workshop on the management of tuna fishing capacity and could report back to the Scientific Committee in 2006.

11.22 The Scientific Committee noted that a decision on the 2007 meeting of Secretariats, COFI and the associated Meeting of Regional Fishery Bodies was a matter for the Commission.

11.23 The Scientific Committee noted the work of the Technical Advisory Committee of the FAO Project "Management of tuna fishing capacity: conservation and socio-economics" with interest, but agreed that it was not currently in a position to appoint a member to the committee.

COOPERATION WITH FFA

11.24 Although no immediate specific items of work relevant to cooperation between the FFA Secretariat and the Scientific Committee were raised, the Scientific Committee noted that communication was required in the interests of avoiding potential duplication especially in relation to its new GEF Pacific Islands Oceanic Fisheries Management Project.

COOPERATION WITH THE INTERNATIONAL SCIENTIFIC COMMITTEE (ISC)

11.25 The Scientific Committee noted that the ISC has not yet attained observer status within the WCPFC. It is understood that the ISC is in the process of developing a draft MOU to govern its relationship with the WCPFC. The Scientific Committee was informed that some of the areas covered in the draft MOU include the scientific structures agreed during PrepCon for the provision of scientific information and advice to the Commission (WCPFC/PrepCon/45 Annex II and III), and the possible exchange of data and information between the WCPFC and the ISC.

11.26 The Scientific Committee noted that it was premature to discuss details of future cooperation between the ISC and Scientific Committee, until the ISC has discussed its proposed MOU with the Commission.

COOPERATION WITH SPC OFP

11.27 The Scientific Committee noted that an MOU would be developed to govern the relationship between the SPC OFP and the WCPFC.

11.28 With respect to cooperation with SPC OFP, the meeting noted that the SPC OFP has two roles with respect to the Scientific Committee, one as an IGO observer, and one as a service provider to the Commission (SPC OFP also has a third role in servicing the member Pacific Island countries and territories – but this is not necessarily directly related to the work of the Commission).

11.29 The Scientific Committee looked forward to these matters being clarified in the MOU between the SPC OFP and WCPFC, and noted that such work whilst of interest to the Scientific Committee was the role of the Secretariat and Commission.

COOPERATION WITH OTHER ORGANISATIONS

11.30 The Scientific Committee noted that close contact would also need to be established with the Scientific Committees of other RFMOs (i.e. ICCAT, IOTC and CCSBT), and that invitations to participate in future meetings of the Scientific Committee should be extended to these organisations.

NEXT MEETING

11.31 The Scientific Committee recommended to the Commission that it accept the kind offer of the Philippines to host the next session of the Scientific Committee in Manila. The Scientific Committee noted that in order to facilitate arrangements, the Philippines have requested that the Commission write to its Government to formalise hosting arrangements.

11.32 The Scientific Committee recommended to the Commission and the Philippines that the meeting occur from 7-18 August 2006. These dates were selected to:

a) Be as late as feasible to facilitate the best science information possible being available for the consideration of the Scientific Committee; and

b) To avoid a clash with the meeting of the CCSBT Scientific Committee, scheduled for later in August.

OTHER BUSINESS

STATEMENT FROM GREENPEACE

11.33 The Chair invited L. Toribau, the representative of Greenpeace, to give an official statement to the Scientific Committee, based on their information paper WCPFC-SC1 GN IP-8. The full statement from Greenpeace is appended as Annex XII.

FUTURE PUBLICATIONS BY THE WCPFC

11.34 Considering that it will be important for the Scientific Committee to keep track of all its scientific and technical productions and results and that the other tuna commissions have established their own policies for the publication of their scientific and technical documents, the Scientific Committee discussed future policy concerning technical and scientific publications.

11.35 The Scientific Committee noted that matters of importance in determining such a policy included:

a) The type and series of publications that could be potentially managed by WCPFC and classified under a framework;

b) The physical status of these documents: on paper or/and computerised forms;

c) The entry of WCPFC documents into the FAO/ASFA bibliographical system to allow a worldwide and permanent identification of these WCPFC documents by any person interested by the subject;

d) Lessons to be learnt from the publication policies and processes of other relevant RFMOs; and

e) Estimates of the future costs (human and financial) of organisation of these publications by WCPFC.

11.36 The Scientific Committee recommended that the Secretariat develop such an information paper for the Scientific Committee to consider at its 2006 meeting to allow the Scientific Committee to make informed recommendations to the Commission upon this matter.

OUTGOING SWG CONVENERS

11.37 Canada on behalf of the Scientific Committee thanked the outgoing convenors of the ME-SWG (J. Sibert) and ST-SWG (T. Lawson) for their excellent contribution, commitment and leadership to those groups.

ADVICE TO THE COMMISSION

11.38 Advice to the Commission, including recommendations requiring Commission decisions, is presented in paragraphs 11.1 to 11.36 above.

12. ADOPTION OF THE REPORT

12.1 Thirty participants acting as rapporteurs, the Scientific Committee in plenary and the Interim Scientific Adviser prepared the report of the meeting.

12.2 The report of the first regular session of the Scientific Committee was adopted by consensus.

13. CLOSE OF THE MEETING

13.1 In closing the meeting, the Chairman of the Scientific Committee thanked the Government of New Caledonia and the SPC OFP and for hosting this inaugural meeting. He also thanked all participants for their contributions to the meeting, and the Interim Science Adviser, the rapporteurs and the SPC OFP staff for their hard work in drafting and distributing meeting documents. The Chairman acknowledged the financial support provided by the Commission.

13.2 J. Hampton, on behalf of SPC OFP, expressed his hopes that the facilities provided for the meeting were as expected, his thanks to SPC OFP staff and others for their hard work during the week, and his best wishes to the Philippines in hosting the second regular session of the Scientific Committee.

13.3 The Committee shared its views on their observations of this first meeting and ideas for the development of future meetings.

13.4 J. Majkowski on behalf of FAO and B. Thoulag (Federated States of Micronesia) on behalf of the FFA members congratulated the Chairman for successfully leading this first regular session of the Scientific Committee.

13.5 The Interim Scientific Adviser thanked the staff of the SPC OFP for their superb administrative and logistical support without which the meeting would not have occurred, all the rapporteurs for their hard work in completing the report under considerable pressure, all participants for their good humour throughout the meeting and congratulated the Chairman on leading such a challenging meeting.

13.6 The Chairman closed the meeting on Friday 19th August 2005.

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ANNEX I - LIST OF PARTICIPANTS

LIST OF PARTICIPANTS

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ANNEX II - AGENDA FOR THE FIRST REGULAR SESSION OF THE SCIENTIFIC COMMITTEE

AGENDA FOR THE FIRST REGULAR SESSION OF THE SCIENTIFIC COMMITTEE

1. OPENING OF MEETING
1.1 Welcoming address
1.2 Adoption of agenda
1.3 Meeting arrangements
1.4 Appointment of SWG Conveners
1.5 Process for SWG and Scientific Committee reports
1.6 TOR for SWGs

2. REVIEWS OF FISHERIES
2.1 Overview of WCPO fisheries
2.2 Overview of EPO fisheries
2.3 Fishery reports from members and observers
2.4 Fishery reports from regional fisheries organisations

3. SPECIALIST WORKING GROUPS (SWG)
(*Stock Assessment SWG, Methods SWG, Statistics SWG, Ecosystem and Bycatch SWG, Biology SWG and Fishing Technology SWG*)
3.1 Adoption of agenda
3.2 Review of available information
3.3 Future work programme
3.4 Advice to the Scientific Committee
3.5 Adoption of report

4. STATUS OF THE STOCKS
4.1 Bigeye
4.2 Yellowfin
4.3 Skipjack
4.4 South Pacific albacore
4.5 Other species
4.6 Advice to the Commission

5. MANAGEMENT INFORMATION
5.1 Estimates of sustainable catch levels and sustainable effort levels for bigeye, yellowfin and South Pacific albacore
5.2 Five and ten year projections for bigeye and yellowfin
5.3 Effects on stocks of measures to mitigate catch of juvenile bigeye and yellowfin
5.4 Estimates of the mortality of non-target species
5.5 Additional analyses required
5.6 Advice to the Commission

6. DATA
6.1 Scientific data to be provided to the Commission
6.2 IPDCP Review
6.3 Rules and procedures for the management and dissemination of Commission data
6.4 Observer data requirements
6.5 Cooperation with Technical and Compliance Committee on data issues
6.6 Advice to the Commission

7. FUTURE WORK PROGRAMME
7.1 Scientific Committee work programme for 2006
7.2 SWG work programmes for 2006
7.3 Research priorities, research planning and coordination

7.4 Development of a medium term research plan
7.5 Advice to the Commission

8. SPECIAL REQUIREMENTS
8.1 Requirements of Small Island developing states and territories with respect to data
8.2 Requirements of Small Island developing states and territories with respect to scientific research
8.3 Advice to the Commission

9. BUDGETS AND FINANCE
9.1 Implications of Scientific Committee proposals
9.2 Advice to the Commission

10. SCIENTIFIC COMMITTEE ADMINISTRATION
10.1 Rules of procedure
10.2 Appointment of Vice-Chair and SWG Conveners
10.3 TOR for the independent review
10.4 Future operation of the Scientific Committee
10.5 Advice to the Commission

11. OTHER MATTERS
11.1 Cooperation with the Technical and Compliance Committee
11.2 Advice to the Technical and Compliance Committee
11.3 Cooperation with the IATTC and other international organisations
11.4 Next meeting
11.5 Other business
11.6 Advice to the Commission

12. REPORTS TO THE COMMISSION
12.1 Adoption of the report of the first regular session of the Scientific Committee

13. CLOSE OF MEETING
13.1 Closing of the meeting

ANNEX III - LIST OF SCIENTIFIC COMMITTEE PAPERS

LIST OF SCIENTIFIC COMMITTEE PAPERS

ADMINISTRATION PAPERS

WCPFC-SC1 2005/01 Notice of Meeting

WCPFC-SC1 2005/02 Provisional Agenda

WCPFC-SC1 2005/03 Indicative Schedule

WCPFC-SC1 2005/04 Meeting Arrangements & Registration Form

WCPFC-SC1 2005/05 Guidelines for the preparation of Fisheries Reports

WCPFC-SC1 2005/06 List of Working Papers

WCPFC-SC1 2005/07 Annotated Provisional Agenda

WCPFC-SC1 2005/08 Depository Statement

GENERAL PAPERS

GN WP–1 Williams, P. & C. Reid. **Overview of the western and central Pacific Ocean (WCPO) tuna fisheries, including economic conditions – 2004.** Oceanic Fisheries Programme, Secretariat of the Pacific Community, Noumea, New Caledonia and Forum Fisheries Agency. Honiara, Solomon Islands.

GN IP–1 Anonymous. **Report of the Seventeenth Meeting of the Standing Committee on Tuna and Billfish (SCTB17), 9–18 August 2004, Majuro, Marshall Islands.** Secretariat of the Pacific Community (SPC).

GN IP–2 Harley, S, and Smith, N. **Summary of New Zealand research into tunas and tuna-related species.** Ministry of Fisheries, New Zealand.

GN IP–3 Stocker, M. (editor). **Report of the Nineteenth North Pacific Albacore Workshop.** Fisheries and Oceans. Canada.

GN IP–4 Anonymous. **Report of the Plenary Session of the Fifth Meeting of the Interim Scientific Committee for Tuna and Tuna-like Species in the North Pacific.** Tokyo, Japan March 28-30, 2005.

GN IP–5 Gilbert, A. & J–P Gaudechoux. **Pacific Islands Marine Resources Bibliography. (A list of bibliographic references held at the SPC-Noumea Library).** Secretariat of the Pacific Community (SPC).

GN IP–6 **Project on the Management of Tuna Fishing Capacity: Conservation and Socio-economics: Proposal – Methodological Workshop on the management of tuna fishing capacity on the basis of stock status, data envelopment analysis and industry survey.** Food and Agriculture Organization of the United Nations (FAO). Rome, Italy.

GN IP–7 **Proceedings of the Second Meeting of the Technical Advisory Committee of the FAO Project "Management of tuna fishing capacity: conservation and socio-economics".** In press. Madrid (Spain), 15-18 March 2004. FAO Fisheries Proceedings No. 2. Eds: W. H. Bayliff, J. I. de Leiva Moreno & J. Majkowski. Rome. 336 pp.

GN IP–8 **Greenpeace Position Paper on the Conservation and Management of Highly Migratory Fish Stocks in the Western and Central Pacific.** Greenpeace Australia-Pacific. Fiji.

STATISTICS SPECIALIST WORKING GROUP PAPERS

ST WP–1 Lawson, T. **Status of data collection, compilation and dissemination.** Oceanic Fisheries Programme, Secretariat of the Pacific Community, Noumea, New Caledonia.

ST WP–2 Lawson, T. **Data-related tasks for the WCPFC Scientific Committee.** Oceanic Fisheries Programme, Secretariat of the Pacific Community, Noumea, New Caledonia.

ST WP–3 Lawson, T. **Update on the proportion of bigeye in 'yellowfin plus bigeye' caught by purse seiners in the Western and Central Pacific Ocean.** Oceanic Fisheries Programme, Secretariat of the Pacific Community, Noumea, New Caledonia.

ST WP–4 Lawson, T. & P. Williams. **Comparison of the species composition of catches by purse seiners in the Western and Central Pacific Ocean determined from observer and other types of data.** Oceanic Fisheries Programme, Secretariat of the Pacific Community, Noumea, New Caledonia.

ST IP–1 Lawson, T. & P. Williams. **Estimates of annual catches in the WCPFC CA.** Oceanic Fisheries Programme, Secretariat of the Pacific Community, Noumea, New Caledonia.

ST IP–2 Williams, P. & T. Lawson. **A summary of aggregate catch/effort and size composition data available to the WCPFC Scientific Committee, highlighting the main data gaps.** Oceanic Fisheries Programme, Secretariat of the Pacific Community, Noumea, New Caledonia.

ST IP–3 Moon, Dae-Yeon. **A summary of Korean tuna fishery observer program for the Pacific Ocean (2004-2005).** National Fisheries Research and Development Institute, Busan, Korea.

ST IP–4 Anon. **Report of the Philippines Tuna Fishery Data Collection Workshop, 20–21 October 2004, Quezon City, Metro Manila, Philippines.** Prepared for the Preparatory Conference for the Commission for the Conservation and Management of Highly Migratory Fish Stocks in the Western and Central Pacific by the Oceanic Fisheries Programme, Secretariat of the Pacific Community, Noumea, New Caledonia, November 2004.

ST IP–5 Lewis, A.D. **The tuna fisheries of Vietnam - an overview of available information.** Oceanic Fisheries Programme, Secretariat of the Pacific Community, Noumea, New Caledonia, April 2005.

ST IP–6 Lewis, A.D. R**eview of Tuna Fisheries and the Tuna Fishery Statistical System in the Philippines.** Prepared for the Preparatory Conference for the Commission for the Conservation and Management of Highly Migratory Fish Stocks in the Western and Central Pacific, with funding from the Australian Centre for International Agricultural Research, by the Oceanic Fisheries Programme, Secretariat of the Pacific Community, Noumea, New Caledonia, November 2004.

METHODS SPECIALIST WORKING GROUP

ME WP–1 Lehodey P. **First application of SEAPODYM to Pacific bigeye tuna.** Oceanic Fisheries Programme, Secretariat of the Pacific Community, Noumea, New Caledonia.

ME WP–2 Senina, I.N., Sibert, J.R. and P. Lehodey. **SEAPODYM on a mixed-resolution spatial scale.** Pelagic Fisheries Research Programme, Honolulu, Hawaii. Oceanic Fisheries Programme, Secretariat of the Pacific Community, Noumea, New Caledonia.

ME WP–3 Ahrens, R. & C. Walters. **Why are there still large pelagic predators in the oceans? Evidence of severe hyper-depletion in longline catch-per-effort.** Fisheries Center, University of British Columbia (BC), Vancouver, B.C. Canada.

ME IP–1 Lehodey P. **Reference manual for the Spatial Ecosystem and Populations Dynamics Model SEAPODYM.** Oceanic Fisheries Programme, Secretariat of the Pacific Community, Noumea, New Caledonia.

ME IP–3 Wang, C-H & S-B Wang. **Theoretical development of Schaefer model and its application.** Institute of Oceanography, National Taiwan University, Taipei, Chinese-Taipei.

FISHING TECHNOLOGY SPECIALIST WORKING GROUP

FT WP–1 Campbell, R. **Measuring effective longline effort in the Australian Eastern Tuna and Billfish Fishery.** CSIRO. Division of Marine Research, Hobart, Australia.

FT WP–2 Alicia Delgado de Molina, Javier Ariz, Pilar Pallarés, Rosa Delgado de Molina and Santiago Déniz. **Project on new FAD designs to avoid entanglement of by-catch species, mainly sea turtles and acoustic selectivity in the Spanish purse seine fishery in the Indian Ocean.** Instituto Español de Oceanografia, Spain. IPD, Spain. Spanish Oceanographic Institute, Spain.

FT WP–3 Itano, D. **The transition and evolution of the Fishing Technology Working Group of the SCTB into the structure of the WCPFC Scientific Committee.** Pelagic Fisheries Research Programme, Honolulu, Hawaii.

FT WP–4 Itano, D. **A summarization and discussion of technical options to mitigate the take of juvenile bigeye and yellowfin tuna and associated bycatch species found in association with floating objects.** Pelagic Fisheries Research Programme, Honolulu, Hawaii.

FT IP–1 Fukofuka, S. & D. Itano. **Handbook for the identification of yellowfin and bigeye tunas in fresh, but less than ideal condition.** Pelagic Fisheries Research Programme, Honolulu, Hawaii. Oceanic Fisheries Programme, Secretariat of the Pacific Community, Noumea, New Caledonia.

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ANNEX IV - ABBREVIATIONS AND ACRONYMS USED

ABBREVIATIONS AND ACRONYMS USED

ALB	Albacore (*Thunnus alalunga*)
AMSY	Average maximum sustaibnable yield
$B_{current}$	Average biomass over the period 2001-2003
BET	Bigeye tuna (*Thunnus obesus*)
BI-SWG	Biology Specialist Working Group
B_{MSY}	Biomass that will support the maximum sustainable yield
CCSBT	Commission for the Conservation of Southern Bluefin Tuna
COFI	Committee on Fisheries (FAO)
Commission	The Commission for the Conservation and Management of Highly Migratory Fish Stocks in the Western and Central Pacific
Convention	The Convention for the Conservation and Management of Highly Migratory Fish Stocks in the Western and Central Pacific
CPUE	Catch Per Unit Effort
CSIRO	Commonwealth Scientific and Industrial Research Organisation (Australia)
DWFN	Distant water fishing nation
EB-SWG	Ecosystems and Bycatch Specialist Working Group
ECOPATH	An ecosystem modelling tool
EEZ	Exclusive Economic Zone
ENSO	El Nino Southern Oscillation
EPO	Eastern Pacific Ocean
ETBF	Eastern Tuna and Billfish Fishery (Australia)
EU	European Union
F	Fishing mortality rate
FAD	Fish Aggregating Device
FAO	Food and Agriculture Organisation of the United Nations
$F_{current}$	Average fishing mortality over the period 2001-2003
FFA	Pacific Islands Forum Fisheries Agency
FIGIS	Fisheries Global Information System
FL	Fork length
F_{MSY}	Fishing Mortality that will support the maximum sustainable yield
FPOW	Fishing power
FR	Fisheries Reports
FSM	Federated States of Micronesia
FT-SWG	Fishing Technology Specialist Working Group
FTWG	Fishing Technology Working Group (of the SCTB)
F/V	Fishing vessel
GEF	Global Environment Fund
GLM	General Linear Model
GRT	Gross registered tonnage
HBF	Hooks between floats
IATTC	Inter-American Tropical Tuna Commission
ICCAT	International Commission for the Conservation of Altlantic Tunas
IOTC	Indian Ocean Tuna Commission
IPDCP	Indonesia and Philippines Data Collection Project
ISC	International Science Committee
IUU	Illegal, Unregulated and Unreported
JPY	Japanese Yen
m	Metres
ME-SWG	Methods Specialist Working Group

MFAD	Moored Fish Aggregation Device
MFCL	MULTIFAN-CL (A stock assessment modelling approach)
MOU	Memorandum Of Understanding
MSY	Maximum Sustainable Yield
mt	Metric tonnes
NZ	New Zealand
p.a.	per annum
PFRP	Pelagic Fisheries Research Program (Hawaii, USA)
PNA	Parties to the Nauru Agreement
PNG	Papua New Guinea
PrepCon	Preparatory Conference
RFMO	Regional Fisheries Management Organisation
RMI	Republic of the Marshall Islands
SA-SWG	Stock Assessment Specialist Working Group
SCG	Scientific Coordinating Group
SCG3	Third Meeting of the Scientific Coordinating Group of the WCPFC
SCTB	Standing Committee on Tuna and Billfish
SEAPODYM	Spatial ecosystem and populaton dynamics model
SHBS/STATHBS	Statistical habitat based standardisation
SKJ	Skipjack tuna (*Katsuwonus pelamis*)
SPC	Secretariat of the Pacific Community
SPC OFP	Secretariat of the Pacific Community Oceanic Fisheries Programme
SSB	Spawning stock biomass
SSH	Sea Surface Height
SST	Sea Surface Temperature
ST-SWG	Statistics Specialist Working Group
SWG	Specialist Working Group
TAL	Temperate albacore longline
TCC	Technical and Compliance Committee of the WCPFC
TDL	Tropical deep longline
TDR	Time and Depth Recorder
TOR	Terms of Reference
TSL	Tropical shallow longline
UNCLOS	The 1982 United Nations Law of the Sea Convention
US$	United States Dollar
USA	United States of America
VMS	Vessel Monitoring System
WCP-CA	Western and Central Pacific Fisheries Commission Convention Area
WCPFC	Western and Central Pacific Fisheries Commission (the Commission for the Conservation and Management of Highly Migratory Fish Stocks in the Western and Central Pacific)
WCPO	Western and Central Pacific Ocean
WG	Working Group
WG II	Working Group II of the PrepCon
YFN	Yellowfin tuna (*Thunnus albacares*)

ANNEX V - REPORT OF THE FISHING TECHNOLOGY SPECIALIST WORKING GROUP

REPORT OF THE FISHING TECHNOLOGY SPECIALIST WORKING GROUP

INTRODUCTION

1. D. Itano, convener of the Fishing Technology SWG (FT-SWG) opened the meeting, acknowledging the assistance of Peter Ward and Lara Manarangi-Trott who agreed to serve as session rapporteurs.

2. The meeting was attended by Robin Allen, Norihisa Baba, Steve Beverly, Deirdre Brogan, Robert Campbell, Pablo Chavance, Cuewapur Chouky, Ray Clarke, Les Clark, Nathaniel Cornuet, Kim Duckworth, Steve Dunn, Karen Evans, Siosifa Fukofuka, Arthur Hore, David Itano, Terese Kendrick, Ludwig Kumoru, Chung-Hai Kwoh, Tim Lawson, Tony Lewis, Chi-Chao Liu, Lara Manarangi-Trott, Sione Vailala Matoto, Josh Mitchell, Peter Miyake, Dae-Yeon Moon, Julie Mounier, Toni Mulipola, Hiroaki Okamoto, Brendon Pasisi, Cedric Ponsonnet, Chris Reid, Roberto Sarralde, Peter Sharples, Robert Skillman, Dan Sua, Bernard Thoulag, Yuji Uozumi, Peter Ward, Peter Williams, and Ren-Fen Wu.

3. The draft provisional agenda was reviewed and adopted with minor timing changes. The revised final agenda adopted by the FT-SWG is attached as Appendix I. A list of abbreviations and acronyms used in this report is included in Annex IV.

RESEARCH PRIORITIES

4. The Convener presented a summary of WCPFC-SC1 FT WP-3 the transition and evolution of the Fishing Technology Working Group of the SCTB into the structure of the WCPFC Scientific Committee. The paper examines the work conducted by the Fishing Technology Working Group (FTWG) of the SCTB since its inception, which included contributions to SCTB 14 – 17. All 101 papers submitted to the FTWG during this period in addition to any SCTB papers that had direct relevance to the TOR to the FTWG are listed and most are hyper-linked to the SPC SCTB website for easy reference. Appendix IV of WCPFC-SC1 FT WP-3 lists all FTWG related papers within general categories that provides rapid access to this body of work and essentially defines the scope of work that the FTWG has conducted. These categories are listed below:

a. Effort standardisation and estimation of effective fishing effort;
b. Fishing strategy and influences on effective fishing effort;
c. Vessel and gear attributes;
d. Documentation of fishing gear and technology;
e. Fish Aggregation Devices;
f. Training and information materials in support of improved catch and effort data;
g. Gear modifications for bycatch reduction and increased targeting;
h. Fleet characterisation, recent developments and innovations; and
i. Fishing capacity.

5. It was noted that the intention of WCPFC-SC1 FT WP-3 was to provide a reference document of completed research that may be useful to assist the work of the newly formed FT-SWG.

6. The Convener then distributed a summarisation of research priorities listed in the Final Report of Working Group II ((WCPFC/PrepCon/45), as presented at PrepCon 7, outlining the scientific role, data requirements and research priorities of the (then) proposed Scientific Committee of the Commission. It was noted that the relevant research priority to the FT-SWG was identified as: "… further development of methods to standardise effort, including better use of vessel operational details, environmental data and archival tagging data…".

7. The SWGs now in place were proposed in that document. At that time, it was recommended that the Fishing Technology SWG take on the following tasks: "…Reviews developments with respect to fishing vessel, gear and operational procedures to characterise changes in fleets and gear and to provide data to inform a range of topics such as the standardisation of CPUE, and evaluating changes in fishing efficiency…".

8. In review of the work of the SCTB/FTWG and recommendations arising from SCTB 17, the following topics were identified as priority issues for the FT-SWG to undertake:

a. Identification of operational level data useful to evaluate fishing efficiency, targeting, bycatch and mitigation for collection by the Commission;
b. Mechanisms to increase targeting (decrease bycatch), with particular emphasis on the avoidance of juvenile bigeye and yellowfin tuna by purse seine;
c. Issues related to the use of FADs by large scale fisheries, both anchored and drifting;
d. Issues related to vessel efficiency and capacity or total effective effort by regional fisheries; and
e. Mechanisms to improve species-specific catch and effort data.

9. Portions of Part II, Article 5 of the Convention (Principles and measures for conservation and management) were highlighted. In particular, directives from Sections d, e and g were noted as being most appropriate to the duties of the FT-SWG, e.g. "… assess the impacts of fishing, other human activities and environmental factors on target stocks, non-target species, and species belonging to the same ecosystem or dependent upon or associated with the target stocks; … promote the development and use of selective, environmentally safe and cost-effective fishing gear and techniques; and take measures to prevent or eliminate over-fishing and excess fishing capacity … ".

10. It was discussed that the role of the FT-SWG was not to implement management measures or conduct research but to recommend, review and report on appropriate research and work to the Scientific Committee for consideration of suitability and implementation. It was agreed that the essence of these directives and recommendations should define the future TOR of the FT -SWG.

TERMS OF REFERENCE AND IDENTIFICATION OF PRIORITY ISSUES

11. The draft TORs of the FT-SWG that had been circulated prior to the meeting were tabled for discussion. It was noted that the current meeting would operate under this version of the TORs with the intention of the group to develop a new set of TORs for consideration by the Scientific Committee for adoption and use at the next meeting of the FT-SWG.

12. The FT-SWG suggested that the new TORs be directly linked to Convention text, e.g., Part II, Article 5 and the final report of WG II of PrepCon and SCG3 as detailed above. The FT-SWG recognised potential overlap between its proposed work and the work of other SWGs, and further recognised the importance of close communication between the other SWGs to avoid duplication of effort. For example, work related to technological solutions to bycatch problems could be seen as overlapping with the duties of the EB-SWG. It was noted that proposed work related to improving the understanding of recent and historical changes in effective fishing effort is also covered by the work of the SA-SWG. The FTWG of the SCTB has produced materials to improve species-specific identification of target catch which potential overlap with the work of the ST-SWG. However, it was clarified that the ST-SWG is involved primarily with data collection, compilation and dissemination while the role of the FT-SWG would be to develop specific training and educational materials in an effort to improve the quality of submitted data. The meeting further noted the importance of addressing socio-economic influences on fishing strategies, effective fishing effort and capacity issues.

13. Potential overlap between the FT-SWG and duties of the TCC was discussed. It was noted that the structure and work plan for the TCC will be deliberated just prior to the Commission annual

meeting, scheduled for December 2005 in Pohnpei, FSM, therefore the degree of overlap remains undefined. The meeting stressed the importance of two-way collaboration and linking of crosscutting issues between the FT-SWG, the TCC and the other SWGs of the Scientific Committee and other relevant bodies. It was recognised that advances in fishing technology or methodology that improve catch rates or landings move rapidly between ocean basins. In response, the group recognised the importance of maintaining close links with other regional fishery management organisations (RFMOs) and the tuna-harvesting sector worldwide.

14. It was agreed to circulate a revised draft TOR incorporating these concerns for review and comment by the FT-SWG post-session. The revised draft TOR incorporating these comments are given below for consideration by the Scientific Committee and Commission below:

a. Technology is the practical application of science, tools, techniques or other organised knowledge to conduct tasks efficiently. The objective of the Convention is to ensure, through effective management, the long-term conservation and sustainable use of highly migratory fish stocks in the Western Central Pacific Ocean (Convention, Article 2);
b. The FT-SWG will address directives to assess the impacts of fishing (through the collection of operational level data and other means); promote the development and use of selective, environmentally safe and cost-effective fishing gear and techniques; and promote measures to prevent or eliminate over-fishing and excess fishing capacity (Convention, Part II, Article 5, sections d, e, g);
c. The Fishing Technology SWG will work in close collaboration with the other SWGs of the Scientific Committee, the TCC, other regional fishery management organisations and the private sector. Specific duties of the FT-SWG shall include, but not be limited to the following:
d. Promote, assist and review analyses of technical data relevant to changes in effective fishing effort in concert with the work of the SA-SWG and ME-SWG;
e. Promote, assist and review the identification, collection and verification of operational level data from all fleets in collaboration with the ST-SWG;
f. Promote, assist and review research, analyses and the generation of materials on innovative fishing methods and technology to minimise bycatch levels and increase effective targeting in collaboration with the EB-SWG and BI-SWGs;
g. Promote, assist and review the development and provision of resources to assist fishers, port samplers and observers toward providing and collecting high quality data;
h. Promote, assist and review research and reporting on the current status and recent developments in regional fisheries and related shore side developments;
i. Examine and review the technical aspects of capacity measurement and monitoring of fisheries within the WCP-CA; and
j. Promote, assist and review studies on socio-economic and other factors that may influence fishing strategies, effective fishing effort and fishing capacity.

PRESENTATIONS OF PAPERS

15. The Convener referred to four working papers and five information papers that had been submitted to FT-SWG (Annex III), noting that the distinction between what constituted a working or information paper was not clear. It was decided to allow each paper, regardless of designation to be presented on behalf of the author or a designated individual. Two information papers were not presented to the FT-SWG meeting due to lack of time but were presented during the plenary summary and are briefly described here to provide a complete record of submitted work.

SELECTIVITY, TARGETING AND BYCATCH REDUCTION

16. The Convener presented WCPFC-SC1 FT WP-2 project on new FAD designs to avoid

entanglement of by-catch species, mainly sea turtles and acoustic selectivity in the Spanish purse seine fishery in the Indian Ocean on behalf of the authors. The paper describes a collaborative pilot project based in the Indian Ocean between the Spanish purse seine industry and research personnel of the Instituto Español de Oceanografia. The objective of the project is to improve selectivity and decrease bycatch levels by purse seine gear operating on fish aggregation devices (FADs). The project will take two approaches: 1) development and testing of drifting FAD designs that attract tuna but avoid entanglement of bycatch species (particularly marine turtles) and 2) the use of acoustic techniques for size and species discrimination to study aggregation dynamics on drifting FADs to improve purse seine selectivity.

17. The project is funded by the Spanish Fisheries Administration and is slated for completion in February 2006. It was noted that the possible entanglement of turtles, sharks and billfish in drifting FADs and their appendages is a significant problem issue that purse seine fisheries need to address. The second phase of the project will look at species discrimination using high definition echo sounders linked to computers for image storage aimed at developing acoustic techniques to avoid bycatch and undersize tuna (particularly yellowfin and bigeye).

18. The Convener noted this as an excellent example of a joint project between government, industry and research to proactively address a topical fisheries problem and why the FT-SWG should seek out information and collaboration from other regions. The FT-SWG applauded the intention of the project to test biodegradable materials for FAD construction and suggested that similar projects should be conducted or promoted within the WCP-CA.

19. A discussion followed regarding what proportion of drifting FADs are lost or abandoned during fishing operations in the WCP-CA. This information is not currently known, but the Convener noted that the number is likely to be high, as vessels are known to routinely set on and abandon FADs belonging to other vessels. The Convener cited a paper on the development, design and status of FADs in the WCPO that had been submitted to the FTWG during SCTB 17. One conclusion of the study was that there is a paucity of recent data on the design, deployment strategy and efficacy of drifting FADs in the WCPO. However, it may be possible that the free text fields of observer reports may contain a great deal of this sort of information. The Observer and Port Sampling Coordinator of the SPC OFP noted that a backlog of observer reports are currently being examined and this sort of information could be compiled. However, practical considerations of manpower and work priorities suggests that external funding or contracts may be a more viable means to examine and compile this sort of data. The FT-SWG suggested that a scoping study of the number of drifting FADs lost or abandoned within the WCP-CA be conducted and reported on at the next Scientific Committee meeting.

20. WCPFC-SC1 FT IP-3 Depth, temperature, and capture time of longline targeted fish in New Caledonia: results of a one year study described work to improve knowledge of the vertical distribution of the tunas targeted by longliners and advise fishing operators on the depths at which to set hooks according to the species targeted, New Caledonia's ZoNéCo EEZ Marine Resource Assessment Programme performed experimental cruises to set instrument-fitted longlines (TDR and hook timers on a 200 hook longline). These longlines were deployed at dawn each day, and it was noted there was no bycatch of seabirds during the course of the study.

21. Main results include:

a. The greater the fishing depth, the smaller the proportion of non-marketable species, until their complete disappearance at depths greater than 300 m;
b. Down to a depth of 200 m, shark catches (all species combined) were considerable;
c. Albacore tuna - few fish were caught during this study (5% as against 45-60% by commercial fishermen). The explanation could be that the areas fished were too close the barrier reef. This species has a very broad bathymetric distribution: 80% of catches were recorded at depths between 100 – 410 m, corresponding to a temperature range of 12 – 22°C;
d. Yellowfin tuna - 80% of catches were between 50 – 250 m, corresponding to a temperature

range of 18 – 26°C. The maximum yields were obtained in the upper 100 m of the water column; and

e. Bigeye tuna - 80% of catches were between 250 – 380 m, corresponding to a temperature range of 17 – 29°C. Strong seasonal variability is recorded, with all catches occurring in the cool season. During this season, the theoretical maximum yields are obtained at depths between 300 – 400 m.

22. Moreover, by using information on maximum depth and sagging ratio for each longline segment, it was possible to develop a key to the distribution of hooks by depth strata so as to refine stock appraisal through improved vertical distribution of fishing effort and its impact on an unevenly distributed resource.

23. Information pamphlets have been prepared to help fishers to better target commercial species. There was insufficient data to investigate species depth distributions with size.

24. WCPFC-SC1 FT IP-4 Notes on a longline trip in the New Caledonia EEZ using TDRs in combination with remote sensing data (SSH and SST) described a May 2005 longline trip made in New Caledonia's EEZ to determine why similar longline vessels were producing markedly different catch rates, even when they were fishing the same areas. In this fishery, albacore is the targeted and more desirable catch. Fishing vessel 'AA' experienced catch rates for albacore that were twice as high while F/V 'BB' was out-fishing F/V 'AA' at a rate of eight-to-one for bigeye tuna. The use of TDRs on F/V 'AA' indicated higher catch rates for albacore at in depth ranges of 170 – 320 m @ 17 - 21°C and 320 – 425 m @ 13 - 17°C for bigeye tuna. Apparently, they were achieving such different results because of setting strategy.

25. It was recommended that the F/V 'BB' change its setting strategy to produce a shallower set. Other recommendations included better use of on-board SST monitoring and the use of remote sensing data, e.g. SST and SSH maps. Catch rates of the F/V 'BB' subsequently improved to similar desirable levels achieved by the F/V 'AA', e.g. more albacore and less bigeye.

TRAINING MATERIALS

26. WCPFC-SC1 FT IP-1 and WCPFC-SC1 FT IP-2 were not formally presented to the FT-SWG due to the limited time available, but the group discussed the importance of this type of training material.

27. WCPFC-SC-1 FT IP-1 Handbook for the identification of yellowfin and bigeye tunas in fresh, but less than ideal condition was another in a continuing series of FTWG identification guides aimed at improving the ability of fishers, port samplers and observers to identify yellowfin and bigeye of different sizes and condition. Previous versions depicted a wide range of both species in either brine frozen or in very fresh condition as would be seen by a port samplers or handline/troll fishermen respectively. FT IP-1 was developed in a manner established by the earlier handbooks, but depicts yellowfin and bigeye in fresh condition with varying degrees of colour loss, damage or mutilation as may be typically seen by an observer onboard a purse seine vessel during the fish loading process.

28. WCPFC-SC1 FT IP-2 Training guides for the identification of yellowfin and bigeye tunas to assist Indonesian port sampling and observer programs (Part 1 & Part 2) consists of the same images depicted in INF–FTWG–4, and INF-FTWG-5 (SCTB 17) for identifying frozen and fresh yellowfin and bigeye tuna, translated into Bahasa Indonesia. The effort was carried out on the initiative of CSIRO, Hobart Australia and the Research Institute of Marine Fisheries, Indonesia. The guide will be used to improve port-sampling data in Indonesia.

29. The Convener noted the initiative of these organisations in an effort that will also assist the goals of the Commission. It was recommended that the Scientific Committee recommend to the

Commission that funding should be identified to reproduce and distribute these sorts of materials to foster the recording and submission of high quality data rather than have to correct erroneous data after it has been submitted.

EFFECTIVE EFFORT

30. WCPFC-SC1 FT WP-1 Measuring effective longline effort in the Australian Eastern Tuna and Billfish Fishery describes a project to better define targeting and effective longline effort useful for effort standardising through the use temperature-depth recorders, hook timers and archival tags off eastern Australia on a range of pelagic species. The project has the following objectives:

a. Determination of the depths attained by longline fishing gears deployed in the ETBF and investigation of the relationships between targeting and gear setting practices and hook depths and longline shape characteristics;
b. Investigations of the relationships between hook depth and the capture depths and associated water temperatures for the principal species caught by longline gears in the ETBF;
c. Investigations of the time-of-capture of the principal catch species caught by longline gears in the ETBF;
d. Investigation, and where necessary refinement, of the technical assumptions used in the habitat based models being used to standardise longline catch per unit effort in the WCPO;
e. Development of habitat-based methods for standardising longline catch rates and application to the ETBF; and
f. Investigation of the relationships between longline fishing practices, gear configurations and the incidental capture of bycatch and byproduct species in the ETBF.

The project is currently in early stages but results and recommendations should be reported to subsequent SWG and Scientific Committee meetings.

CAPACITY ISSUES

31. The Convener presented WCPFC-SC1 FT IP5 Past developments and future options for managing tuna fishing capacity, with special emphasis on tuna purse seine fleets. This paper is an excerpt from an FAO publication containing the proceedings of a meeting of the FAO Technical Advisory Committee of the FAO's project on Management of Tuna Fishing Capacity. The entire proceedings of this meeting have been submitted to the Scientific Committee meeting as WCPFC-SC1 GN IP-7. WCPFC-SC1 FT IP5 provides a review of efforts by RFMOs to limit or reduce capacity in large-scale tuna fisheries, with notes on the positive and negative aspects of different management options. The author notes that according to recent studies, overcapacity currently exists for both longline and purse seine tuna fisheries in all ocean basins. The paper recommends some form of rights-based management at the vessel level, rather than at the catch level, combined with vessel buy-back programs as offering a positive likelihood of achieving management objectives. The article recommends that all RFMOs implement in the near term some mechanism to halt the growth of capacity in all tuna fisheries. The author endorses the adoption of cubic meters of refrigerated hold space as a measurable unit of capacity as a reasonable proxy for fishing power upon which fleets could be managed. The importance of accurate and verified regional vessel registers recording vessel and gear attributes was noted along with the need for controls on IUU fleets.

32. The Convener presented WCPFC-SC1 FT IP-4 a summarisation and discussion of technical options to mitigate the take of juvenile bigeye and yellowfin tuna and associated bycatch species found in association with floating objects. The paper describes WCPFC/PrepCon document WP 24 (Management Options for Bigeye and Yellowfin tuna in the Western and Central Pacific Ocean), which is a discussion reference paper on a range of management options for yellowfin and bigeye tuna with examples of proposals or implementation of various management options by other RFMOs. The

SCG3 examined the issue within a science-based environment, working to identify the data requirements, status of data inputs and the types of analyses necessary and possible given current and medium-term data availability. Both efforts were important steps toward addressing the issue of managing FAD impacts, with particular reference to limiting or reducing fishing mortality on yellowfin and bigeye tuna.

33. It was explained that the intent of WCPFC-SC1 FT IP-4 was to re-examine and discuss the proposed management options as outlined in WCPFC/PrepCon/WP24 in relation to implementation issues, practicality and likelihood of addressing management objectives in relation to realistic levels of monitoring, compliance and data inputs that may be available to the Commission in the short to medium-term. Some of these criteria may be seen as issues of the TCC, but this committee will not meet until late 2005 and it is hoped that this review may assist their efforts.

34. Aspects of the biology and behaviour of bigeye tuna were also examined in relation to specific management options, in reference to a review paper WCPFC-SC1 BI IP-1 Excerpt from "Background Paper for Amendment 14 to the Pelagic's Fishery Management Plan" – Chapter 1: Bigeye tuna (*Thunnus obesus*) general description of the species within the Pacific Ocean that has been submitted to the Scientific Committee meeting.

35. The meeting noted that the use of output controls should also be given consideration as they have been used to successfully manage fisheries in other regions. The Convener clarified that the negative aspects toward the use of general output controls in WCPFC-SC1 FT WP-4 were specific to the difficulty in establishing accurate levels of total allowable catch due to the large, diverse and multi-species nature of tuna fisheries within the WCP-CA and levels of monitoring that are likely to be realised in the near term.

36. The FT-SWG identified the importance and need to develop standardised definitions of technical terms used in Commission deliberations, such as for measurements of capacity, vessel efficiency, "bycatch", byproduct and types of floating object sets, i.e. FADs, logs, moored or anchored vs. drifting FADs, etc. It was suggested that work could proceed through a glossary attached to each FT-SWG report and material developed for the next Scientific Committee meeting.

FUTURE WORK PROGRAM

37. In recognition of the crosscutting nature of the FT-SWG, the meeting recommended that the FT-SWG should formalise and define links with the other SWGs to avoid duplication of effort while providing information and data necessary to address Commission objectives. It was recommended that well defined collaborative links be established with other SWGs to foster high quality, species-specific reporting, information on technical aspects of bycatch mitigation and information useful for fleet-specific effort standardisation.

38. The FT-SWG discussed and nominated a number of tasks that may be considered for implementation by the Scientific Committee, either through delegation to the FT-SWG or by other means, i.e. contracts and directed assignments. These suggestions fell into three categories: 1) recommendations to the Scientific Committee; 2) work plan items for 2006; and 3) general tasks for the medium term. A tentative indication and suggestions to the Scientific Committee of who may conduct the work is provided in parentheses following each item.

2006 WORK PLAN

Work for 2006 includes:

a. Characterise the historical and current operational details of Japanese longline and other major

longline fleets in the WCP-CA (Australia, Japan, Korea, Chinese Taipei);

b. Identify, compile and analyse information on gear and technology (e.g. hook number of catch, set details, FAD characteristics, etc.) that have already been or should be collected through data collection programs that may be useful for effort standardisation, e.g., logbooks, observer and port-sampling programs (FT-SWG in collaboration with national and regional organisations. The examination of historical logbook and observer data may require external funding and contracted parties);
c. Report on the ongoing projects to measure effective effort in the Australian east coast tuna and billfish fishery (CSIRO);
d. Report on the results of the Instituto Español de Oceanografia study on FAD selectivity in the Indian Ocean (Instituto Español de Oceanografia);
e. Develop a working paper on standard technical fishery terms commonly used by Commission scientists (FT-SWG);
f. Monitor new developments in fleets, fisheries, marketing and shore side infrastructure with implications to expanding or contracting fishing effort. Examine format of Fishery Reports by members and observers to see if additional information should be requested (FT-SWG);
g. Reproduce (in quantity) and distribute already developed training materials to improve species-specific identification of target and non-target species to improve data sources to fishermen and port sampling/observer programs (Commission to seek funding and/or national and regional programs to self-fund);
h. Further develop training materials to improve species-specific identification of target and non-target species (i.e. oceanic sharks, billfish and species of special concern) to improve the quality of submitted data and data collection programs (FT-SWG);
i. Identify technologically based measures to reduce bycatch and improve targeting. For example, the use of circle hooks to reduce turtle bycatch and monofilament branch lines to reduce shark bycatch in longline fisheries. The impact of these measures on both target and non-target species should be examined (USA National Marine Fisheries Service, Australia, Korea, FT-SWG);
j. Examine and review options for capacity measurement and monitoring in regional fisheries (FT-SWG, TCC); and
k. Conduct and report on a scoping study of the number of drifting FADs lost or abandoned within the WCP-CA to the next Scientific Committee meeting.

MEDIUM TERM WORK PROGRAM

Characterise the major fishing fleets. This information, including historical and current details of fishing gear and practices, will be used in standardising catch rates, specifically to document changes in efficiency, primarily for longline and purse seine. Initially the priority should be the major longline and purse seine fleets but eventually characterising all segments of the fishery that exact significant fishing mortality in the WCP-CA (Commission to fund directed work through contracts, ongoing work of the FT-SWG), and:

l. Supply observer programs in the WCP-CA with time-depth recorders and hook timers for use on all major longline fleets to refine effort standardisation (Commission to seek funding and/or national and regional observer programs to self-fund);
m. In collaboration with the Methods SWG, promote, review and conduct effort standardisation analyses using technical, biological and other data inputs (Ongoing work of the FT-SWG);
n. Work to identify and refine the necessary technical data inputs for effort standardisation efforts (Ongoing work of the FT-SWG);
o. Monitor new developments in fishing gear and practices, fishing modes and related shore side developments as they relate to changes in fishing power (Ongoing work of the FT-SWG);
p. Develop training materials to improve species-specific identification of target and non-target species (e.g. sharks, billfish and species of special interest) to improve the quality of submitted data and data collection programs (Ongoing work of the FT-SWG);
q. Investigate and promote studies on socio-economic influences on fishing strategies, spatio-

temporal fishing patterns and influences on effective fishing effort (Ongoing work of the FT-SWG); and

r. Examine and review the technical aspects of capacity measurement and monitoring of fisheries within the WCP-CA.

CLOSING ISSUES

39. The FT-SWG suggested that the version of the FT-SWG TOR used during the meeting should be redistributed for comment. The revised TOR reflecting these comments is included in paragraph 14 for consideration by the Scientific Committee.

40. Nominations for a future Convener of the FT-SWG to serve in 2006 – 2007 were solicited for endorsement by the Scientific Committee. The group volunteered no nominations at this time. The Convener suggested that meeting participants should confer out of session and were strongly advised that some nomination should come forth from the Members.

41. D. Itano was subsequently nominated as Convener for 2006-2007.

42. The Convener thanked those present for their hard work and support throughout the period of the Fishing Technology Working Group of the SCTB and for their continued support throughout the transitional process into the formation of the FT-SWG.

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APPENDIX I – AGENDA ADOPTED FOR USE AT THE FIRST MEETING OF THE FISHING TECHNOLOGY SWG

FISHING TECHNOLOGY – SPECIALIST WORKING GROUP
8 AUGUST 2005

1. Preliminaries
   a. Opening of meeting and assignment of rapporteurs
   b. Review and adoption of agenda
   c. Overview of Scientific Committee and SWG meeting structure and reports
   d. (Refer to Annotated Provisional Agenda WCPFC-SC1 2005/07 rev 1, AGENDA ITEM 3; and Indicative Schedule WCPFC-SC1 2005/03 rev1)

2. Research priorities – initial discussion
   a. Transition between SCTB and WCPFC structure (WCPFC-SC1 FT WP-3)
   b. Review of directives to the FT-SWG

3. Terms of Reference and identification of priority issues
   a. Review and comment on TOR (draft v3)
   b. Integration with Technical and Compliance Committee and the Scientific Committee
   c. (Annotated Provisional Agenda, AGENDA ITEM 11.1)
   d. Final drafting of TOR for adoption consideration by plenary

4. Presentations of FT Working and Information papers (brief presentations and discussion)
   a. Selectivity, targeting and bycatch reduction (WCPFC-SC1 FT WP-2, WCPFC-SC1 FT IP-3, WCPFC-SC1 FT IP-4)
   b. Training materials (WCPFC-SC1 FT IP-1, WCPFC-SC1 FT IP-2)
   c. Effective effort (WCPFC-SC1 FT WP-1)
   d. Capacity issues and Management Options (WCPFC-SC1 FT IP-5, WCPFC-SC1 FT WP-4)

5. Work program
   a. Identification of specific work for 2006 and the medium term and research needed
   b. Options for completion of work, i.e. who and costs
   c. Delegation and implementation of tasks

6. Closing issues
   a. FT report and summary preparation and review
   b. Organisation of FT plenary session
   c. Nominations for suggestions for FT-SWG Convener
   d. Annotated Provisional Agenda, WCPFC-SC1-2005/07 rev, Item 1.4
   e. Close of meeting

ANNEX VI – REPORT OF THE METHODS SPECIALIST WORKING GROUP

REPORT OF THE METHODS SPECIALIST WORKING GROUP

INTRODUCTION

1. Under the TOR of the ME-SWG, it will coordinate research and make recommendations to the WCPFC Scientific Committee on technical questions related to analytical methods used for fishery management. It had as a specific objective to critically review the 2005 stock assessment methodology and provide suggestions for future improvements as outlined in the TOR.

2. John Sibert served as chair, with Nick Davies, Dale Kolody and Robert Ahrens as rapporteurs. The meeting was attended by Robert Ahrens, Robin Allen, Gwenhael Allain, Terry Amram, Keith Bigelow, Robert Campbell, Les Clark, Sangaa Clark, Victor David, Nick Davies, Sylvester Diake, Karen Evans, Ulunga Fa'anunu, Alain Fonteneau, Shelton Harley, John Hampton, David Kirby, Pierre Kleiber, Patrick Lehodey, Jeon Rack Koh, Dale Kolody, Marc Labelle, Adam Langley, Naozumi Miyabe, Augustine Mohiba, Brett Molony, Chris Reid, Tekirua Riinga, John Sibert, Robert Skillman, Max Stocker, SunKwon Soh, Chi-Lu Sun, Saimone Tuilaucala, Koji Uosaki. The agenda is included in Appendix 1, and the documents presented are listed in the Annex III.

DEVELOPMENT OF MULTIFAN-CL

3. Recent developments of MFCL model were reviewed as applied in the stock assessments of yellowfin and bigeye tunas in the western and central Pacific Ocean.

SPATIAL PARTITIONING

4. J. Hampton provided an overview of the changes in spatial configuration of the yellowfin and bigeye tuna assessment models (WCPFC-SC1 SA WP-1, WCPFC-SC1 SA WP-2) according to recommendations from the 2004 assessment. For both assessments, a six-region stratification was adopted, compared to the five-region stratification used in recent years. The additional region resulted from the division of the region north of 20°N at 170°E. This longitudinal boundary was extended south to replace the previous boundary at 160°E. These changes were made to better characterise heterogeneity in targeting practices by the longline fishery and to be more consistent with the so-called Longhurst Ecological Provinces.

5. No direct comparison was made with respect to the 2004 assessment based on the new spatial structure.

6. The value of maintaining two southern regions was questioned, given that they have very small catch and biomass relative to the equatorial regions. This split was justified on the basis of the high quality data available from the Western region, which suggests a relatively discrete sub-population in the Coral Sea.

7. It was noted that the spatial structure adopted seemed to be based primarily on fishery aggregations, without explicit consideration of the underlying oceanography. It was suggested that the spatial coherence of the fishery characteristics should be analysed to see how expansion of regional areas affects assessment results. A previous MFCL analysis without regional structure estimated similar population inferences to the dis-aggregated analysis. However, only the dis-aggregated model can provide regional advice. These spatial issues were revisited with respect to the CPUE standardisation.

8. It was suggested that the large catches in the western equatorial region could be sub-divided into more homogeneous units. This was considered unfeasible at this time because of the poor quality

of the Indonesian and Philippines data, but it was noted that this situation is changing in relation to the Philippines and might merit revisiting in the future.

9. Comments were sought with respect to the perceived effectiveness of the spatial parameterisation and reliability of the migration co-efficient estimation. It was noted that the tagging data are highly influential. Indirect inferences can be made in relation to contrasting CPUE signals among regions. The assessments suggest that bigeye tuna have limited movement among regions, while yellowfin tuna and skipjack tuna are much more dynamic. However, it was recognised that movement rates might not be well determined. Sensitivity to movement rates can be examined by imposing alternative movement patterns in the model and examining the implications for the quality of fit to the data. This was identified as a potential topic for future work.

SELECTIVITY PARAMETERISATION

10. In the 2005 assessments, MFCL selectivity was given a functional form consisting of a cubic spline with 5 nodes in place of an independent parameter for each age class. This greatly reduces the number of estimated parameters and the corresponding computational overhead, without adversely affecting the shape of the estimated selectivity curves.

DIFFERENT WEIGHTINGS OF CATCH AND SIZE-FREQUENCY LIKELIHOOD CONTRIBUTIONS (BIGEYE TUNA)

11. Relative to the 2004 bigeye tuna analysis, the catch contribution to the total likelihood was given higher weight, and the size-frequency contribution was given lower weight. This change produced a better fit to the total longline catch, at the expense of the size-frequency fit. The new weighting method was considered to be an improvement, given the crucial reliance of assessment models on relative abundance indices, and the uncertainty about some of the size data and length-weight conversion factors. However, the ME-SWG emphasises the need to achieve the best-standardised CPUE indices for input to the assessment models.

STOCK-RECRUITMENT FUNCTION - STEEPNESS PARAMETER

12. In 2005, a more generic prior on the stock-recruitment curve steepness function was introduced to better represent our prior knowledge of this parameter than that used in previous assessments. A beta distribution bounded by 0.2-1.0, with a mode of 0.85, and SD of 0.16 was used.

IMPROVEMENTS TO CPUE STANDARDISATION

13. A. Langley presented the longline CPUE indices for bigeye tuna and yellowfin tuna using GLM and statistical habitat standardisation methods (WCPFC-SC1 SA WP-8). A significant change to the manner in which the relative biomass in each MFCL region was weighted was presented. In the previous assessments, the individual MFCL regions were assigned relative weighting factors that scaled the longline exploitable biomass in each region. These region-specific weighting factors were based on a qualitative assessment of the level of longline fishing activity in each region. Concern was expressed during SCTB17 that the weighting factors were giving too much weight to the peripheral regions and, consequently, resulting in unrealistic biomass distributions and overly optimistic assessments (SCTB 17).

14. For the current assessment, region-specific weighting factors were calculated based on CPUE data standardised using a GLM to estimate a latitude/longitude categorical term for each 5° x 5° degree latitude/longitude cell:

$$\ln(CPUE_{(k,j)}) = aLATLONG_{(k)} + bHBF_{(j)} + \varepsilon_{(k,j)}$$

15. A constant region-specific scaling factor was then computed for each MFCL region by summing the standardised CPUE over all cells that comprise the individual region.

$$Scalar_r = \sum \exp(aLATLONG_{(k,r)})$$

16. The resulting weighting factors were then applied to scale the region-specific standardised CPUE index (year/quarter) derived from a separate GLM model.

17. The region-specific weighting factors derived from this approach differed considerably from the weightings used in the previous assessments and resulted in a lower level of biomass in the more peripheral regions. Concern was raised regarding the assumption that these weighting factors were constant over time. It was suggested that decadal changes in region-specific weighting factors could be calculated and compared.

18. Lessons from physical oceanography suggest that the inherently variable CPUE may result in a time series that is dominated by fitting to noise if the CPUE model is overly dis-aggregated. One could undertake standardisation on the basis of core areas, but there is a risk of hyper-stability occurring if the areas were too large. Adam Langley suggested that within region heterogeneity could be investigated via the examination of the interaction between the year/quarter variable and the 5x5 degree latitude/longitude variable included in the GLM models. This would reveal if there were significant differences in the temporal trend in CPUE between the individual latitude/longitude cells within a region.

19. It was emphasised that all our CPUE standardisation approaches are dependent upon a poor understanding of the operations and technological development of the Japanese longline fleet. In region 3 and some others areas, some of this information is available starting in the late-70s but coverage is low, in the mid-1980's the coverage improves. Typical operational information is also available.

20. The ME-SWG endorsed the new procedure for calculating CPUE indices as a substantial improvement on the old methodology, and encourages further work along this line.

STANDARDISATION OF CPUE - GLM AND STATHBS APPROACHES (YELLOWFIN AND BIGEYE TUNA)

21. Longline CPUE indices for bigeye and yellowfin were derived using two different standardisation procedures - GLM and statistical habitat standardisation (Pacific-wide and region-specific). The STATHBS procedure was examined with and without an area effect (5*5 lat/long). In the absence of the area effect, there was large spatial heterogeneity in the model residuals, indicating that the estimated habitat preferences were not adequately reflecting the vertical distribution of either species. The area effect contributed substantially to the explanatory power of the model and the resulting year/quarter indices approximated the indices derived by the GLM procedure. The region-specific STATHBS model performed better than the Pacific-wide model and resulted in quite different habitat preferences being estimated for each region, although some spatial trends were still apparent in the residuals. Based on these observations it was considered that the current parameterisation of the STATHBS model was not adequate to define the true habitat preference of either species and, consequently, the resulting year/quarter indices may be biased. On that basis, it was recommended that the GLM CPUE indices should represent the base-case for each assessment and further work should be undertaken to improve the parameterisation of the STATHBS model.

22. Habitat-based standardisation is still considered a work in progress, and it was noted that deficiencies might be attributable to several sources. The oceanographic variables describing tuna habitat might be inaccurate in some regions, or the factors that can be measured might be poor proxies for the relevant but unknown factor (e.g. forage density). Tuna habitat may vary among regions and age-classes more than we know on the basis of a small number of archival tag recoveries, deployed over a minor portion of the WCPO (Coral Sea and FAD-related releases are over-represented). The assumed hook depth distributions used in the standardisation may be badly represented (e.g. due to changes in the buoyancy characteristics of the fishing line). It might be prudent to reconsider the role of the STATHBS model as a mechanistic tool for understanding the tuna biology, until considerable advances can be realised.

23. Further lines of investigation were suggested to improve and explore the STATHBS:

a. Other physical factors than SST and oxygen could be incorporated into the analysis as proxies for habitat (e.g. thermocline structure, horizontal gradients, deep scattering layer);
b. Archival tagging studies can be undertaken in areas other than the Coral Sea, away from FADs, seamounts, and on tuna of wide range of age classes; and
c. More studies of hooking depths could be undertaken with Time-Temperature-Depth Recorders. This is currently being done in the Australian longline fishery. Hook by hook analysis of catch provides a less desirable method of approaching this, because depth inferences are indirect. Hooks per basket analyses are even less informative.

ESTIMATES OF SUSTAINABLE CATCH AND EFFORT LEVELS AND THE IMPACTS ON STOCKS OF TARGET SPECIES

24. J. Hampton presented an overview of the methodology used to address the WCPFC request for information on bigeye, yellowfin and South Pacific albacore sustainable catch and effort levels, and on the impacts on bigeye and yellowfin tuna stocks of various potential management options, as documented (WCPFC-SC1 SA WP-10). Sustainable effort levels were estimated using the ratio of the estimated fishing mortality at MSY to the 2001-2003 average fishing mortality. This ratio could be applied (as a multiplier) to the 2001-2003 levels of effort to obtain effort limits consistent with F_{MSY}.

25. Sustainable catch and effort levels were estimated using equilibrium yield analyses that were incorporated into the respective assessment models. It was noted that the estimation of MSY using the classical yield analysis involves using equilibrium recruitment as predicted by a Beverton-Holt stock-recruitment relation. This level of recruitment corresponds approximately to the long-term average recruitment, which may be lower (in the case of yellowfin and bigeye) or higher (in the case of albacore) than recent recruitment levels. If sustainable catch levels are to be applied over a limited time period (e.g. less than three years) and reviewed regularly, it may be more appropriate to use recent average recruitment to determine such catch levels. Accordingly, sustainable catch levels were estimated using both the equilibrium stock-recruitment relation and the 1994-2003 average recruitment.

26. The high estimates of sustainable catch and effort for South Pacific albacore were discussed and explained in terms of the albacore assessment model estimates. Essentially, the high estimates result because the predominantly longline exploitation targets the oldest age classes, which limits the impacts of fishing on the adult biomass. However, projections demonstrated that adoption of effort levels consistent with MSY would cause large declines in longline exploitable abundance, and hence longline CPUE, that would almost certainly render these fisheries unprofitable and therefore unsustainable.

27. The methodology used to assess the effects on the bigeye and yellowfin tuna stocks of various potential management options was presented. The method involved conducting stock projections over

a five- and ten-year periods from 2005 to 2014 using the MFCL model output to project catch and biomass with parameters estimated in respective assessments. Forty-four separate management options were investigated for bigeye tuna and yellowfin tuna each with two recruitment assumptions. The options included the status quo (defined in the directive from the Commission to be the 2003 levels of catch and effort), 15 and 30% reductions of catch or effort (applied equally to fisheries both individually and combined), a variety of area-time closures and manipulations of purse seine effort designed to mimic controls on sets on logs and FADs. Several practical decisions were made regarding assumptions and the structure of the projections, including:

a. The projections were deterministic and did not include a treatment of uncertainty. However it is well known that estimates of future biomass are very uncertain, and that uncertainty increases with time;
b. The Commission stipulated that 2003 be used as the basis for comparisons of catch and effort;
c. The catchability of all fisheries was held constant during the projection period at 2004 levels, with seasonal variation included as appropriate;
d. Two methods were used to model future recruitment: recruitment predicted from the long-term stock-recruitment relation, and 1994-2003 average recruitment;
e. Assumptions were required regarding the re-distribution of fishing effort where areas were closed to certain fisheries or fishing methods. It was assumed that effort would re-distribute to the adjacent area for such scenarios; and
f. Multi-species interactions were not investigated. However, reductions or modifications of purse seine effort would affect catches of skipjack, and these should be investigated in the future.

28. This first attempt to evaluate alternative management options suggested that there might be some options that would potentially be more favourable in terms of both future catch increases and biomass conservation. However, there were a number of methodological concerns:

a. The future management objectives (i.e. the importance of short-term changes in catch, the definition of sustainability and the operative trade-offs) were not defined by the Commission. In carrying out the analysis, conservation performance was defined relative to MSY-related reference points, but changes in biomass relative to the unexploited biomass or to the biomass at some historical date might be preferable. This would remove the problem of the inherent difficulty of estimating MSY and allow computation of a simple benchmark that can be independently applied to different sub-regions. In the future, the ME-SWG would like to see more explicit direction from the Commission;
b. The selection of the most recent year (2003) as the reference year for catches to take into projections introduces a potential bias in interpreting the projections and can be considered to be a source of structural uncertainty. For instance the distribution of purse seine effort during 2003 was concentrated in Region 3 and was therefore considerably different than in 2001 and 2002 during the development of the moderate El Niño event of 2002. An average over several years (e.g. 2001-2003) may be a more appropriate basis for comparison; and
c. Statistical and structural uncertainty in the projections was not considered. It was recognised that it would have been preferable to integrate over model structural uncertainty and parameter uncertainty (including variability in future recruitment). However, it was recognised as logistically unfeasible to run the large number of scenarios that needed to be compared given the limited time and resources available. The results should be presented to managers with a strong caveat that deterministic results might be very different from actual outcomes. Furthermore, it is impossible to predict how fleets will respond to different management actions, and there may be consequences which have unexpected impacts on species other than the target for which the decision was made. The relative performance among the different management options may or may not change drastically if the full uncertainty (structural and statistical) was considered. It is recommended that some measure of uncertainty should be included in future projections.

29. It was recognised that MFCL might not be the best platform with which to undertake this type of analysis. The advantages of using MFCL are that it ensures that the projections are consistent with the assessments and that the variance structure of model parameters could potentially be applied to the estimation of uncertainty in the projections.

DEVELOPMENTS OF THE SEAPODYM MODEL

FIRST APPLICATION OF SEAPODYM TO PACIFIC BIGEYE TUNA

30. P. Lehodey presented results of an application of the spatial ecosystem and population dynamics model (SEAPODYM) to bigeye tuna (WCPFC-SC1 ME WP-1) that integrates the dynamics of primary production, middle trophic levels, and top predatory populations with fisheries impacts, i.e. a spatially resolved, multi-species full ecosystem model. A brief description of the software components was presented, with a more detailed description of model components provided in an information paper (WCPFC-SC1 ME IP-1). This is the first presentation of the model results for a multi-species simulation, which includes bigeye tuna.

31. New features in the model included more realistic structure for forage populations and the inclusion of multiple species of top predators. The forage-predator coupling had different components with species specific feeding behaviours of the predators considered i.e. for skipjack, bigeye, and yellowfin, and ontogenetically changing trophic relationships among the top level predator species.

32. SEAPODYM predictions of bigeye biomass trajectories were similar to these estimated by the MFCL stock assessments for the MFCL regions. Also the spatial distribution of predicted bigeye tuna juvenile and biomass correspond with observed distributions of larvae and observed catch respectively. The ME-SWG was encouraged by the apparent agreement between the two models and the by other insights provided by multi-species simulations using SEAPODYM that are not described by MFCL, e.g. a concurrent increase in skipjack tuna abundance is predicted during a period of bigeye tuna decline but there is no decline predicted for yellowfin tuna.

33. The ME-SWG endorsed the intention to include albacore in SEAPODYM

34. The ME-SWG also recommended further work to compare biomass trends in the SEAPODYM model and the MFCL model with and without fishing mortality.

35. As the model has potential utility for multi-species fisheries management in the near future, it is important to identify and reduce model uncertainties. Points identified include:

a. The biophysical relationship linking primary production and forage;
b. Physical oceanography;
c. Forage information, e.g. a time series of acoustic estimates of vertical biomass of forage would be valuable; and
d. Movement parameters may be better determined using tag-recapture information, and electronic tagging data.

36. The model has utility for identifying future research needs and corresponding field sampling programmes to identify, for example, breeding grounds, juvenile fish distribution. SEAPODYM also has the potential to aid in estimation of population biomass across a range of EEZs.

SEAPODYM ON A MIXED-RESOLUTION SPATIAL SCALE

37. J. Sibert presented an overview of the developments made to the SEAPODYM model on a mixed-resolution spatial scale (WCPFC-SC1 ME WP-2).

38. The spatial ecosystem and population dynamics model (SEAPODYM) for simulating spatial structure of tuna species based on advection-diffusion-reaction equations was implemented with mixed-resolution grid. Non-regularity of the grid is defined by analytical stretching functions, which allow generation of grid node concentrations in specified regions and enhance the accuracy of the algorithm used to numerically solve partial differential equations. Transformation to orthogonal or non-orthogonal grids is incorporated in the numerical scheme through the derivatives of the stretching functions as a grid metrics. With this approach, the number of nodes as well as the cost for numerical computations remains the same as for the model working on a uniform grid. A computer tool for grid generation was developed. It allows building of land masks for arbitrary depth and transfer data utilised by the model onto designed grids. Numerical simulations were performed to test how finer grid resolution in areas of large variations in environmental data or fish biomass can improve the results of simulations for population of skipjack. Two mixed-resolution grids were created - with higher resolution in Kuroshio extension region (35N, 130E, 25S, 160E) and WCPO area (20N, 120E, 20S, 180E). Application to fisheries data requires interpolation of aggregated data. High-resolution ("operational level") fisheries data should be used, where available, to further improve the results in mixed resolution models.

39. Increasing the resolution appears to improve model catch predictions, as indicated by improved correlation coefficients. Further work is required to determine the optimum resolution.

40. Preliminary results of statistical parameter optimisation in SEAPODYM were presented. The ME-SWG felt that these results were a promising approach to objectively parameterising SEAPODYM and encourage further work on this problem.

CONTRIBUTED PAPERS

WHY ARE THERE STILL LARGE PELAGIC PREDATORS IN THE OCEANS? - EVIDENCE OF SEVERE HYPER-DEPLETION IN LONGLINE CATCH-PER-EFFORT

41. R. Ahrens presented an overview of an investigation of evidence of hyper depletion[9] in pelagic longline catch effort data (WCPFC-SC1 ME-WP3).

42. Industrial catch-per-effort (CPUE) data are used as an indicator of population abundance and, contrary to strong cautions of potential biases, are often used without regard for spatial interactions as the only data source from which inferences are made. Recent controversy surrounding the status of large predatory pelagic communities has resulted from varying interpretations of the Japanese longline CPUE data. Contrary to many stock assessments on the major tuna species, ratio and fished-area-only CPUE estimators for specific regions of the world oceans indicate that large pelagic predator biomass has declined to 10% of pre-industrialised fishing levels, with large declines occurring in the first few years of fishing. The authors re-examined the SPC public domain longline 5°x5° global data set, correcting for errors that result from utilising ratio CPUE estimators, to see if such spatially corrected CPUE data provide a more reliable indicator of population abundance.

43. Although spatially corrected CPUE time series indicate depletion more in line with current stock assessments, there is evidence of severe hyper-depletion even in the corrected data. For several species, estimates of recruitment (to size classes fished by longlining) based on catch and CPUE would indicate linear stock recruitment relationships. Such relationships are contrary to current assessments and are expected under declining catchability (q) over time. When recruitment is assumed stable (utilising compensation observed over most species) q is calculated to decline rapidly over the initial years of the fishery. Other, more complex assessments utilising recruitment and abundance estimates from catch composition data also estimate-declining q even after the period of

[9]Hyper depletion in an index of abundance such as CPUE results when the index declines faster than population abundance.

early CPUE decline. Apparent fishing mortality rates (F) required to produce the initial declines in ratio CPUE with 20-30% of the maximum effort observed later, imply substantially higher F in later periods if q is assumed constant. Such an effect is also observed in the analysis of 5° x 5° cell specific depletion models. Such high fishing mortality rates are inconsistent with current estimates from stock assessment, and with size composition of catches; yield per recruit analysis indicates that such Fs would have resulted in greater declines in mean weights than observed in the catch. Such observations can be explained by hyper depletion in the early CPUE data and further investigation into the early spatial distribution of fishing effort is required to determine if effort was initially targeted at localised spatial aggregations or alternately if longline effort initially removed more active and susceptible components of the population.

44. The ME-SWG notes with interest the conclusion that aggregated longline catchability declined in the early part of the time series. Unfortunately little information is available on gear/operation changes during the early years of the fishery.

45. This analysis points out clearly that catch and effort aggregated over 5 degree geographic squares and across fleets of different flag are heterogeneous. Fishing was not uniformly distributed over the 5° x 5° square. Changes in CPUE can only be correctly interpreted by analysis of more detailed information, such as operational level data.

REVIEW ME-SWG DRAFT TERMS OF REFERENCE

46. The ME-SWG reviewed the draft TOR proposed by the convener and approved the following revision:

> The ME-SWG will coordinate research and make recommendations to the WCPFC Scientific Committee on technical questions related to analytical methods used for fishery management. The TOR for the ME-SWG include the following:

a. Support the work of other WCPFC Specialist Working Groups by reviewing and evaluating analytical methods used to assess stocks, investigate ecosystem variability, and evaluate management options;
b. Investigate the statistical properties and performance of selected stock assessment methods using simulation analysis and other appropriate methods and, on the basis of studies undertaken, make recommendations regarding the most appropriate methods to be used for the assessment of target and non-target species of the western and central Pacific Ocean tuna fishery;
c. Provide ongoing review of the structure of stock assessment and projection models as applied to various species of interest and, where necessary, make recommendations regarding enhancements to the models to improve their performance or to address deficiencies with respect to specific applications;
d. Coordinate research to determine appropriate biological reference points for target and non-target species of the western and central Pacific Ocean tuna fishery and make recommendations on the basis of this research;
e. Advise the Scientific Committee on appropriate methods of formulating scientific advice for management;
f. Advise the Scientific Committee on methods that might be used to support the ecosystem approach to fisheries in the western and central Pacific Ocean; and
g. Advise the Scientific Committee on analytical research and data needed to support management of fisheries for highly migratory fish stocks in the western and central Pacific Ocean.

SELECTION OF A CONVENOR

47. R. Campbell (Australia) was nominated and accepted as future convenor for the ME-SWG.

TASKS FOR 2006

48. The ME-SWG noted two tasks for 2006:

a. Physical factors other than SST and oxygen could be incorporated into CPUE standardisation algorithms analysis as proxies for habitat (e.g. thermocline structure, horizontal gradients, deep scattering layer); and
b. Examine the sensitivity of the 2005 MFCL assessments for yellowfin tuna and skipjack tuna to alternative movement patterns in the model, and the implications for the quality of fit to the data.

MEDIUM AND LONG-TERM TASKS

49. Projections of the MFCL model under alternative management options would be more informative if the structural and statistical uncertainty was considered. The ME-SWG recommended that consideration be given to quantifying the underlying uncertainty when providing advice based on the relative performance of alternative management options to the commission, while recognising that this is a long-term enterprise.

50. Further development of the methods used to evaluate potential management strategies is required. There are advantages in using the MFCL stock assessment model with its spatial parameter estimates for evaluating management strategies that take account of these processes, e.g. time-spatial closures. However, a more tractable model that is less computationally intensive is required for simulations. Model simplifications may include lower spatial resolution (MFCL), or fewer movement parameters (SEAPODYM).

51. The ME-SWG noted that alternative procedures for evaluation of management options that would enable exploration of uncertainty, and be more flexible in respect to temporal and spatial resolution should be developed.

52. In the context of the CPUE standardisation, the ME-SWG recommended further work to improve habitat characterisation methods including:

53. Archival tagging studies be undertaken in areas other than the Coral Sea, away from FADs, seamounts, and on tuna of wide range of age classes;

54. More studies of hook depth could be undertaken with Time-Temperature-Depth Recorders. This is currently being done in the Australian longline fishery. Hook-by-hook analysis of catch provides a less desirable method of approaching this, because depth inferences are indirect. Hooks-per-basket analyses are even less informative.

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APPENDIX I – AGENDA ADOPTED FOR USE AT THE FIRST MEETING OF THE METHODS SWG

METHODS – SPECIALIST WORKING GROUP
8 AND 9 AUGUST 2005

Monday, August 8, 2005, 11:00

a. Introduction
b. Selection of rapporteurs
c. Adoption of agenda
d. Review of available information
e. Development of MFCL.
f. Stock assessment of yellowfin tuna in the western and central Pacific Ocean. Hampton, J., P. Kleiber, A. Langley, Y. Takeuchi & M. Ichinokawa. SA WP–1
g. Stock assessment of bigeye tuna in the western and central Pacific Ocean, with comparisons to a Pacific-wide assessment. Hampton, J., P. Kleiber, A. Langley, Y. Takeuchi, M. Ichinokawa & M. Maunder SA WP–2.
h. Spatial partitioning
i. Improvements to CPUE standardisation
j. Management scenario evaluation
k. Additional reference points
l. Discussion
m. Conclusions

Tuesday, August 9, 2005, 8:30

a. Review of available information (continued)
b. Development of SEAPODYM
c. First application of SEAPODYM to Pacific bigeye tuna. Lehodey P. ME WP–1.
d. SEAPODYM on a mixed-resolution spatial scale. Senina, I.N., Sibert, J.R. and P. Lehodey. ME WP–2
e. Discussion
f. Conclusions
g. Contributed papers
h. Why are there still large pelagic predators in the oceans? Evidence of severe hyper-depletion in longline catch-per-effort. Ahrens, R. & C. Walters. ME WP–3

Tuesday, August 9, 2005, 13:00

a. Future Plans
b. Review ME-SWG draft TOR (attached below)
c. Selection of convener
d. Tasks for 2006
e. Medium and long-term plan
f. Advice to Scientific Committee
g. Other Business
h. Preparation of report

ANNEX VII - REPORT OF THE STATISTICS SPECIALIST WORKING GROUP

REPORT OF THE STATISTICS SPECIALIST WORKING GROUP

INTRODUCTION

1. The main session of the ST-SWG was held during the morning and afternoon of 9 August 2005 and four evening sessions took place from 9 to 12 August 2005. Tim Lawson was Convener. Kim Duckworth and Shui-Kai (Eric) Chang were appointed rapporteurs.

2. Participants included R. Allen (IATTC), J. Amoe (Fiji), D. Bebegu (Papua New Guinea), D. Brogan (SPC), S. K. Chang (Chinese Taipei), L. Clark (FFA), S. Clark (Tokelau), R. Clarke (United States of America), N. Cornuet (New Caledonia), P. Dalzell (United States of America), S. Diake (Solomon Islands), K. Duckworth (New Zealand), S. Dunn (FFA), R. Etaix-Bonnin (New Caledonia), U. Fa'anunu (Tonga), S. Fukofuka (SPC), N. Goundar (Greenpeace), A. Hore (New Zealand), D. Itano (United States of America), C. Karnella (United States of America), S. Harley (New Zealand), T. Kendrick (New Zealand), J.-R. Koh (Republic of Korea), L. Kumoru (Papua New Guinea), C.-H. Kwoh (Chinese Taipei), T. Lawson (SPC), A. Lewis (SPC), C.-C. Liu (Chinese Taipei), L. Manarangi-Trott (Cook Islands), S. Matoto (Tonga) P. Miyake (Japan), A. Mohiba (Papua New Guinea), D.-Y. Moon (Republic of Korea), A. Mulipola (Samoa), H. Okamoto (Japan), C. Ponsonnet (French Polynesia), R. Sarralde (European Union), P. Sharples (SPC), R. Skillman (United States of America), D Su'a (FFA), E. Tardy (Wallis and Futuna), B. Thoulag (Federated States of Micronesia), L. Tovibau (Greenpeace), Y. Uozumi (Japan), P. Ward (Australia), P. Williams (SPC) and R.-F. Wu (Chinese Taipei).

3. The agenda was adopted as attached in Appendix 1.

CONVENER'S REPORT ON THE STATUS OF DATA COLLECTION, COMPILATION AND DISSEMINATION

4. T. Lawson presented WCPFC-SC1 ST WP-1 Status of Data Collection, Compilation and Dissemination.

DATA COLLECTION

5. Activities of the Indonesia and Philippines Data Collection Project commenced with the review of the tuna fisheries and the current statistical system conducted by A. Lewis from 8 to 28 July 2004 (Information Paper ST IP–6). The Philippines Tuna Fishery Data Collection Workshop was held from 20 to 21 October 2004 to review recommendations from the review and to plan port sampling and surveys (Information Paper ST IP–4). In January 2005, the Bureau of Agricultural Statistics recommenced surveys of tuna landing ports, and the Bureau of Fisheries and Aquatic Resources recommenced port sampling, with IPDCP funds. IPDCP activities in Indonesia will commence once sufficient funds have been contributed. The IPDCP was further discussed under Scientific Committee agenda item 6.2.

6. Recent developments in port sampling programmes and observer programmes are reported in WCPFC-SC1 ST WP–1.

COMPILATION OF DATA

7. Tables of annual catch estimates compiled by the SPC OFP for 1950–2004 for tuna and billfish are presented in WCPFC-SC1 ST IP–1. Estimates of average annual catches in recent years of major non-target fish species, determined from observer data, are also presented.

8. Tables of coverage of tuna fisheries in the WCP-CA by data held by the SPC OFP are

presented in Appendix I of WCPFC-SC1 ST WP–1. Coverage by operational catch and effort data held by the SPC OFP for 2003 is 51.2% (percentage of catch of target tuna species in the WCP-CA), the highest level ever achieved. Coverage by port sampling data for 2003 is 5.1%. Coverage by observer data for 2003 is 4.8%, while coverage for 2004 is slightly higher, 5.8%. Figure ST1 illustrates the trends in coverage from 1970 to 2004; the coverage for recent years may increase as more data become available.

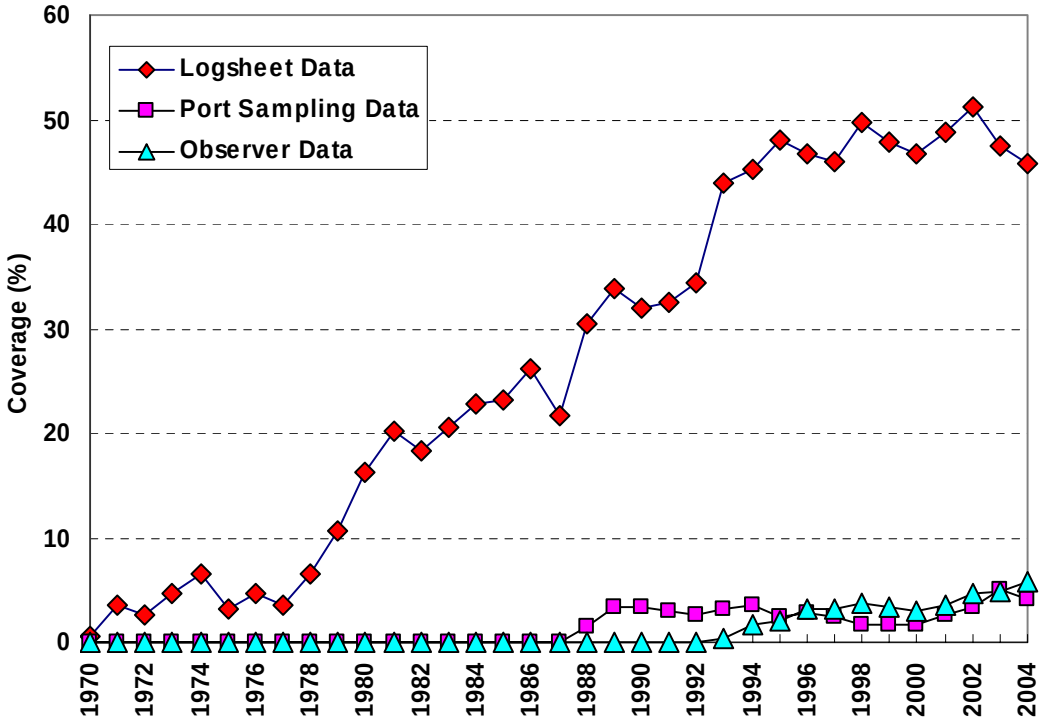

Figure ST1. Coverage of tuna fisheries in the WCP-CA by logsheet catch and effort data, port sampling data and observer data compiled by the SPC OFP.

9. The principle gaps in coverage by operational level catch and effort data (logsheet data) include the domestic fisheries of the Philippines and Indonesia, the distant-water longline fleets of Korea and Chinese Taipei, and the longline, pole-and-line and purse-seine fleets of Japan on the high seas. A full list of gaps in data, together with summaries of the availability of catch and effort data and size composition data, are given in Appendices 8–11 of Information Paper ST IP–2.

10. Detailed information regarding the compilation of data covering the fleets of each of the fishing States or entities are given in Appendix II of WCPFC-SC1 ST WP–1.

DISSEMINATION OF DATA

11. Figure ST2 shows the number of instances of:

a. Releases of public domain catch and effort data via the SPC OFP website;
b. Releases of data by the SPC OFP, other than via the website; and
c. Releases of statistics and other information by the SPC OFP, during each twelve-month period from July to June.

From July 2004 to June 2005, there were 166 releases of public domain data via the SPC OFP website (down from 121 during the previous period), 20 releases of data by the SPC OFP other than via the website (down from 21), and 23 releases of statistics and other information (up from 55). There were a total of 209 releases of data and other information from July 2004 to June 2005 (up from 197 during the previous period).

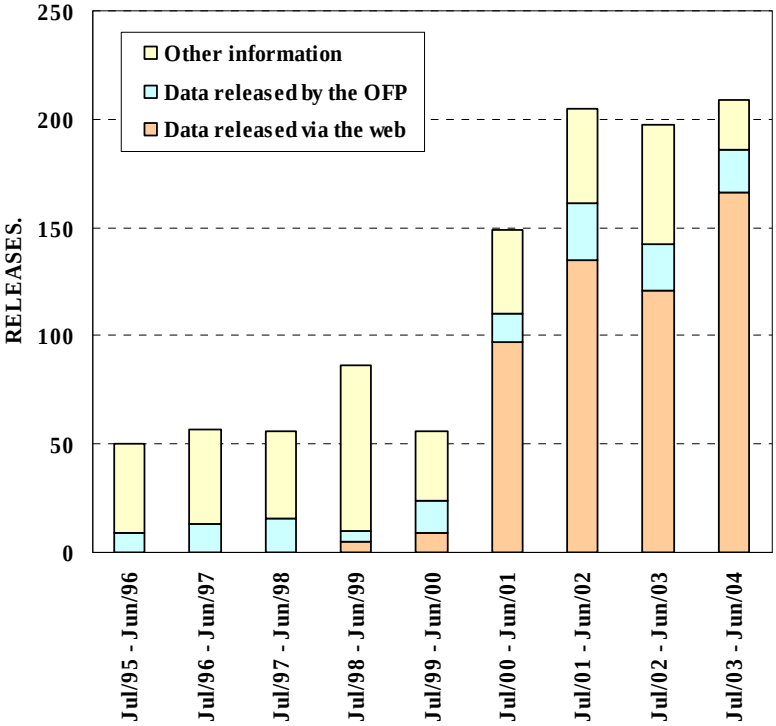

Figure ST2. Dissemination of data by the SPC OFP.

12. All instances of dissemination of data by the SPC OFP from 1 July 2004 to 30 June 2005, other than via the SPC OFP website, are listed in Appendix III of WCPFC-SC1 ST WP–1.

REVIEW OF SCTB17 DIRECTIVES TO THE SCTB STATISTICS WORKING GROUP

13. The directives to the SCTB Statistics Working Group that were made at SCTB17 in August 2004 were reviewed.

Examine the relationship between observer coverage rates and the accuracy and reliability of estimators of catches and size frequencies for the purse seine fleets operating in tropical waters (SPC)

14. This study postponed in order to examine purse-seine species composition determined from observer data (WCPFC-SC1 ST WP–3 and WCPFC-SC1 ST WP–4) and will be conducted during the next inter-sessional period.

Review the availability of data to estimate the annual catches of non-target species by purse seiners and, if sufficient data are available, estimate catches of non-target species (SPC)

15. Estimates of the average annual catches of non-target fish species in the WCP-CA in recent years, for longline and purse seine, are presented in Information Paper ST IP–1. However, the estimates are determined from observer data, for which coverage is low (particularly for certain sectors of the longline fishery). Future work will look at:

a. Estimating catches for finer time-area stratification; and
b. Quantifying the reliability of the estimates.

Compile information on the longline fishery in Vietnam, including estimates of annual catche (SPC)

16. A review of the available information on tuna fisheries in Vietnam was funded by the SPC OFP and conducted by A. Lewis in March 2005 (WCPFC-SC1 ST IP–5). Estimates from the study

suggest that the annual catch of oceanic tuna species may be of the order of 40,000 mt, primarily skipjack and yellowfin.

Compile annual catches for the WCP-CA, in addition to estimates for the WCPO Area established at SCTB12

17. Estimates of annual catches for the WCP-CA are presented in WCPFC-SC1 ST IP–1. Additional work is required to resolve discrepancies in estimates of albacore for the north/south Pacific and the east/west Pacific.

Compile catch and effort data covering distant-water longline fleets, stratified by hooks between floats, for habitat-based standardisation of fishing effort (Japan, Republic of Korea, Chinese Taipei, United States of America)

18. Catch and effort data covering distant-water longline fleets, stratified by hooks between floats, were provided by Japan. Data from the Republic of Korea, Chinese Taipei and the United States of America are forthcoming.

Examine the bias introduced in estimates of CPUE by excluding strata with less than a minimum number of vessels from releases of catch and effort data aggregated by time-area strata (United States of America)

19. This study postponed due to other priorities and will be conducted during the next inter-sessional period.

Identify and rescue historical catch and effort data, such as pre–1972 Japanese pole-and-line data and pre–1950 fishing surveys (Australia, Japan, United States of America, SPC)

20. Bigeye and yellowfin length and weight data for longline provided back to 1948 were provided by Japan and imported into the SPC OFP database. Efforts to rescue historical data, such as experimental fishing by United States purse seiners, continue.

SCIENTIFIC DATA TO BE PROVIDED TO THE COMMISSION

21. Draft recommendations on (a) scientific data to be provided to the Commission and (b) standards for the provision of operational catch and effort data to the Commission based on the procedures of the SPC OFP and standards of the Standing Committee on Tuna and Billfish (Working Paper ST WP–2) were considered and it was agreed that the following recommendations would be made to the Commission.

Recommendation SC1–ST–1
Scientific Data to be Provided to the Commission

1. Estimates of annual catches

The following estimates of catches during each calendar year shall be provided to the Commission for each gear type:

- catches of bigeye *(Thunnus obesus*), skipjack (*Katsuwonus pelamis*), yellowfin (*Thunnus albacares*), striped marlin (*Tetrapturus audax*), blue marlin (*Makaira mazara*), black marlin (*Makaira indica*) and swordfish (*Xiphias gladius*) in (i) the WCPFC Statistical Area (see paragraph 8 below) and (ii) the portion of the WCPFC Statistical Area east of the 150° meridian of west longitude; and

• catches of albacore (*Thunnus alalunga*), striped marlin and swordfish in (i) the Pacific Ocean south of the Equator, (ii) the Pacific Ocean north of the Equator, (iii) the WCPFC Statistical Area north of the Equator, (iv) the WCPFC Statistical Area south of the Equator, and (v) the portion of the WCPFC Statistical Area east of the 150° meridian of west longitude. For trollers targeting albacore in the Pacific Ocean south of the Equator, the following estimates of catches during the fishing season (July to June) should also be provided:

• catches of albacore in the Pacific Ocean south of the Equator.

Catch estimates shall also be provided for other species as determined by the Commission.

Estimates of discards should also be provided.

Longline catch estimates shall be for whole weight, rather than processed weight.

All catch estimates shall be reported in tonnes (i.e. metric tons).

The statistical methods that are used to estimate the annual and seasonal catches shall be reported to the Commission, with reference to the coverage rates for each type of data (e.g., operational level catch and effort data, records of unloadings, species composition sampling data) that is used to estimate the catches and to the conversion factors that are used to convert the processed weight of longline-caught fish to whole weight.

2. Number of vessels active

The number of vessels active in the WCPFC Statistical Area during each calendar year shall be provided to the Commission for each gear type.

For longliners, pole-and-line vessels and purse seiners, the number of vessels active shall be provided by gross registered tonnage (GRT) class. The GRT classes are defined as follows:

• Longline: 0–50, 51–200, 201–500, 500+
• Pole-and-line: 0–50, 51–150, 150+
• Purse seine: 0–500, 501–1000, 1001–1500, 1500+

For trollers targeting albacore in the Pacific Ocean south of the Equator, the number of vessels active in the WCPFC Statistical Area during the fishing season (July to June), shall also be provided and should be provided for the Pacific Ocean south of the Equator.

3. Operational level catch and effort data

Operational level catch and effort data (e.g., individual sets by longliners and purse seiners, and individual days fished by pole and line vessels and trollers) shall be provided to the Commission, in accordance with standards to be established by the Commission.

It is recognised that certain members and cooperating non-members of the Commission may be subject to domestic legal constraints, such that they may not be able to provide operational data to the Commission until such constraints are overcome. Until such constraints are overcome, aggregated catch and effort data and size composition data as described in (4) and (5) below shall be provided. Unraised longline catch and effort data stratified by the number of hooks between floats and the finest possible resolution of time period and geographic area shall also be provided.

It is also recognised that certain members and cooperating non-members of the Commission may have practical difficulties in compiling operational data for fleets comprised of small vessels, such as certain sectors of the fisheries of Indonesia, the Philippines and small island developing States.

4. Catch and effort data aggregated by time period and geographic area

If the coverage rate of the operational level catch and effort data that are provided to the Commission is less than 100%, then catch and effort data aggregated by time period and geographic area that have been raised to represent the total catch and effort shall be provided. Longline catch and effort data shall be aggregated by periods of month and areas of 5° longitude and 5° latitude. Catch and effort data for surface fisheries shall be aggregated by periods of month and areas of 1° longitude and 1° latitude.

If the coverage rate of the operational catch and effort data that are provided to the Commission is less than 100%, then catch and effort data that have been raised to represent the total catch and effort shall also be aggregated by periods of year and areas of national jurisdiction and high seas within the WCPFC Statistical Area.

The statistical methods that are used to derive the aggregated catch and effort data shall be reported to the Commission, with reference to the coverage rates of the operational catch and effort data, and the types of data and method used to raise the catch and effort data.

5. Size composition data

Length and/or weight composition data that are representative of catches by the fisheries are essential for stock assessments and shall therefore be provided to the Commission at the finest possible resolution of time period and geographic area.

6. The roles of flag states and coastal states

Flag states or entities shall be responsible for providing to the Commission scientific data covering vessels they have flagged, except for vessels operating under joint-venture or charter arrangements with another state such that the vessels operate, for all intents and purposes, as local vessels of the other state, in which case the other state shall be responsible for the provision of data to the Commission.

It is recognised that the ability of flag States or entities to provide scientific data to the Commission may be constrained by the terms of bilateral or regional arrangements, such as the Treaty on Fisheries Between the Governments of Certain Pacific Island States and the Government of the United States of America.

Scientific data compiled by coastal states shall also be provided to the Commission.

7. Time periods covered and schedule for the provision of data

Estimates of annual or seasonal catches should be provided to the Commission from 1950 onwards or from the year in which the fleet began operating.

Operational catch and effort data, and size composition data, should be provided for all years, starting with the first year for which the data are available.

For all gear types, except trollers targeting albacore in the Pacific Ocean south of the Equator, estimates of annual catches, the number of vessels active, catch and effort data, and size composition data, covering a calendar year should be provided by April 30 of the year following the calendar year (e.g., data covering calendar year 'x' should be provided by 30 April of year 'x+1').

For trollers targeting albacore in the Pacific Ocean south of the Equator, estimates of annual catches, the number of vessels active, catch and effort data, and size composition data, covering a fishing season (July to June) should be provided by April 30 of the year following the year in which the season ends (e.g., data covering the season from July of year 'x' to June of year 'x+1' should be provided by 30 April of year 'x+2').

Estimates of annual catches, the number of vessels active, catch and effort data, and size composition data should be revised, and the revisions provided to the Commission, as additional data become available.

8. Definition of the WCPFC Statistical Area

The WCPFC Statistical Area is defined as follows: from the south coast of Australia due south along the 141° meridian of east longitude to its intersection with the 55° parallel of south latitude; thence due east along the 55° parallel of south latitude to its intersection with the 150° meridian of east longitude; thence due south along the 150° meridian of east longitude to its intersection with the 60° parallel of south latitude; thence due east along the 60° parallel of south latitude to its intersection with the 130° meridian of west longitude; thence due north along the 130° meridian of west longitude to its intersection with the 4° parallel of south latitude; thence due west along the 4° parallel of south latitude to its intersection with the 150° meridian of west longitude; thence due north along the 150° meridian of west longitude; and from the north coast of Australia due north along the 129° meridian of east longitude to its intersection with the 8° parallel of south latitude, thence due west along the 8° parallel of south latitude to the Indonesian peninsula; and from the Indonesian peninsula due east along the 2°30′ parallel of north latitude to the Malaysian peninsula.

9. Periodic reviews of the requirements for scientific data

The Commission, through its Scientific Committee, shall periodically review the requirements for scientific data and shall provide the Commission with revised versions of this recommendation, as appropriate.

Recommendation SC1–ST–2
Standards for the Provision of Operational Level Catch and Effort Data to the Commission

1. Data items that shall be reported to the Commission

1.1 Vessel identifiers, for all gear types

Name of the vessel, country of registration, registration number, international radio call sign: The registration number is the number assigned to the vessel by the State that has flagged the vessel. A code may be used as a vessel identifier instead of the name of the vessel, registration number and call sign for vessels that have fished and that intend to fish only in the waters of national jurisdiction of the State that has flagged the vessel.

1.2 Trip information, for all gear types

The start of a trip is defined to occur when a vessel (a) leaves port after unloading part or all of the catch to transit to a fishing area or (b) recommences fishing operations or transits to a fishing area after transhipping part or all of the catch at sea (when this occurs in accordance with the terms and conditions of article 4 of Annex III of the Convention, subject to specific exemptions as per article 29 of the Convention).

Port of departure, date of departure, port of unloading, date of arrival in port of unloading: If the start of a trip coincides with recommencing fishing operations or transiting to a fishing area after transhipping part or all of the catch at sea, then "Transhipment at sea" shall be reported in lieu of the port of departure, and if the end of a trip coincides with transhipping part or all of the catch at sea, then "Transhipment at sea" shall be reported in lieu of the port of unloading.

1.3 Information on operations by longliners

Activity: This item should be reported for each set and for days on which no sets were made, from the start of the trip to the end of the trip. Activities should include "a set"; "no fishing — in transit"; "no fishing — gear breakdown"; "no fishing — bad weather"; and "no fishing — in port".

Date of start of set and time of start of set: The date and start of set time should be GMT/UTC. If no sets are made, the date and main activity should be reported.

Position of start of set: The position of start of set should be reported in units of at least minutes of latitude and longitude. If no sets are made, the noon position should be reported.

Number of hooks per set.

Number of branch lines between floats. The number of branch lines between floats should be reported for each set.

Number of fish caught per set, for the following species: albacore (Thunnus alalunga), bigeye (Thunnus obesus), skipjack (Katsuwonus pelamis), yellowfin (Thunnus albacares), striped marlin (Tetrapturus audax), blue marlin (Makaira mazara), black marlin (Makaira indica) and swordfish (Xiphias gladius), and other species as determined by the Commission. If the total weight or average weight of fish caught per set have been recorded, then the total weight or average weight of fish caught per set, by species, should also be reported. If the total weight or average weight of fish caught per set have not been recorded, then the total weight or average weight of fish caught per set, by species, should be estimated and the estimates reported. The total weight or average weight shall refer to whole weights, rather than processed weights.

1.4 Information on operations by pole-and-line vessels and related gear types

Activity: This item shall be reported for each day, from the start of the trip to the end of the trip. Activities should include "a day fishing or searching with bait onboard"; "no fishing — collecting bait"; "no fishing — in transit"; "no fishing — gear breakdown"; "no fishing — bad weather"; and "no fishing — in port".

Date: The date should be GMT/UTC.

Noon position: The noon position should be reported in units of at least minutes of latitude and longitude.

Weight of fish caught per day, for the following species: albacore, bigeye, skipjack, yellowfin, and other species as determined by the Commission.

1.5 Information on operations by purse-seiners and related gear types

Activity: This item shall be reported for each set and for days on which no sets were made, from the start of the trip to the end of the trip. Activities should include "a set"; "a day searched, but no sets made"; "no fishing — in transit"; "no fishing — gear breakdown"; "no fishing — bad weather"; and "no fishing — in port".

Date of start of set, time of start of set and time of end of set: The date and time of the start of set and the time of end of set should be GMT/UTC. If no sets are made, the date and main activity should be reported.

Position of set or noon position: If a set is made, then the position of the set shall be reported. If searching occurs, but no sets are made, then the noon position shall be reported. The position should be reported in units of at least minutes of latitude and longitude.

School association: All common types of school association should be reported, while uncommon types of association should be reported as "other". Common types of school association are "free-swimming" or "unassociated"; "feeding on baitfish"; "drifting log, debris or dead animal"; "drifting raft, FAD or payao"; "anchored raft, FAD or payao"; "live whale"; and "live whale shark".

Weight of fish caught per set, for the following species: albacore, bigeye, skipjack, yellowfin, and other species as determined by the Commission.

1.6 Information on operations by trollers and related gear types

Activity: This item shall be reported for each day, from the start of the trip to the end of the trip. Activities should include "a day fished"; "no fishing — in transit"; "no fishing — gear breakdown"; "no fishing — bad weather"; and "no fishing — in port".

Date: The date should be GMT/UTC.

Noon position: The noon position should be reported in units of at least minutes of latitude and longitude.

Number of fish caught per day, for the following species: albacore, bigeye, skipjack, yellowfin, and other species as determined by the Commission.

If the total weight or average weight of fish caught per day have been recorded, then the total weight or average weight of fish caught per day, by species, should also be reported. If the total weight or average weight of fish caught per day have not been recorded, then the total weight or average weight of fish caught per day, by species, should be estimated and the estimates reported. The total weight or average weight shall refer to whole weights, rather than processed weights.

2. Geographic area to be covered by operational catch and effort data to be provided to the Commission

The geographic area to be covered by operational catch and effort data to be provided to the Commission shall be the WCPFC Statistical Area, except for fisheries targeting albacore in the Pacific Ocean south of the Equator, for which the geographic area should be the Pacific Ocean south of the Equator.

3. Target coverage rate for operational level catch and effort data to be provided to the Commission

The target coverage rate for operational catch and effort data to be provided to the Commission is 100%.

4. Procedures for the verification of operational level catch and effort data

Operational level catch and effort data should be verified as follows:

- The amount of the retained catch should be verified with records of unloading obtained from a source other than the crew or owner or operator of the fishing vessel, such as an agent of the company responsible for unloading or onward shipping or purchasing of the catch.
- Positions of latitude and longitude should be verified with information obtained from vessel monitoring systems.
- The species composition of the catch should be verified with sampling conducted by observers during fishing operations or by port samplers during unloading.

DATA SECURITY AND PROCEDURES FOR THE DISSEMINATION OF SCIENTIFIC DATA BY THE COMMISSION

22. The data security procedures followed by the OFP are listed in Appendix I of Working Paper ST WP–2. It was suggested that a review of these procedures should be included in the terms of reference of the independent review of the transitional science structure and function of the Commission that should be carried out two years after entry into force of the Convention (see Scientific Committee agenda item 10.3, Terms of Reference for the independent review).

23. A draft recommendation on principles and procedures for the dissemination of scientific data by the Commission based on the procedures of the OFP and of the Standing Committee on Tuna and Billfish (WCPFC SC-1 ST WP–2) was considered and it was agreed that the following recommendation would be made to the Commission.

Recommendation SC1–ST–3

The Scientific Committee recommends that the Commission establish an *ad hoc* task group to identify types of data that must be treated as confidential and to develop draft rules and procedures to govern the security and confidentiality of data collected and held by the Commission. It also recommends that the following text be taken into consideration in this regard.

Principles and Procedures for the Dissemination of Scientific Data by the Commission

The basic principle for the dissemination of data for scientific research by the Commission is that all instances of the dissemination of data shall be authorised by the sources of the data. The authorisation to disseminate data that the Commission considers to be in the public domain shall be taken for granted. The authorisation to disseminate data that the Commission does not consider to be in the public domain shall be sought from the sources of the requested data and, when authorised, the individual scientists that have requested the data must sign a Confidentiality Agreement prior to the release of the data.

The Commission shall disseminate scientific data according to the following procedures.

1. Estimates of annual catches

Estimates of annual catches of target and major non-target species by flag, gear type and statistical area are considered to be in the public domain. They shall be (a)

published in statistical bulletins, (b) made available for downloading on the Internet and (c) released on request.

2. Catch and effort data

Longline catch and effort data aggregated by 5° longitude and 5° latitude and month, and surface catch and effort data aggregated 1° longitude and 1° latitude and month, for individual fishing nations or entities, which have been raised to represent total catch and effort, are considered to be in the public domain, provided that the catch of no individual vessel can be identified within a stratum. In cases when an individual vessel can be identified, the data shall be aggregated to preclude such identification.

Catch and effort data considered to be in the public domain shall be (a) made available for downloading on the Internet and (b) released on request.

Catch and effort data aggregated at a finer resolution of time and area, and operational catch and effort data, may be released with authorisation from the sources of the requested data, subject to acceptance of the Confidentiality Agreement below.

3. Other types of scientific data

The principles and procedures for the dissemination of catch and effort data shall also apply to the dissemination of other types of scientific data (e.g. size composition data) by the Commission.

4. Confidentiality Agreement for the dissemination of non-public domain data

Individuals requesting non-public domain data shall provide a description of the scientific research project, including the objectives, methodology and intentions regarding publication. The research project must be consistent with the objective of the Convention, i.e., to ensure, through effective management, the long-term conservation and sustainable use of highly migratory fish stocks in the western and central Pacific Ocean.

Prior to the release of non-public domain data, the individuals requesting the data shall sign a Confidentiality Agreement that states:

- Prior to the publication of the results of the research project, the manuscript shall be provided to and cleared by the Executive Director, who shall ensure that any data that are published are considered to be in the public domain.
- The data shall be (a) used only for the research project for which the data were requested, (b) accessed only by the individuals requesting the data, and (c) destroyed upon completion of the research project.
- All published reports of the results of the research project shall be provided to the Executive Director for subsequent forwarding to the sources of the data and to the Scientific Committee.

If the sources of the data have authorised the use of the data under conditions that are different from those presented above, then the Confidentiality Agreement will be modified accordingly.

5. Documentation of the dissemination of scientific data by the Commission

The Executive Director shall document all requests for scientific data and the responses to the requests, and shall make the documentation available for periodic review by the Scientific Committee.

OBSERVER DATA REQUIREMENTS

24. A draft recommendation to the Commission on scientific aspects of observer programmes (WCPFC SC-1 ST WP–2) was considered. The draft recommendation concerned the primary objectives of observer programmes, coverage rates, sampling protocols and standards for observer data collection forms. However, the draft recommendation reflected the experience of only those observer programmes for which technical support has been provided by the SPC OFP, and not other observer programmes in the region. The Statistics SWG did not have sufficient time at its inaugural meeting to

discuss scientific aspects of observer programmes; it was therefore considered premature to make a recommendation to the Commission in this regard. Nevertheless, it was agreed that the Scientific Committee should consult with the TCC in regard to the priorities and objectives of the regional observer programme under Article 12.2(f) of the Convention.

SPECIES COMPOSITION OF CATCHES BY PURSE SEINERS IN THE WCPO

25. T. Lawson presented WCPFC SC-1 ST WP–3, "Update on the proportion of bigeye in 'yellowfin plus bigeye' caught by purse seiners in the Western and Central Pacific Ocean", which updated a study conducted in 2003 (SCTB16 Working Paper SWG–6). The previous study addressed the problem of the misidentification of bigeye as yellowfin in purse-seine logsheet data and examined the effects of school association, year, quarter, area and flag on the proportion of bigeye in 'yellowfin plus bigeye' determined from 1,508 species composition samples containing yellowfin and/or bigeye collected by observers during 1998–2001. Analyses of variance indicated that school association is the variable most strongly related to the proportion of bigeye in 'yellowfin plus bigeye' and that year is strongly or weakly related, depending on the other variables that are included in the model. The present study examined 2,678 samples collected during 1995–2003. School association was again found to be strongly related, whereas no other variables were found to be statistically related. A two-variable model, with school association and year, was used to determine adjustment factors for 1995–2003 to capture the year effect and improve the fit. Adjustment factors for 1989–1994 determined from port sampling data covering the United States purse-seine fleet were also presented. The proportion of bigeye in 'yellowfin plus bigeye' for associated schools has varied considerably through time (Figure ST3). The proportions of bigeye in 'yellowfin plus bigeye' for adjusted and unadjusted annual catch statistics were compared for the purse-seine fleets of Japan, the Republic of Korea, Chinese Taipei and the United States.

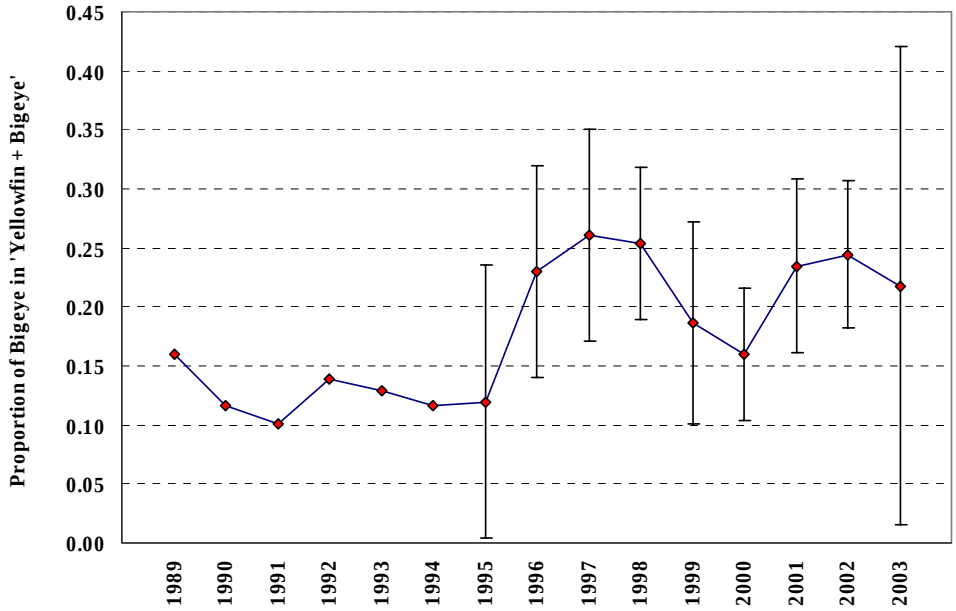

Figure ST3. Proportion of bigeye in 'yellowfin plus bigeye' for associated schools determined from port sampling data for the United States purse-seine fleet (1989–1994) and observer data for all fleets (1995–2003). Bars for the proportions determined from observer data represent plus or minus two standard errors.

26. T. Lawson also presented WCPFC SC-1 ST WP–4, "Comparison of the species composition of catches by purse seiners in the Western and Central Pacific Ocean determined from observer and other types of data". The proportion of skipjack in purse-seine catches determined from 4,428 species composition samples containing skipjack, yellowfin and/or bigeye that were collected by observers during 1995–2003 was found to be 55.4%. This value is inconsistent with proportions of skipjack

determined from logsheet data, records of unloadings, port sampling data and Final Out-Turn Reports, which ranges from 72% to 78%. Comparisons of the observer data with the port sampling data indicated that there were more large (>80 cm) yellowfin and bigeye in the observer samples than in the port samples.

27. A simulation study of the sampling of an average-sized associated set and an average-sized unassociated set, with the species–size distribution for each set based on port sampling data, was conducted. An average-sized set weighs about 30 tonnes and consists of about 11,000 fish, whereas an average observer sample consists of only about 60 fish. For the associated set, it was shown that the proportion of skipjack determined from observer data, i.e. 48%, corresponds to a bias of 3.0 times the random probability of sampling large yellowfin and bigeye; this bias corresponds to sampling 5.7 large yellowfin and bigeye instead of 2.0 fish under random sampling. For the unassociated set, the proportion of skipjack determined from observer data, i.e. 71%, corresponds to a bias of 2.6 times the random probability of sampling large yellowfin and bigeye; this bias corresponds to sampling 2.4 large yellowfin and bigeye instead of 1.0 fish under random sampling.

FUTURE WORK OF THE STATISTICS SWG

28. The future work programme for the Statistics SWG is presented below.

a. Better characterisation of current catch and catch composition from Indonesia, Philippines, and for Vietnam as they impact on the stocks in the WCP-CA (From the inaugural WCPFC report);
b. Reconstruction of early catch history (catch, effort, size composition) for all fisheries (From the inaugural WCPFC report);
c. Improve the estimation of annual catches of non-target species (SPC);
d. Examine the relationship between observer coverage rates and the accuracy and reliability of estimators of catches by the purse-seine fleets (SPC);
e. Examine the sampling protocols for purse-seine observer and port sampling programmes to identify possible sources of bias in species composition data (SPC);
f. Review scientific aspects of observer programmes, such as objectives, coverage rates, sampling protocols, standards for data collection forms, and the relationship between national and regional observer programmes;
g. Examine the bias introduced in estimates of CPUE by excluding strata with less than a minimum number of vessels from catch and effort data aggregated by time-area strata (United States);
h. Review the availability of data for shark assessments (SPC); and
i. Review the available information on IUU fishing to examine the extent to which catches in the WCP-CA may be unreported.

OTHER MATTERS

INDONESIA AND PHILIPPINES DATA COLLECTION PROJECT

29. The participants endorsed the recommendation in the final report of PrepCon Working Group II that:

a. The Commission adopts the Indonesia and Philippines Data Collection Project and assumes responsibility for its management as soon as possible;
b. The Commission establish the IPDCP Steering Committee to monitor project activities and developments in regard to funding, and to report thereon to the Scientific Committee. Membership of the Steering Committee should include Indonesia, the Philippines, donors, the Chairman of the Scientific Committee and the SPC Oceanic Fisheries Programme; and

c. Commission members and potential members contribute, as soon as possible, the balance of the funds required to implement the IPDCP.

EXCHANGE OF TUNA FISHERIES DATA BETWEEN IATTC AND WCPFC

30. The participants agreed that cooperation with IATTC should include the exchange of data between IATTC and WCPFC. In this regard, it was noted that an Agreement on the Exchange of Tuna Fisheries Data between IATTC and SPC was reached in March 2003 (Appendix II in WCPFC SC-1 ST WP–2), and that this Agreement could serve as a model for an agreement on the exchange of data between IATTC and WCPFC. Under the Agreement, SPC provides IATTC with catch and effort data aggregated by time-area strata covering the Western and Central Pacific Ocean and operational catch and effort data covering trips that take place at least in part in the Eastern Pacific Ocean, and IATTC provides SPC with catch and effort data aggregated by time-area strata covering the Eastern Pacific Ocean and operational data covering trips that take place at least in part in the Western and Central Pacific Ocean. If used as a model for an agreement on the exchange of data between IATTC and WCPFC, the Agreement should be modified to refer to the WCPFC WCP-CA, rather than the Western and Central Pacific Ocean.

TERMS OF REFERENCE FOR THE STATISTICS SWG

31. The TOR presented in WCPFC SC-1 ST WP–2 were endorsed subject to review for future use:

> The TOR of the Statistics SWG is to coordinate the collection, compilation and dissemination of tuna fisheries and related data. The 'collection of data' refers to the use of forms by national agencies or the Commission to record various types of data (e.g., logsheets or logbooks to record operational catch and effort data, observer data collection forms, port sampling forms, records of unloadings, etc.). The 'compilation of data' refers to the provision of data by national agencies to the Commission in accordance with policies and procedures that have been established by the Commission in this regard. The 'dissemination of data' refers to the release of data by the Commission to the users of the data.
>
> The coordination of the collection of data shall include periodic reviews of the Commission's standards for data collection, such as:
>
> a. Minimum standards for data collection forms;
> b. Sampling protocols for data collection programmes;
> c. Target coverage rates for data collection programmes;
> d. Sampling designs for data collection programmes; and
> e. Procedures for the verification of data.
>
> The coordination of the compilation of tuna fisheries and related data shall include:
>
> a. Periodic reviews of the Commission's policies in regard to the provision of data;
> b. The coverage of data compiled by the Commission; and
> c. The quality of data compiled by the Commission.
>
> The coordination of the dissemination of data shall include periodic reviews of:
>
> a. The Commission's policies in regard to the dissemination of data; and
> b. The instances of the dissemination of data by the Commission.
>
> The coordination of the collection, compilation and dissemination of data shall also

include any other activities that the Scientific Committee considers to be appropriate.

The Statistics SWG shall advise the Scientific Committee in regard to issues concerning data that can be used for both scientific and compliance purposes, and that require liaison with the TCC.

SELECTION OF A CONVENOR

32. The ST-SWG recommended that K. Duckworth convene the ST-SWG in 2005-2007.

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APPENDIX I – AGENDA ADOPTED FOR USE AT THE FIRST MEETING OF THE STATISTICS SWG

STATISTICS – SPECIALIST WORKING GROUP
AUGUST 2005

1. Preliminaries
2. Convener's report on the status of data collection, compilation and dissemination
3. Scientific data to be provided to the Commission
4. Data security and procedures for the dissemination of scientific data by the Commission
5. Observer data requirements
6. Species composition of catches by purse seiners in the WCPO
7. Future work of the Statistics SWG
8. Other matters
9. Adoption of the report

ANNEX VIII - REPORT OF THE BIOLOGY SPECIALIST WORKING GROUP

REPORT OF THE BIOLOGY SPECIALIST WORKING GROUP

INTRODUCTION

1. Chi-Lu Sun lead the session of the Biology Specialist Working Group, outlining the agenda and noting that the aim of the Group was to review biological research being carried out in the WCPO for the WCPFC Scientific Committee with the aim of improving our understanding of the biology of the main target species for stock assessment purposes. Rob Campbell and Regis Etaix-Bonnin were appointed rapporteurs.

2. The meeting was attended by Robert Ahrens, Valerie Allain, Terry Amram, Norihisa Baba, Steve Beverly, Keith Bigelow, Karine Briand, Robert Campbell, Shui-Kai Chang, Les Clark, Sangaa Clark, Raymond Clarke, Chouki Cuewapur, Paul Dalzell, Nick Davies, Sylvester Diake, Steve Dunn, Karen Evans, Ulunga Fa'anunu, Alain Fonteneau, Nilesh Goundar, John Hampton, Shelton Harley, Arthur Hore, Simon Hoyle, David Itano, Charles Karnella, David Kirby, Pierre Kleiber, JeonRack Koh, Dale Kolody, Ludwig Kumoru, Chung-Hai Kwoh, Marc Labelle, Adam Langley, Patrick Lehodey, Antony Lewis, Chi-Chao Liu, Jacek Majkowski, Lara Manarangi-Trott, Sione Vailala Matoto, Joshua Mitchell, Naozumi Miyabe, Peter Miyake, Augustine Mohiba, Brett Molony, Dae-Yoon Moon, Antonio Mulipola, Hiroaki Okamoto, Brendon Pasisi, Kevin Piner, Cedric Ponsonnet, Chris Reid, Gary Sakagawa, Roberto Sarralde, John Sibert, Robert Skillman, SungKwon Soh, Max Stocker, Dan Su'a, Chi-Lu Sun, Bernard Thoulag, Lagi Toribau, Saimone Tuilaucala, Koji Uosaki, Yuji Uozumi, Peter Ward, Peter Williams, and Len-Fen Wu.

3. The Biology SWG adopted its agenda as outlined in Appendix I. The documents presented are listed in Annex III. A list of acronyms used in this report is included in Annex IV.

REPRODUCTIVE BIOLOGY

4. Chi-Lu Sun presented paper WCPFC-SC1 BI WP-1 *Reproductive biology of yellowfin tuna in the Central and Western Pacific*.

5. For 1613 fish examined for the yellowfin tuna (*Thunnus albacares*) caught by the Taiwanese offshore longline vessels from the tropical western Pacific Ocean and landed at the Tungkang fish market, September 2001 to September 2002, the sex ratio was about 1:1 but males became predominant after 138 cm fork length. Monthly variation in the gonad somatic indices, the mean diameter of the most advanced stage of oocytes, and the proportion of the developmental stages of ovaries were used to determine spawning season. The results showed that spawning occurred throughout the year with a peak in February and June. The predicted length at 50% maturity of females was 107.77 cm. On the basis of the proportion of females with postovulatory follicles, spawning frequency was estimated at an interval of 1.69 days for mature females and 1.33 days for reproductively active females, implying that reproductively active yellowfin tuna spawned almost daily. The average batch fecundity was estimated as 2.71 million oocytes, or 62.1 oocytes per gram of body weight.

6. In response to a question about how often a single yellowfin tuna may spawn during a season, it was pointed out that yellowfin tuna are multiple spawners and may spawn as frequently as every few days (1.33 on average). David Itano also pointed out the congruence of the current results with those obtained during a large-scale reproductive study he had undertaken during the late 1990s. In particular, the length at 50% maturity for both longline caught (107.2cm) and purse seine caught (108cm) yellowfin in equatorial regions found in this previous study were seen to be very similar to the result for the present study (107.7cm). He emphasised the need for sub-regional studies like the present as local oceanographic conditions can play an important role in the timing of spawning. On the other hand, it was also pointed out that studies undertaken in other

oceans had indicated that yellowfin tuna caught by purse seiners are usually more sexually active, implying that there may be changes in spawning behaviour based on vertical distribution in the water column.

FEEDING BIOLOGY

7. Valerie Allain from SPC presented WCPFC-SC1 BI WP-2 Diet of large pelagic predators of the western and Central Pacific Ocean.

8. To develop ecosystem modelling and ecosystem approach to fisheries management, a good comprehension of ecosystem dynamic is needed and it is mainly driven by trophic interactions between the components of this ecosystem. A large sampling programme over the western and central Pacific allows collecting stomach samples of tuna and bycatch species for diet analysis. The diet composition of bigeye, yellowfin, albacore and skipjack of the warm pool is presented. When classifying preys according to their depth distribution and behaviour, it appears that the diet is in agreement with what is known of the vertical behaviour of the tunas. Bigeye and albacore feed mainly on mesopelagic preys (200-400 m depth) while yellowfin and skipjack feed mainly in the epi-pelagic layer (0-200m depth). The mean length of the preys is different according to the predators and there is little overlap between the diets of the 4 species. Diet studies provide valuable information on basic biology and behaviour of the predators, but they are also an important parameter for ecosystem modelling and can be used as ecosystem indicators to detect changes in the ecosystem.

9. In response to a question about a similar study undertaken 30-40 years ago, V. Allain stated that she did have access to the results of this study but that there were some problems with the accuracy of the data. In response to a further query about whether the small proportion of epi-pelagic prey in their stomachs implied that bigeye did not spend much time feeding whilst in the epi-pelagic layer, it was pointed that that they may be feeding on the migratory meso-pelagic and bathy-pelagic prey during this time. It was acknowledged that there were differences in feeding behaviour by region but that samples were not large enough to ascertain whether there were also seasonal differences. It was pointed out that quickly digesting prey items such as oceanic anchovy could result in a bias in the proportion of items identified in stomachs. Given the large proportion of unidentified prey items in skipjack stomachs, V. Allain pointed out that they were suspected to be mainly fish and probably migratory meso-pelagic items. It was also queried as to whether the sampling method may also result in biases as bigeye caught deep during the day are likely to have different stomach contents to those caught shallow at night, as are fish caught on FADs or around logs. It was acknowledged that there are some differences, as differences are found in the proportion of empty stomachs sampled by gears. Finally, in response to a question about the results for albacore, it was pointed out that samples for 150 albacore that been collected, but that these were mainly from French Polynesia and New Caledonia, though the study could be augmented with the collection of more samples from observer programs in other areas.

BEHAVIOUR AND MOVEMENT

10. Gwenhael Allain from SPC presented WCPFC-SC1 BI WP-3 the influence of the environment on horizontal and vertical bigeye tuna movements investigated by analysis of archival tag records and ecosystem model outputs.

11. The influence of the environment on horizontal and vertical bigeye tuna (*Thunnus obesus*) movements was investigated by analysis of archival tag records (from the Coral Sea 1999-2002, Papua New Guinea, New Caledonia and Tonga waters 2002-2005) and SEAPODYM ecosystem model outputs. Horizontal movements were investigated on a 10-day scale and showed a high degree of residency in NW Coral Sea and around New Caledonia, a clear migration/dispersion

pattern by a few individuals in the Coral Sea (eastward in December, westward in July). The latitudes estimated for each individual were improved by comparison of temperatures recorded by the tags and extracted from ocean model outputs corresponding to the geolocation areas. Tag-recorded horizontal movements were used to validate the parameterisation of `bigeye habitat' in SEAPODYM (based on temperature and estimated forage biomass). Vertical movements exhibited two major seasonal behaviours that were significantly related to environment: a classic W-shaped feeding behaviour observed all year round, in which the dive depth during the day was related to the estimated deep forage abundance; a feeding and reproductive behaviour observed from August to November, in which tunas would target seasonal forage biomass concentrations, especially in warmer surface waters during the day. The precision of geolocation estimates (especially for PSAT data) and the gap in space-time scales between tag records and model outputs remain critical. The results will be used for the parameterisation of bigeye habitat in SEAPODYM and constitute a first stage towards the definition of a rule-based IBM of bigeye tuna movements in relation to their environment.

12. During the discussion of this paper it was pointed out that there is a high degree of uncertainty associated with the spatial location of fish tracked with archival tags due to uncertainties in the geo-location algorithms used. It was also pointed out that the fish tagged had generally been between 70-80 cm in length and had been recaptured up to 120 cm in length.

13. David Itano from PFRP presented WCPFC-SC1 BI WP-4 The use of FADs to monitor the behaviour and movements of tuna, billfish and pelagic sharks

14. The paper describes ongoing research funded by the Pelagic Fisheries Research Program in collaboration with the Institute for Research and Development (IRD, France). Rather than provide summarised results and discussion, the paper was compiled to demonstrate the utility of sonic tags to address FADrelated management concerns. Sonic tags are capable of locating the position of a tagged animal with great precision in contrast with archival tags (including popup satellite uploading archival tags).

15. Deepwater moored FADs (MFADs) surrounding the central Hawaiian island of Oahu have been converted into a passive listening station by attaching sonic receivers directly to the MFAD mooring systems, 18.3 m below the surface. The receiver network has been functional since August 2002 and will be maintained into the future, dependent on funding availability. Receivers record the presence of coded sonic tags when they are within approximately one km of the receiver-equipped MFAD (depending on tag model and battery size), thus providing accurate, fishery independent data for FADassociated species.

16. Coded sonic tags have been implanted into yellowfin and bigeye tuna to investigate FAD related residence times and inter-FADmovements. Recently, miniaturised depth sensing sonic tags have been implanted into small (<40 cm) and medium sized (>60 cm) yellowfin tuna in mixed-size and mixed-species FAD aggregations. Resulting data will be analysed to compare size-related vertical behaviour and trophic selectivity, as inferred by the gut sampling of tuna captured from the same aggregations. The project has recently begun to implant striped marlin (Tetrapterus audax) and oceanic whitetip shark (Carcharhinus longimanus) to investigate FAD utilisation and FAD associated behaviour of non-target top predators. This is the first known case of successful “out of water” implantation of electronic tags in billfish.

17. David Itano suggested the use of sonic tagging technology could represent a cost-effective means to obtain fishery independent residence time and vertical behaviour of target and non-target species found in association with FADs: information that may be useful to examine the impact of large-scale FAD arrays such as those that exist in Papua New Guinea, the Philippines and Indonesia. He further noted that FADs appear to have a dramatic influence on the “normal” behaviour of pelagic fishes with implications to vulnerability that need to be defined by region due to environmental differences (e.g. SST, vertical thermal structure, localised productivity, etc.)

18. H. Okamoto from National Research Institute of Far Seas Fisheries presented WCPFC-SC1 BI WP-5 Behavioural study of small bigeye and yellowfin tunas aggregated with floating object using ultrasonic coded transmitter.

19. Swimming behaviour of bigeye, yellowfin and skipjack tunas associated with floating object was observed using coded transmitters in the equatorial area of the central Pacific in 2001 (July) and 2003 (October to November). Tracking was conducted on nine floating objects and 160 fish attached with ID pinger (coded telemetry) were released and monitored. However, sufficient results were only obtained for fish released around two floating objects. For these two cases, several bigeye and yellowfin tuna individuals stayed relatively long period around the floating object and their diurnal swimming behaviour was observed. It seems that swimming depth of bigeye and yellowfin tunas was related with the depth of thermocline; both species mainly stayed between surface and just under the mixed layer, although several individuals especially bigeye tuna dived into or under the thermocline (maximum around 300m). Difference of swimming depth by fish size was partly observed but the difference was not clear because of insufficient coverage of fish size. Little data on skipjack tuna were obtained because they usually left the floating object shortly after being released.

20. During the ensuing discussion, it was noted that this study confirms that juvenile yellowfin tuna and bigeye tuna show very similar behavioural characteristics, although the vertical distributions of larger fish are different, with bigeye tuna able to swim across the thermocline, for example. A question was asked as to whether the long-term 'natural' behaviour was most relevant to gear selectivity, as compared to fish behaviour during the fishing operation. In response, it was stated that it is not considered to have a major impact, even though some differences in behaviour were apparently related to the fishing technique used. However, there is a need for a more neutral process, especially with respect to fish tracking. In similar studies, some participants reported apparent competition between the two species around FADs, with numerous yellowfin tuna limiting the presence of bigeye tuna, which would stay further away. However, this inter-specific competition would need to be further investigated.

21. K. Evans from CSIRO made a presentation of WCPFC-SC1 BI WP-6 Movement of bigeye tuna, *Thunnus obesus* determined from archival tag light-levels and sea surface temperatures together with WCPFC-SC1 BI WP-7 Behaviour and habitat preferences of bigeye tuna, *Thunnus obesus*, tagged in the western Coral Sea.

22. Conventional and archival tags were deployed on bigeye tuna (*Thunnus obesus*) in waters off the northeastern coast of Australia in the years 1999-2001 as part of a study investigating the movement patterns and habitat preferences of this species in the Coral Sea/western Pacific Ocean area. Of the 269 conventional tags (CTs) and 161 archival tags (ATs) released, 66 (24.5 %) and 17 (10.6 %) have been recovered respectively to date. Time at liberty ranged from 16 to 1,441 days and tuna were recaptured between 9.6 to 7,873.2 nautical miles (nmi) from their place of release, with 90 % of all tagged fish recaptured within 150 NMI of their release position. Returns were seasonal in nature, reflecting CPUE within the domestic fishery and were similar to the results of previous conventional tagging studies in the area.

23. Light data retrieved from 14 of the ATs were used to generate estimates of longitude using light-based geolocation techniques. Because of substantial errors associated with light-based latitude estimates, sea surface temperature matching between those data collected by the tag and those determined using remote sensing was used to determine latitude. Latitude estimates were further refined using a movement filter. Calculated position estimates suggest that, for the large part, bigeye tuna remained within the area of release for the entire time at liberty. Only three fish with ATs and two fish with CTs undertook large scale movements into the greater Coral Sea and WCPO, with two recorded as returning to waters close to their release location. Limitations in the accuracy of geolocation derived position estimates confounded the establishment of finer-scale

movements, although comparisons with post-processing filtering techniques (SST-matched position estimates and Kalman filtered position estimates) suggest there may be some limited movements in a north-south direction.

24. The results of this study suggest that the east coast waters of Australia largely comprises localised populations of bigeye tuna, a proportion of which are transitory, either making cyclical large-scale movements east and into the broader WCPO before returning to the Coral Sea or dispersing into areas outside of the Coral Sea. The limitations of using light-based geolocation techniques to estimate location for a sub-tropical, deep-diving predator such as bigeye tuna are discussed.

25. With regard to behaviour, all individuals demonstrated a distinct diurnal pattern in behaviour and habitat preferences for a large proportion of time at liberty. During the day individuals were mostly distributed between 250-500 m, at water temperatures of 11 and 20°C and at dissolved oxygen levels of 2-4.5 ml/L-1. Daytime diving behaviour was typified by intermittent brief excursions from deeper waters up into shallower waters to re-warm muscles after time spent in cooler waters. At night the majority of time was spent at depths of less than 200 m, at water temperatures greater than 22°C and dissolved oxygen levels of 3-5 ml/L-1. Individuals made irregular excursions to depths greater than 985 m, experiencing temperatures as low as 2.5°C and dissolved oxygen levels of 1.5 ml/L-1. Behaviour and habitat preferences were marked by considerable individual, seasonal and spatial variation; however, separating seasonal variability from that associated with spatial variability was difficult. Individual's additionally demonstrated considerable variability in diving behaviour in association with the lunar cycle, often shifting preferred depths on those nights around the full moon to those slightly deeper than those throughout the rest of the lunar cycle. The considerable individual variation evident in both depth and water temperature preferences suggests a flexibility in the foraging strategies and physiology of individuals, allowing bigeye to maximise their ability to successfully forage in a patchy environment, whilst minimising competition with other tropical and subtropical tuna species for prey resources.

26. During the ensuing discussion, it was noted that the movement filter used in this study imposes constraints to limit the movements of fish to plausible cases in order to address the issue of errors associated with light-based latitude estimates.

27. One question was posed about the fishery from which the data were obtained and the ability to add historical data from other fisheries that have operated in the past within the Coral Sea since this region may appear to be of special interest with regard to bigeye tuna spawning in the WCPO. In response, it was underlined that all the vessels involved in the tagging process were longliners based in ports of the eastern coast of Australia. Recapture also involved New Caledonian and Taiwanese vessels. Some participants added that focusing on this region to address the issue of bigeye tuna spawning does not make much sense as the spawning appears to be opportunistic and driven by environmental conditions which could be in place in other parts of the WCPO.

TERMS OF REFERENCE

28. The convener submitted the BI-SWG draft TOR for discussion. No substantial issues were raised during the discussion except a modification of wording in the preamble for consistency reasons, "HMS" (highly migratory species) being replaced by the term "target and non-target species". The TOR proposed by the BI-SWG are:

> The general objective of the Biology Specialist Working Group is to improve our understanding of the biology of target and non-target species, in particular to provide quantitative estimates of key life history parameters and migration patterns for stock assessment purposes to the WCPFC Scientific Committee.

The functions of the Biology Specialist Working Group are to:

a. Provide a means for evaluating the suite of biological parameters for both target and non-target species;
b. Coordinate the basic research work critical to deal with both target and non-target species biology;
c. Identify key research priorities for future research; and
d. Make recommendations regarding research and biological parameters to support stock assessment.

29. It was also highlighted that the TOR are broad, and it will be up to the Scientific Committee to determine which tasks will be undertaken in order of priority annually.

WORK PROGRAMME FOR 2006

30. As a follow up to the presentations in this session, the Scientific Committee agreed on the necessity to undertake studies on the behaviour and movements of yellowfin tuna and bigeye tuna induced by the presence of FADs and other floating objects.

31. It was also pointed out that there is still unexplained discrepancy between growth parameters estimated by tagging and ageing studies for these species and future work should identify the cause of this.

32. Several participants highlighted the need to carry out studies on the biology of albacore in the South Pacific, as this is a target species of many fleets in the region, especially longliners from Pacific Island countries and territories. In particular, information regarding size at sexual maturity of albacore using modern histological techniques (rather than macroscopic staging) would be useful.

33. Further studies on sexual maturity and spawning of bigeye tuna are also required; in this regard histological data, some collected in the past, could be used.

34. Some domestic fleets of longliners also fish on billfish stocks and on sharks, which are therefore of special interest in the region due to the lack of information on key biological parameters. Further work is therefore required on the basic biology of these species.

SELECTION OF A CONVENOR

35. The BI-SWG recommended that C-L. Sun convene the BI-SWG in 2005-2007.

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APPENDIX I – AGENDA ADOPTED FOR USE AT THE FIRST MEETING OF THE BIOLOGY SWG

BIOLOGY – SPECIALIST WORKING GROUP
11 AUGUST 2005

1. INTRODUCTION – Chi-Lu Sun

2. SELECTION OF RAPPORTEURS

3. ADOPTION OF AGENDA

4. REPRODUCTIVE BIOLOGY
   BI WP-1: Reproductive biology of yellowfin tuna in the central and western Pacific.
   Discussion

5. FEEDING
   BI WP-2: Diet of large pelagic predators of the western and Central Pacific Ocean.
   Discussion

6. BEHAVIOR AND MOVEMENT
   BI WP-3: The influence of the environment on horizontal and vertical bigeye tuna movements investigated by analysis of archival tag records and ecosystem model outputs.
   Discussion
   BI WP-4: The use of FADs to monitor the behaviour and movements of tuna, billfish and pelagic sharks.
   Discussion
   BI WP-5: Behavioural study of small bigeye and yellowfin tunas aggregated with floating object using ultrasonic coded transmitter.
   Discussion
   BI WP-6: Movement of bigeye tuna (*Thunnus obesus*) determined from archival tag light levels and sea surface temperatures.
   Discussion
   BI WP-7: Behaviour and habitat preferences of bigeye tuna (*Thunnus obesus*) tagged in the western Coral Sea.
   Discussion

7. FUTURE PLANS
   a. Review BI-SWG draft TOR
   b. Tasks for 2006

8. PREPARATION OF REPORT

ANNEX IX - REPORT OF THE STOCK ASSESSMENT SPECIALIST WORKING GROUP

REPORT OF THE STOCK ASSESSMENT SPECIALIST WORKING GROUP

"I know that the human being and the fish can co-exist"

INTRODUCTION

1. The meeting of the Stock Assessment Specialist Working Group (SA-SWG) took place during August 11 (afternoon), and August 12 (all day), 2005 at the Secretariat of the Pacific Community in Noumea, New Caledonia.

2. Naozumi Miyabe and Max Stocker served as conveners of the inaugural meeting of the SA-SWG, with Shelton Harley, Dale Kolody, Keith Bigelow, Marc Labelle and Yuji Uozumi serving as rapporteurs. The meeting was attended by Robert Ahrens, Valerie Allain, Terry Amram, Norihisa Baba, Steve Beverly, Keith Bigelow, Karine Briand, Robert Campbell, Shui-Kai Chang, Les Clark, Sangaa Clark, Raymond Clarke, Chouki Cuewapur, Paul Dalzell, Nick Davies, Sylvester Diake, Steve Dunn, Regis Etaix-Bonnin, Karen Evans, Ulunga Fa'anunu, Alain Fonteneau, Nilesh Goundar, John Hampton, Shelton Harley, Arthur Hore, Simon Hoyle, David Itano, Charles Karnella, David Kirby, Pierre Kleiber, JeonRack Koh, Dale Kolody, Ludwig Kumoru, Chung-Hai Kwoh, Marc Labelle, Adam Langley, Patrick Lehodey, Antony Lewis, Chi-Chao Liu, Jacek Majkowski, Lara Manarangi-Trott, Sione Vailala Matoto, Joshua Mitchell, Peter Miyake, Augustine Mohiba, Brett Molony, Dae-Yoon Moon, Antonio Mulipola, Hiroaki Okamoto, Brendon Pasisi, Kevin Piner, Cedric Ponsonnet, Chris Reid, Gary Sakagawa, Roberto Sarralde, John Sibert, Robert Skillman, SungKwon Soh, Dan Su'a, Chi-Lu Sun, Bernard Thoulag, Lagi Toribau, Saimone Tuilaucala, Koji Uosaki, Yuji Uozumi, Peter Ward, Peter Williams, and Len-Fen Wu.

3. The provisional agenda, circulated prior to the meeting, received minor revisions and was adopted as attached in Appendix 1. The documents presented are listed in Annex III. A list of abbreviations and acronyms used is included in Annex IV.

4. On the basis of the presentation of relevant stock assessment papers and the discussions of the SA-SWG, the following stock status descriptions were developed for bigeye tuna, yellowfin tuna, skipjack tuna and South Pacific albacore.

LONGLINE CPUE INDICES FOR THE BIGEYE AND YELLOWFIN

5. Adam Langley presented WCPFC-SC1 SA WP-8 describing the longline CPUE indices for the bigeye and yellowfin assessments. The discussion focused on clarifications of the GLM and STATHBS and directions for future research. Area weighting of the MFCL regions was a substantial improvement in estimating relative abundance. The area weighting considered a period from 1960 to 1986 when the Japanese fleet conducted fishing over a large spatial extent and had fishing access to most EEZs in the WCPO. Future research included:

a. Incorporating albacore CPUE as a covariate in the GLM to represent targeting;
b. Considering finer scale data (e.g. 1 degree) for the STATHBS which would better describe mesoscale variability than the large scale (5 degree) approach; and
c. Deployment of time-depth-recorders (TDRs) to understand the vertical distribution of the longline gear.

6. There was discussion that substantial fisheries had developed in Regions 5 and 6 in recent years and future work on evaluating the relative abundance in different regions might consider alternative models (e.g. SEAPODYM) and data from other fisheries.

7. The paper recommended that the GLM should be used for the base case analyses, and this was endorsed by the SA-SWG. It was noted that the SHBS methodology was still in development and work in this area should continue.

BIGEYE TUNA STOCK ASSESSMENT

8. John Hampton presented WCPFC-SC1 SA WP-2; the MFCL based stock assessment of bigeye tuna in the WCPO. The bigeye tuna model is age-structured and spatially-structured (40 age-classes, 6 regions) and the catch, effort, size composition and tagging data used in the model are classified by fishery and quarterly time periods from 1952 through 2004.

9. A number of changes were made to the 2005 assessment compared to the 2004 assessment. Firstly, the spatial structure of the model was revised to more reasonably describe important ecological and fishery processes. Two of the more major changes related to analyses of CPUE data described in WCPFC-SC1 SA WP-8. The relative abundance of longline vulnerable biomass in each region of the model was estimated in a more objective manner, with estimated biomass better reflecting levels of relative CPUE in each region and the distribution of the stock. This year the GLM-standardised effort was used in the base case model instead of the SHBS-standardised effort because it is a more established methodology, less dependent on initial assumptions, and more consistent with some of the other observations from the fishery. The SHBS-standardised effort was considered as a sensitivity analysis. Other changes included: the relative weightings between longline size and effort data were revised; a cubic spline method was used to parameterise selectivity to obtain better model parsimony; a more appropriate prior for Stock-Recruit Relationship steepness parameter was specified; the impacts of the Stock-Recruit Relationship in the computation of unexploited population were incorporated; the addition of recent fishery data for longline (2003, and 2004 for some fleets) and purse seine (2004); natural mortality at age fixed; and, movement fixed among ages.

10. On the basis of all of the results presented in the assessment, it was concluded that maintenance of current levels of fishing mortality carries a high risk of overfishing. Should recruitment fall to average levels, current fishing mortality would result in stock reductions to near and possibly below MSY-based reference points.

11. The discussion focused on the data used in the stock assessment and some of the sources of uncertainty. It was indicated that for the purpose of the assessment, “current” referred to the average over the years 2001 – 2003. Also, while data for 2004 were incomplete it was not felt that this would greatly influence the conclusions. It was also noted that given the long time since the last major tagging programme, that the tagging data were not as informative to the model and that another large-scale tagging programme would provide information on movements, longevity, and some information on exploitation rates.

12. In response to a question regarding the main sources of uncertainty in the assessment, the following was noted: there are uncertainties in catches in juvenile fisheries (sampling error in observer and port sampling of purse seine catches), problems in the Indonesia/Philippines data (particularly the lack of historical size composition data); problems relating to changes in selectivity and catchability, the estimated increasing trends in estimated recruitment in Region 3 that are correlated with catches, and the inability to model (and lack of data on) time series changes in movement.

13. It was noted that there was some level of arbitrariness regarding the spatial regions in the model, but that the new regions more reasonably describe important ecological and fishery processes, but not necessarily the purse seine fisheries that take bigeye tuna. It was noted that environmental conditions and fishery management measures in adjacent regions could influence the distributions of fishing effort in the longline fishery.

14. It was noted that there were differences between the growth curves implied by tagging versus direct ageing data, and that this should be considered in future analyses. It was also noted that while it would be good to estimate age-specific natural mortality, the current estimates did not make biological sense and that future work in this area may focus on more parsimonious ways to estimate natural mortality at age (e.g. cubic splines or appropriate functional forms).

15. The SA-SWG noted that all model analyses were considered in developing the conclusions of the assessment, and that the conclusions accurately reflected the results presented.

PACIFIC-WIDE BIGEYE TUNA STOCK ASSESSMENT

16. John Hampton presented WCPFC-SC1 SA WP-2 (suppl.), describing comparisons of the WCP-WCP-CA and EPO stock assessment with the Pacific-wide model. There were substantial differences in estimated spawning biomass between the IATTC EPO assessment and the Pacific-wide assessment which were primarily thought to be related to the differences in growth assumed or estimated in each analysis, mean length at age, asymptotic length, and growth variation.

17. It was noted that while the trends in catch in each region were very similar, the catch by fleet was markedly different. In the EPO, the purse seine vessels take about at least half the catch, while in the WCP-CA, longline takes around 70% of the catch.

18. It was noted by several participants that there is considerable uncertainty regarding the levels of mixing of adult bigeye tuna around the boundary between the WCP-CA and EPO. This boundary goes through part of the major longline fishery and vessels fish on both sides of the line depending on environmental conditions and management measures. It was noted by the working group that in order to reduce this uncertainty that a tagging project directed bigeye tuna in these boundary waters was a high priority.

19. The SA-SWG concluded that this work should continue as part of the collaboration with the IATTC.

BIGEYE TUNA STOCK STATUS

20. On the basis of the assessment, the SA-SWG developed the following stock status description for bigeye tuna.

KEY ATTRIBUTES

21. Bigeye tuna are a relatively slow growing tuna that matures at approximately three to four years of age. Bigeye are known to grow to about 200 cm and over 180 kg when eight years or older. These and other characteristics make them less resilient to exploitation than skipjack and yellowfin tunas. They have a wide distribution between 40°N and 40°S (Figure B1) and vertically between surface and 500 m deep (occasionally to 1000 m) due to their tolerance of low oxygen levels and low temperatures. The geographical distribution of bigeye is continuous across the Pacific (Figure B1). However, it has been noted that there are areas of lower catch separating the principal fishing areas to the eastern (east of about 165°W-170°W) and the more western regions of the Pacific. It was also noted that though little information is available on mixing rates, the limited tag returns available suggest low mixing rates between the eastern and western Pacific. In consideration of this information, a Pacific-wide assessment has been conducted collaboratively by the SPC OFP and IATTC in addition to separate assessments for the areas of authority of the IATTC (by the IATTC) and the WCP-CA (by the SPC OFP). Large fish are caught mainly by longline, and these longline-caught bigeye are the most valuable among the tropical tunas. Juvenile fish tend to form mixed schools with skipjack and

yellowfin, which results in catches by the surface fishery, particularly in association with floating objects. Natural mortality is estimated to be relatively low compared with other tropical species.

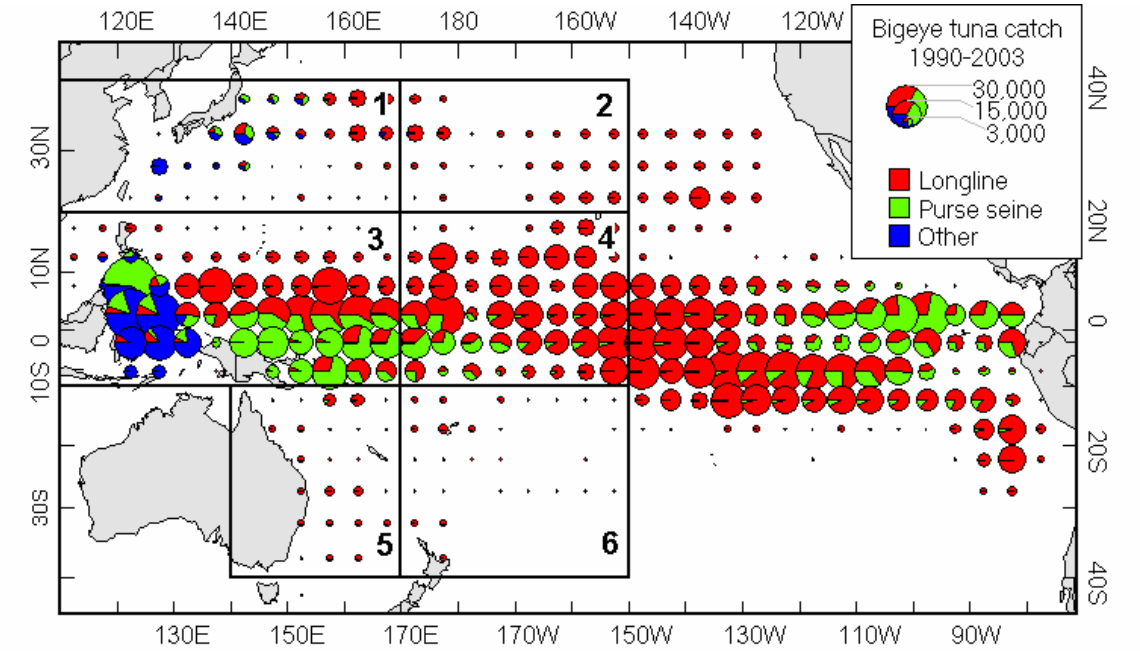

Figure B1. Distribution of bigeye tuna catch, 1990–2003. The spatial stratification used in the WCPO MULTIFAN-CL model is shown.

22. The majority of the catch is taken in equatorial areas, by both purse seine and longline, but with significant longline catch in some sub-tropical areas (east of Japan, north of Hawaii and the east coast of Australia). High catches are also presumed to be taken in the domestic artisanal fisheries of Philippines and Indonesia. These catches, along with small catches by pole-and-line vessels operating in various parts of the WCPO, have approached 20,000 mt in recent years. The statistical basis for the catch estimates in Philippines and Indonesia is weak; however, we have included the best available estimates in this analysis in the interests of providing the best possible coverage of bigeye tuna catches in the WCPO.

TRENDS – CATCH AND CPUE

23. The total bigeye tuna catch in the WCP-CA for 2004 was over 125,000 mt. This represents 52% of the total Pacific catch in the same year. Available statistics (Figure B2) indicate that 67% of the WCPO catch was taken by longline, and most of the remainder by purse seine (20%) and by the domestic fisheries of Indonesia and Philippines and others (13%). The total catch of small bigeye tuna by the purse seine fishery is uncertain, as they are not systematically separated from yellowfin at the unloading sites nor recorded separately on fishing logs. Purse seine catch in 2004, estimated through the statistical analysis of sampling data, was estimated to be 24,790 mt, the fifth consecutive drop in catch since the record in 1999 (38,327 mt), and directly related to reduced drifting FAD use. The WCP–CA pole-and-line fishery has accounted for between 2,000–4,000 mt of bigeye catch annually over the past decade, and the "other" category, representing various gears in the Philippine, Indonesian 7and Japanese domestic fisheries, has accounted for about 11,000–15,000 mt in recent years.

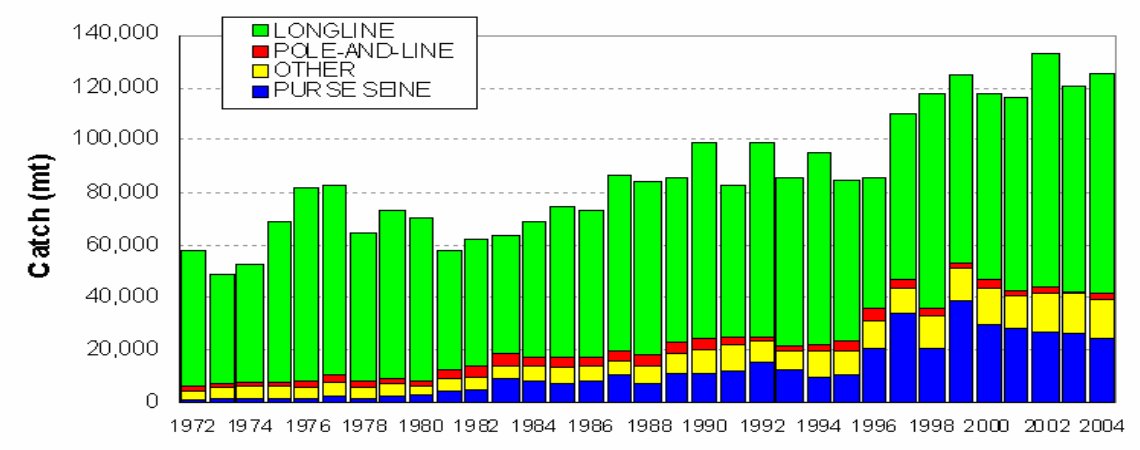

Figure B2. WCP-CA bigeye tuna catch by gear.

24. For the longline fisheries, two estimates of effective (or standardised) effort were derived in a separate study (WCPFC-SC1 SA WP-8). The effort series were standardised using a general linear model (GLM) and an unconstrained statistical habitat-based standardisation (SHBS). An additional series, FPOW, was implemented as the GLM series with a 1% per annum increase in longline efficiency and a 4% per annum increase in purse seine efficiency over time. The resulting time-series of standardised CPUE based on these models are shown in Figure B3.

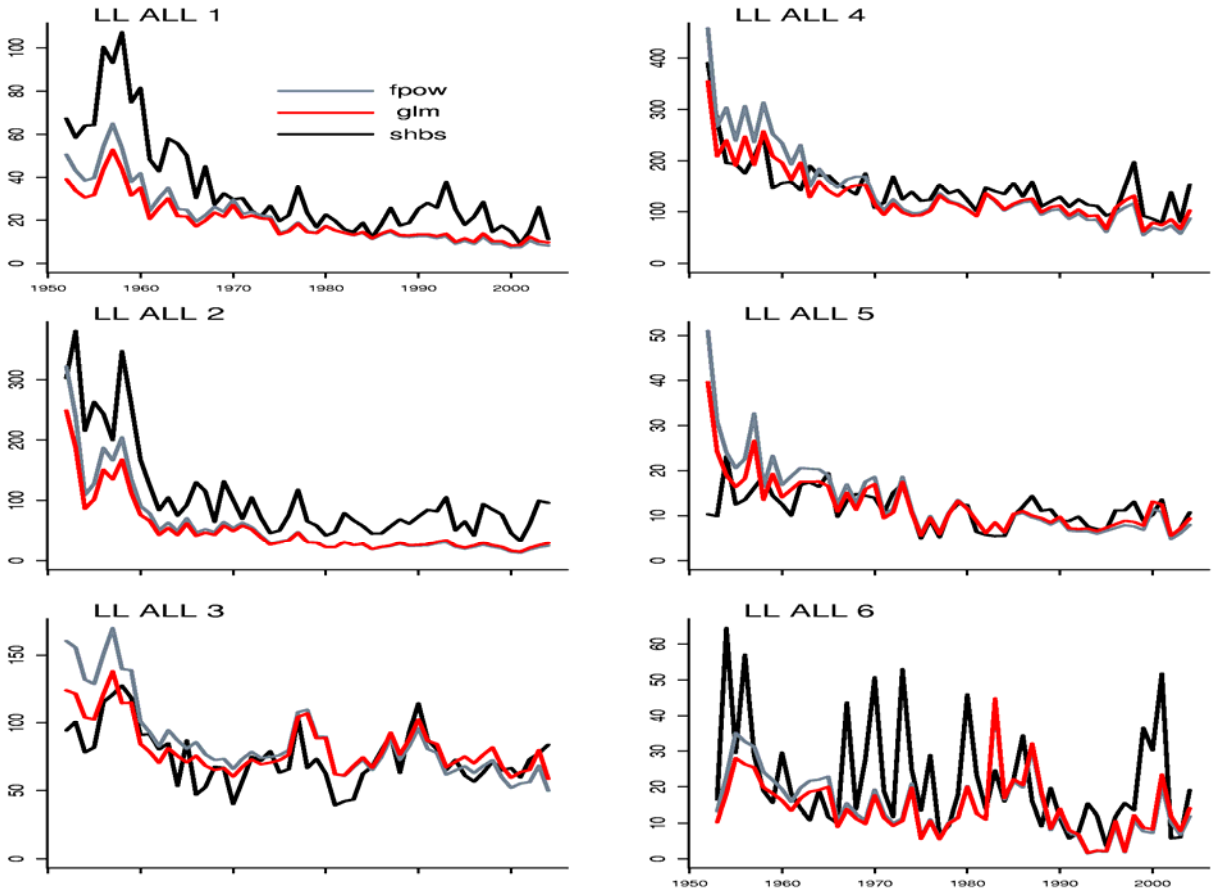

Figure B3. Catch-per-unit-effort (CPUE) for the longline fisheries LL1–LL6 standardised using three methodologies. GLM = general linear model; shbs = statistical habitat-based standardisation. Note that the FPOW series is also based on the GLM methodology.

SIZE OF FISH CAUGHT

25. Annual catch-at-size by major fisheries is shown in Figure B4. The longline fishery clearly accounts for most of the catch of large bigeye in the WCP–CA. This is in contrast to large yellowfin tuna, which (in addition to the longline gear) are also taken in significant amounts from unassociated (free-swimming) schools in the purse seine fishery and in the Philippines handline fishery. Large bigeye are very rarely taken in the WCPO purse seine fishery and only a relatively small amount come from the handline fishery in the Philippines. 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 relatively higher proportion of bigeye taken by associated purse seine sets in 1999 corresponds to stronger recruitment in that year. Bigeye sampled in the longline fishery are predominantly adult fish with a mean size of ~130 cm FL(range 80–160 cm FL), while the domestic surface fisheries of the Philippines and Indonesia take small bigeye in the range 20–60 cm.

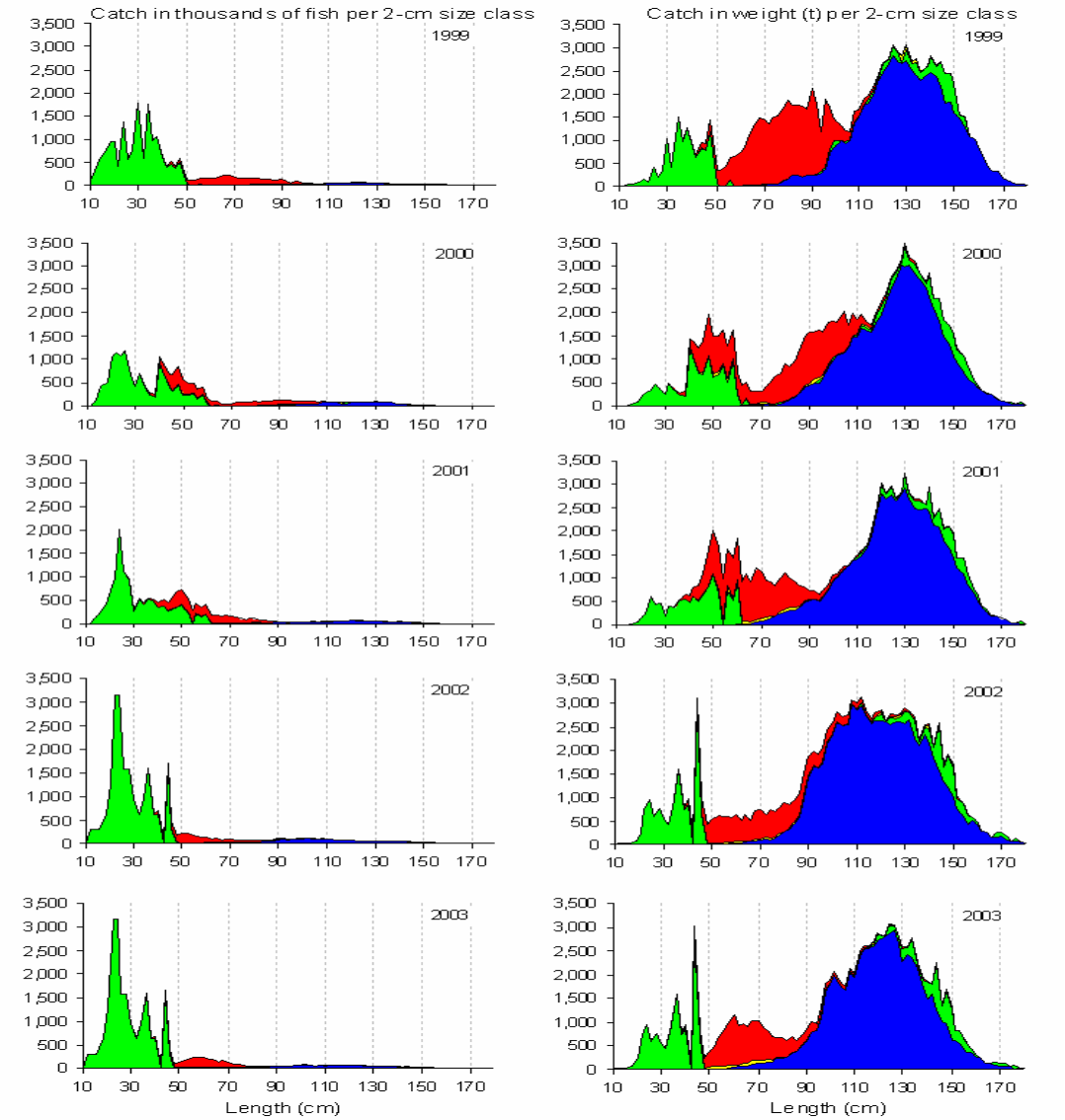

Figure B4. Annual catches of bigeye tuna in the WCP-CA by size and gear type, 1999–2003 (blue–longline; green–Phil-Indo fisheries; red–purse seine associated; yellow–purse seine unassociated, Phil–Indo data carried over from 2002 to 2003).

STOCK ASSESSMENT OF BIGEYE TUNA

26. The stock assessment (WCPFC-SC1 SA WP-2) was conducted using the statistical model MFCL applied to data for the WCPO, as has been done in recent years.

27. A number of changes were made to the 2005 assessment compared to the 2004 assessment. Firstly, the spatial structure of the model was revised to be more consistent with important ecological and fishery processes. Two of the more major changes related to analyses of CPUE data described in WCPFC-SC1 SA WP-8. The relative abundance of longline vulnerable biomass in each region of the model was estimated in a more objective manner, with estimated biomass better reflecting levels of catch in each region. This year the GLM-standardised effort was used in the base case model instead of the SHBS-standardised effort because it is a more established methodology, less dependent on initial assumptions, and more consistent with some of the other observations from the fishery. The SHBS-standardised effort was considered as a sensitivity analysis. Other changes included: revising the relative weightings between longline size and effort data; using a cubic spline to parameterise selectivity to obtain better model parsimony; specification of a weaker prior for Stock-Recruit Relationship steepness parameter; incorporation of the impacts of the Stock-Recruit Relationship in the computation of unexploited population; the addition of recent fishery data for longline (2003, and 2004 for some fleets) and purse seine (2004); natural mortality at age fixed; and movement fixed among ages.

28. The analysis for which GLM effort was used and natural mortality at age was fixed was designated as the base case analysis (GLM-MFIX). The results, shown below, were mostly taken from this base case, although results of other analyses were also referred to as sensitivity analyses where necessary.

RECRUITMENT

29. The GLM-MFIX recruitment estimates (aggregated by year for ease of display) for each region and the WCPO are shown in Figure B5. The regional estimates display large inter-annual variability and variation on longer time scales, as well as differences among regions. For the aggregated estimates, there is decreasing trend to about 1970 and an increasing trend thereafter. This pattern is similar to that estimated in last year's assessment. There are sharp initial declines in recruitment in several regions (1, 2 and 6), which are the model's response to the rapid declines in CPUE in these regions. The post-1970 increase in WCPO recruitment is due primarily constant longline CPUE in Region 3, while corresponding with a period of steadily increasing juvenile catch. This observation is consistent with previous WCPO bigeye assessments.

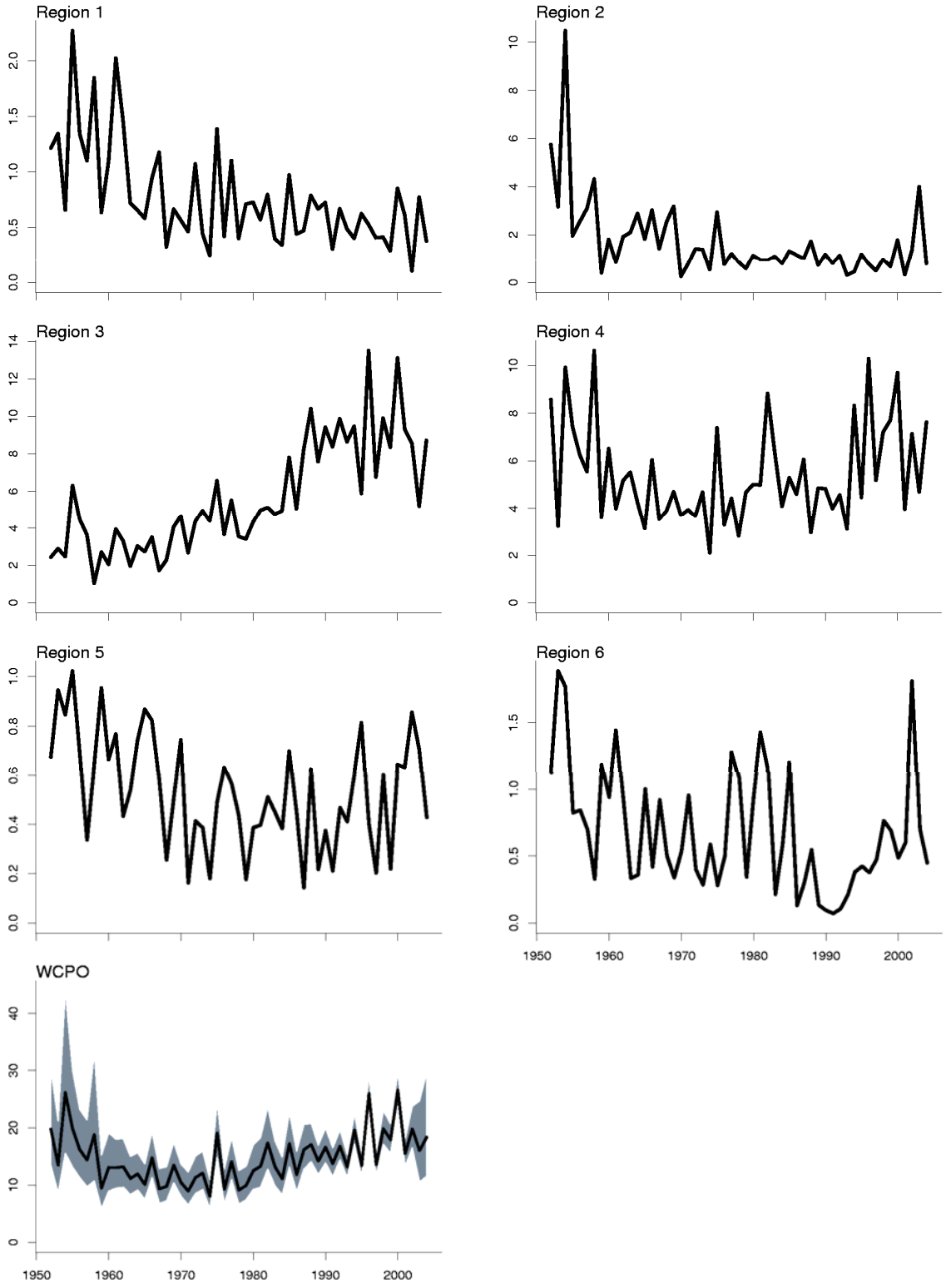

Figure B5. Estimated annual recruitment (millions) by region and for the WCPO (GLM-MFIX model). The shaded area for the WCPO indicates the approximate 95% confidence intervals.

30. Approximate 95% confidence intervals are provided for the aggregate WCPO recruitment estimates. Confidence intervals are wider in the early part of the time series because of the absence of fisheries targeting small fish and lower size frequency sample sizes. There is also the usual expansion in confidence intervals towards the end of the time-series where cohorts have experienced only a short period of exploitation.

31. A comparison of WCPO recruitment estimates for the different analyses is provided in Figure B6. All of the series have a similar time-series pattern, although there is considerable variation in absolute terms.

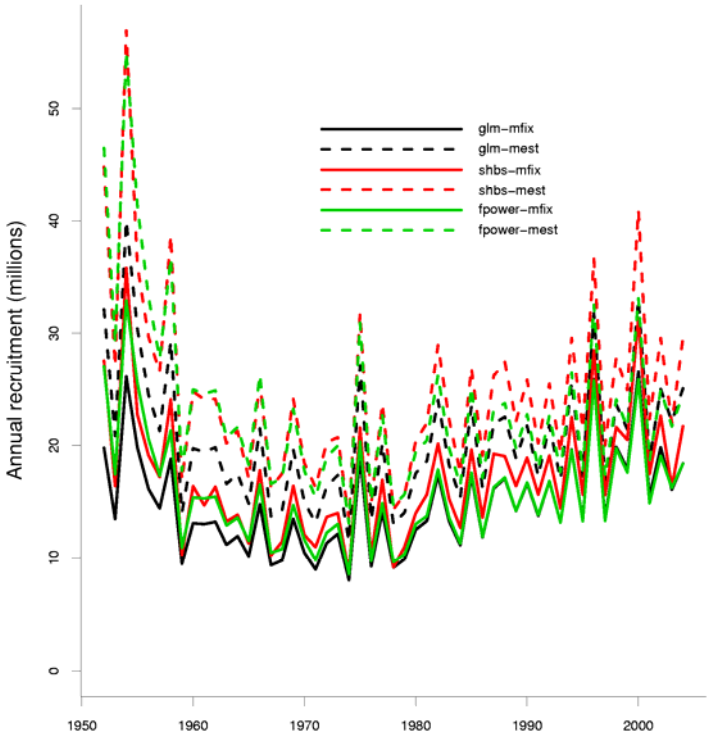

Figure B6. Estimated annual recruitment for the WCPO obtained from the separate analyses using different model options.

BIOMASS

32. Estimated biomass time-series for each region and for the WCPO are shown in Figure B7 for the base-case analysis. WCP-CA estimates of current biomass are largely comprised of fish in Regions 3 and 4. Biomass declines during the 1950s and 1960s in all regions, although there is an initial increase in regions 5 and 6. In Region 3, biomass recovers during the 1970s and 1980s before entering a sharp decline beginning in the mid-1990s. Overall, biomass is estimated to have declined, during the 1950s and early 1960s, to be stable during the 1970s and 1980s and to decline since the 1990s.

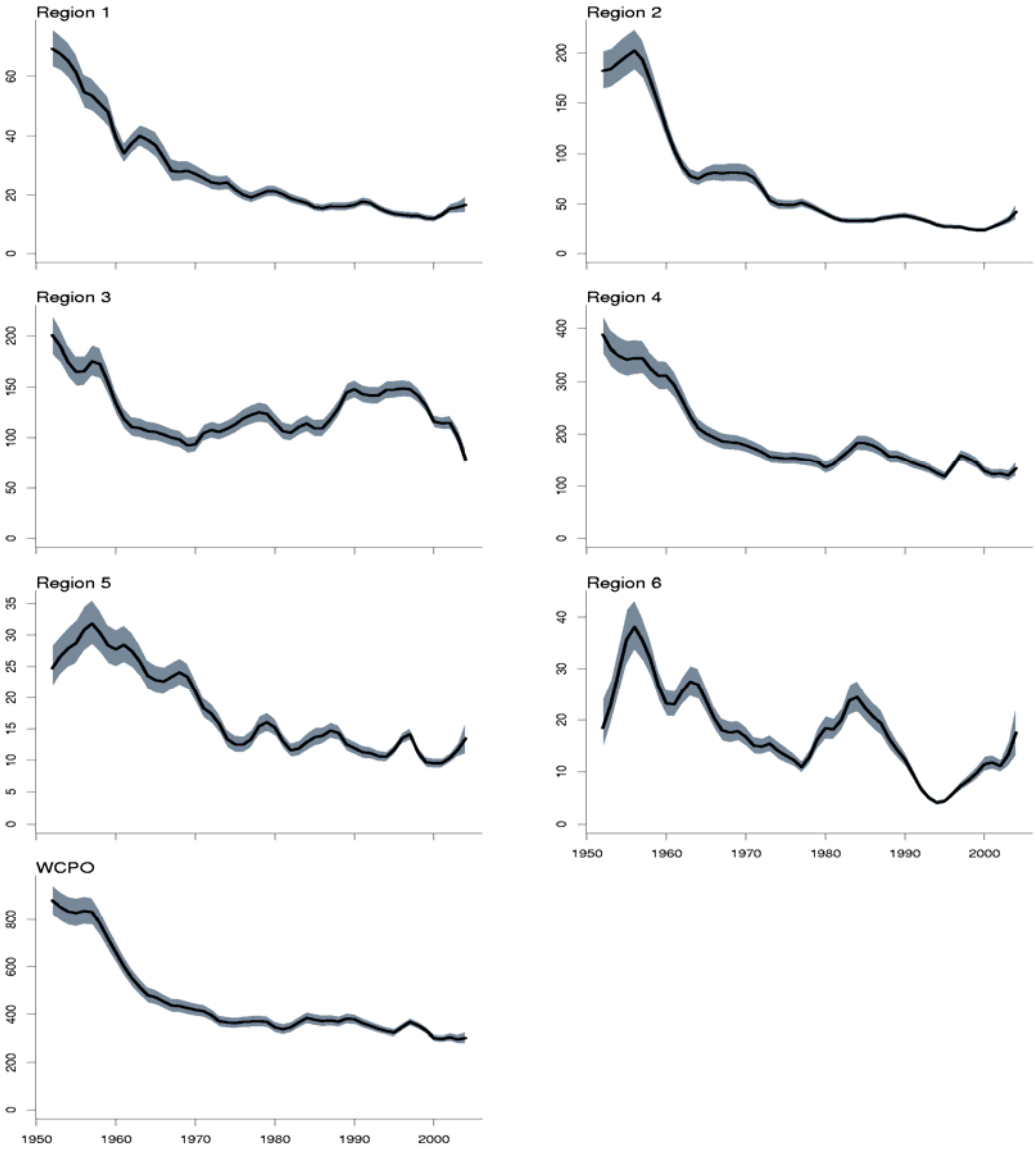

Figure B7. Estimated annual average total biomass (thousand mt) by region and for the WCPO (GLM-MFIX model). The shaded areas indicate the approximate 95% confidence intervals.

33. Total estimated annual average biomass of bigeye tuna in the WCPO indicated a similar declining pattern among different analyses, although the absolute level was different (Figure B8). The largest decline was observed in the FPOW analyses. In all analyses, the largest decline occurred during the late 1950s and the early 1960s, and it has been fairly stable thereafter. The impact on the results of using estimated or fixed natural mortality at age was negligible.

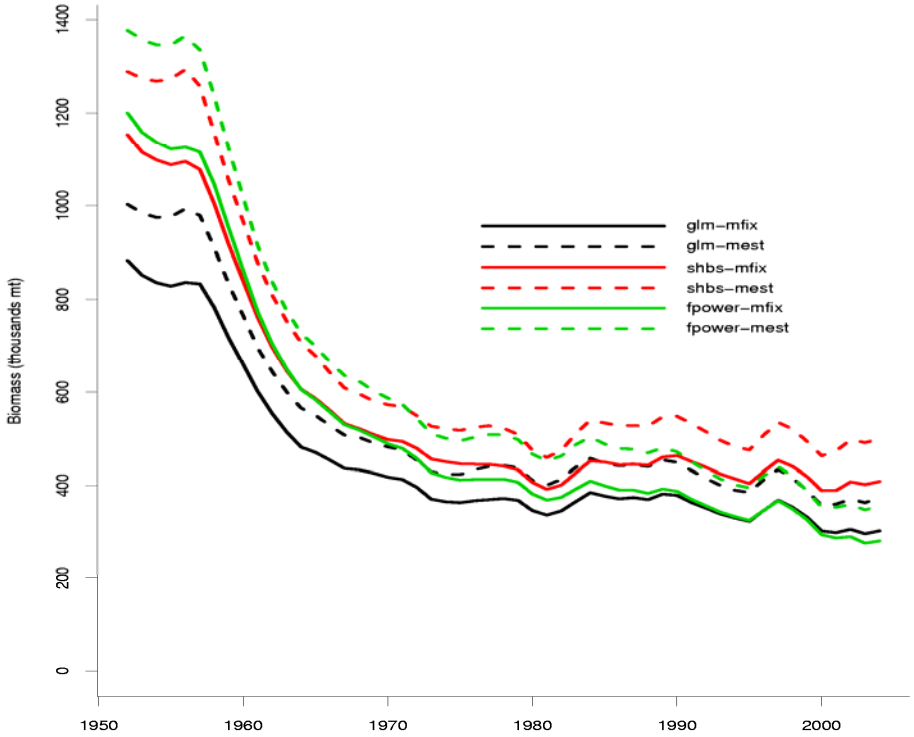

Figure B8. Estimated annual average total biomass (thousands of mt) for the WCPO obtained from the separate analyses using different model options.

FISHING MORTALITY

34. Average fishing mortality rates for juvenile and adult age-classes increase strongly throughout the time series in a similar fashion for all analyses (Figure B9). Fishing mortality on adult bigeye is higher than that for juvenile bigeye, consistent with the predominantly longline exploitation. The apparent drop in fishing mortality in the last year (2004) is due to incomplete catch and effort data for some fisheries.

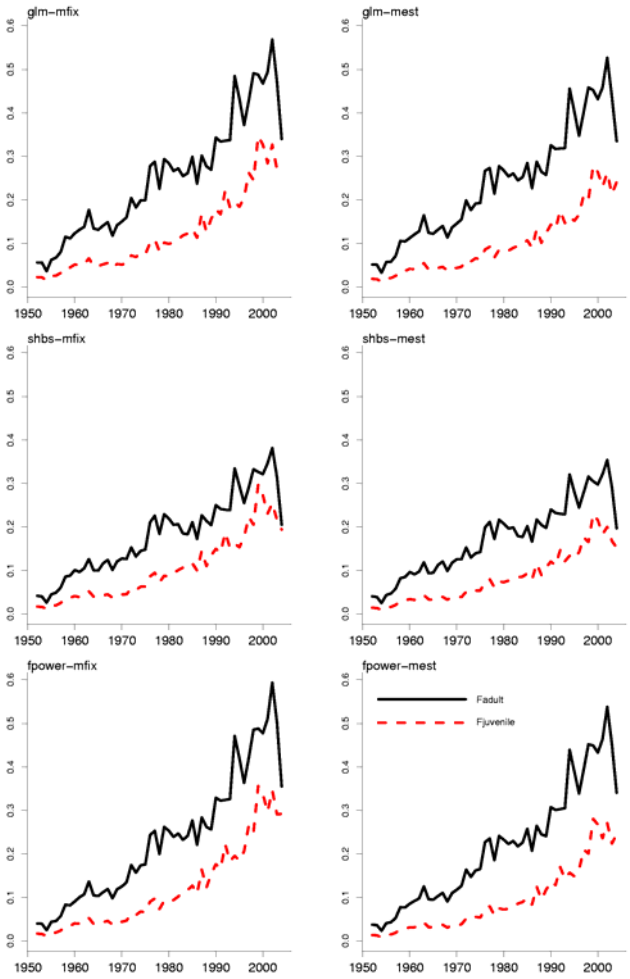

Figure B9. Estimated annual average juvenile and adult fishing mortality for the WCPO obtained from the separate analyses using different model options. The apparent drop in fishing mortality in the last year (2004) is due to incomplete catch and effort data for some fisheries.

35. Fishery impact analysis shows that the highest impacts on the bigeye stock occur in the tropical regions 3 and 4 (Figure B10), with up to 80% and 65% impact respectively. The longline fishery has the highest overall impact on the stock; however, the surface fisheries catching juvenile bigeye have high impact in the tropical regions. Overall fishing impact is approximately 65%.

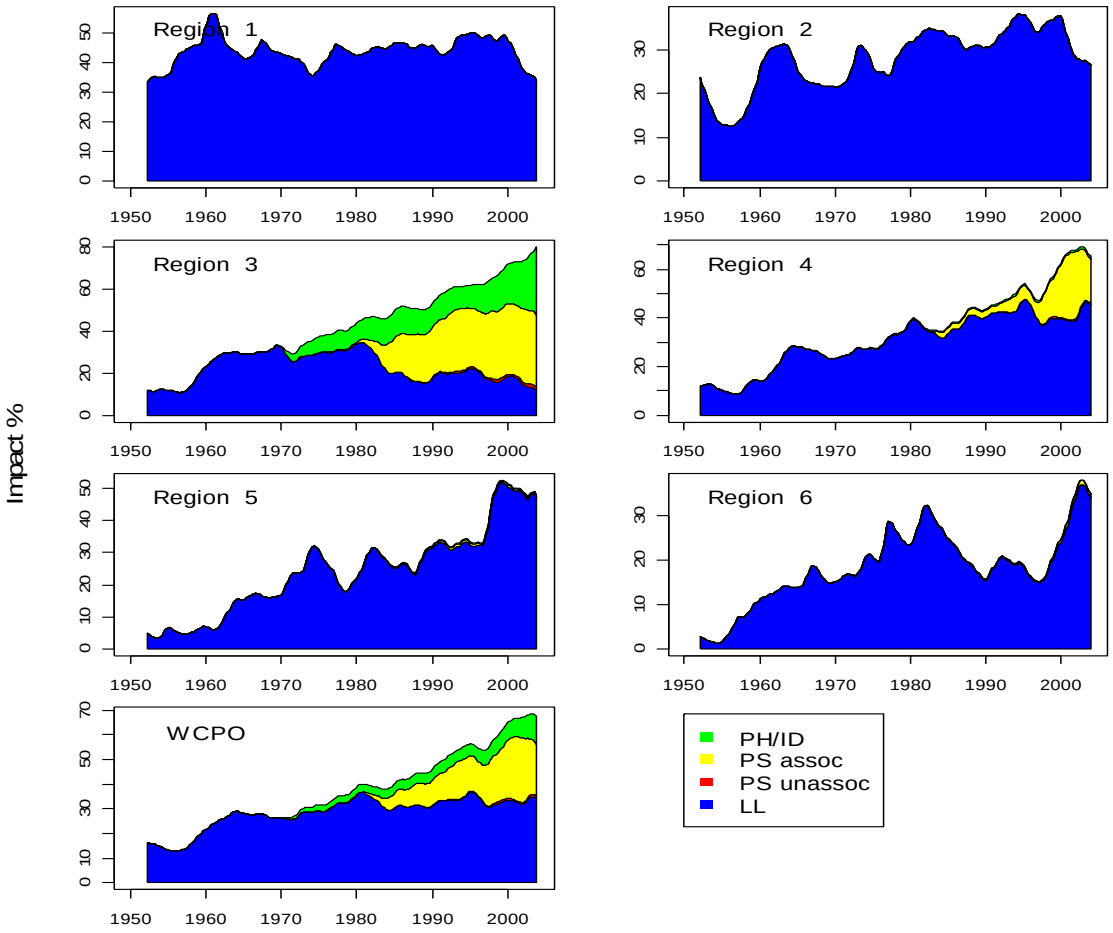

Figure B10. Estimates of reduction in total biomass due to fishing by region and for the WCPO attributed to various fishery groups. LL = all longline fisheries; ID = Indonesian domestic fishery; PH = Philippines domestic fisheries; PS FAD= purse seine FADsets; PS non-FAD= purse seine log and school sets.

STOCK STATUS FOR BIGEYE TUNA

36. The 2005 assessment results were reviewed and confirmed as consistent with the 2004 assessment, although the point estimates of some reference points were slightly more pessimistic in this assessment (Table B1). The current fishing mortality (i.e. the average for 2001-2003) is estimated to be above to MSY level ($F_{current}>F_{MSY}$; overfishing is occurring) (the base case and three of five sensitivity analyses; Table B1 and Figure B11) and the current biomass to be above the MSY level ($B_{current}>B_{MSY}$, not in an overfished state; Figure B12). However, the FPOW analyses were more pessimistic. Probability distributions for $F_{current}/F_{MSY}$ could not be undertaken this year due to technical issues and time constraints.

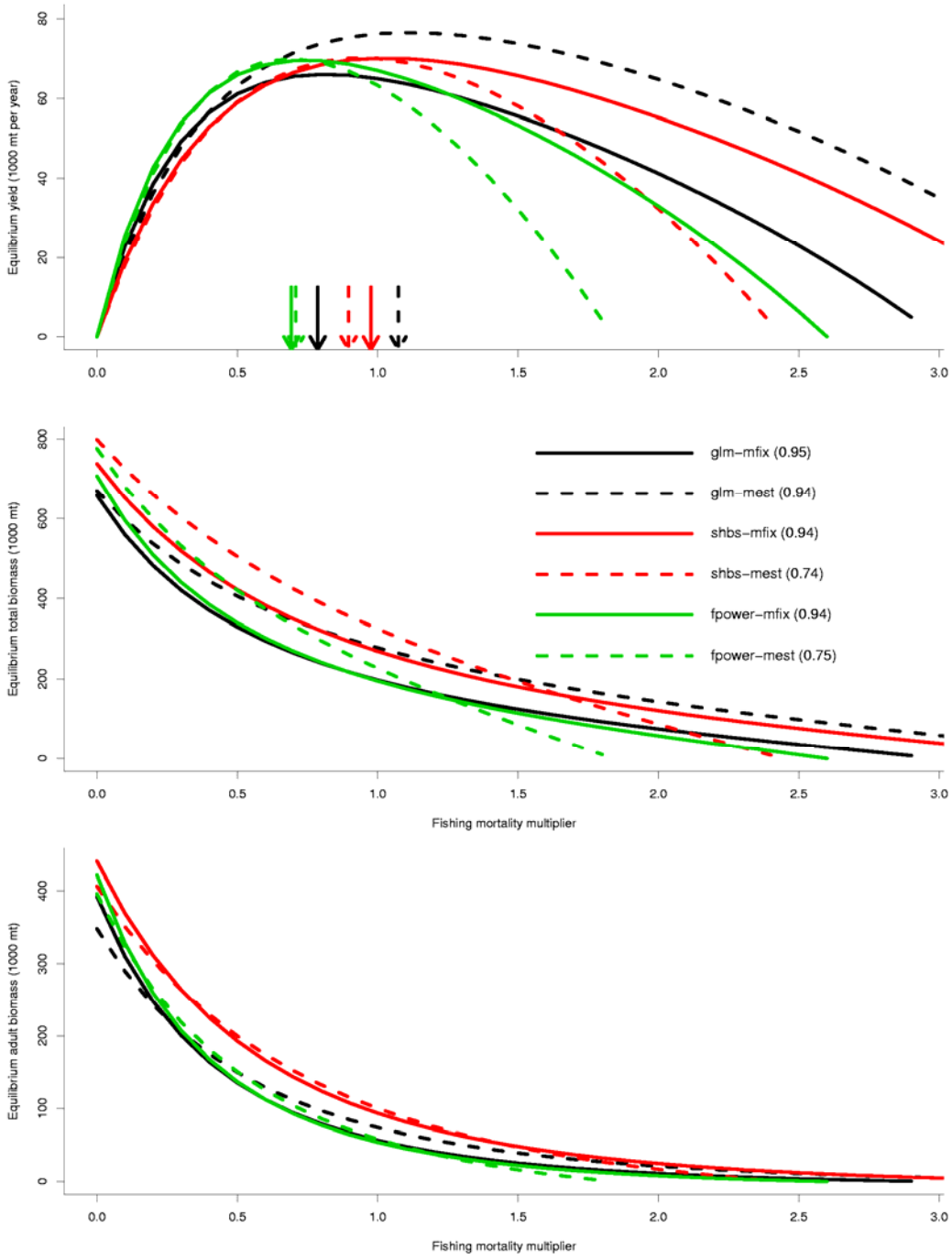

Figure B11. Yield curves estimated from the separate analyses using different model options. Arrows indicate corresponding F_{MSY} relative to the current fishing mortality multiplier and the estimate of steepness associated with each analysis are provided in the figure legend.

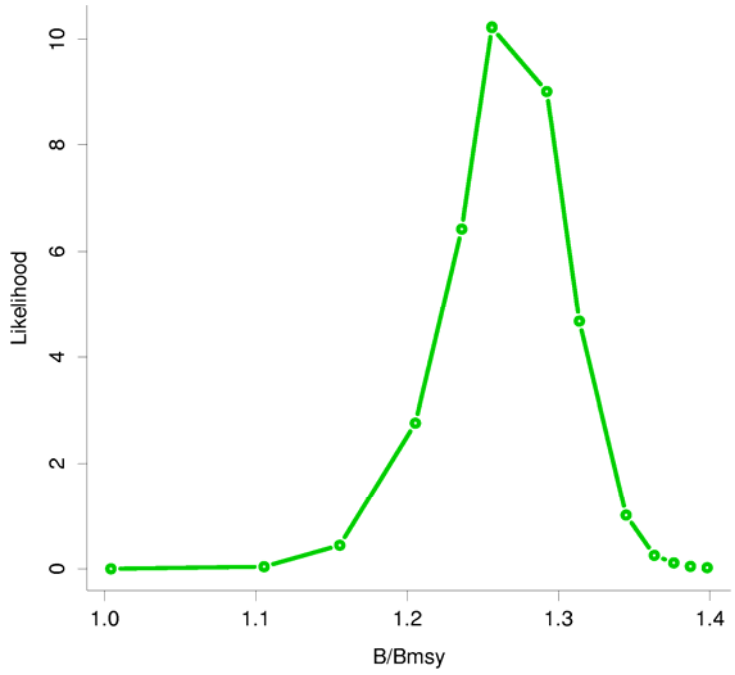

Figure B12: Probability distribution of $B_{current}/\widetilde{B}_{MSY}$ based on the likelihood profile method for the GLM-MFIX model.

37. Yields based on recent estimated average recruitment (1993-2004), which is substantially higher than the long-term average, are 75,000 – 120,000 mt from the range of assessment analyses.

38. According to the information provided by the IATTC, the spawning stock biomass of bigeye tuna in the eastern Pacific Ocean (EPO) has now declined below the MSY level. The stock will likely remain in an overfished condition for some time because of high fishing mortality and low recruitment during the period 1999-2000. The annual meeting of the IATTC adopted several management measures aimed at preventing further decline and promoting recovery of the stock. It was noted that the longline fishery operates continuously across the tropical Pacific (Figure B1) and that collaborative research with the IATTC on Pacific-wide bigeye assessment should continue.

39. On the basis of the assessment results the SA-SWG concludes that current fishing mortality on the bigeye stock in the WCP-CA is near or above MSY levels, and that maintenance of current levels of fishing mortality will move the stock to an overfished state. This likelihood is increased should future recruitment fall back to average levels.

Table B1. Estimates of reference points based on the 2004 and 2005 bigeye tuna stock assessments (note that the base case used in the 2004 assessment was SHBS-MEST, whereas the base case used in the 2005 assessment was GLM-MFIX).

Management Quantity	2005 Assessment	2004 Assessment
Most Recent Catch	125,940 mt (2004) 2001-2003 range 102,000-115,000 mt	96,000 mt (2003)[10]
Maximum yield under recent average recruitment (1994-2003)	93,300 mt	-N/A-
MSY	66,000 ~ 76,000 mt	56,000 ~ 62,000 mt
$\mathbf{Y_{Fcurrent}}$ **/ MSY**	0.90 ~ 1.00	1.00
$\mathbf{B_{current}}$ **/** $\mathbf{B_{current,F=0}}$	0.31 ~ 0.51	0.41 ~ 0.43
Fcurrent / FMSY	Base case: 1.23 Range: 0.90 ~ 1.45	Base case: 0.98 Range: 0.89 ~ 1.02
$\mathbf{B_{current}}$ **/** $\mathbf{B_{MSY}}$	Base case: 1.25 Range: 1.06 ~ 1.48	Base case: 1.75 Range: 1.75 ~ 2.28

YELLOWFIN TUNA STOCK ASSESSMENT

40. Adam Langley presented the paper WCPFC-SC1 SA WP-1 Stock assessment of yellowfin tuna in the western and central Pacific Ocean. The 2005 stock assessment for yellowfin tuna in the western and central Pacific Ocean was implemented in MFCL. The yellowfin tuna model is age- and spatially structured (28 age-classes, 6 regions) and the catch, effort, size composition and tagging data used in the model are classified by 19 fisheries and quarterly time periods from 1952 through 2004. The following substantive changes were introduced from last year:

a. The weighting factors applied to convert Japanese longline-based CPUE indices from the different sub-regions into relative abundance indices were based on a newly developed formal analysis;
b. The model regions were redefined in consideration of Longhurst provinces and homogenous fishery units;
c. Selectivity was parameterised with a series of 5 evenly spaced nodes, interpolated across all age groups with a cubic spline;
d. The stock recruitment relationship steepness prior was relaxed;
e. Stock recruitment implications were introduced to unfished biomass calculations; and
f. The data set has been updated to include an additional year of data from key fisheries.

41. A range of sensitivity analyses was undertaken. Three series of standardised effort were derived the Japanese longline fishery: GLM, SHBS (statistical habitat-based) and FPOW (the GLM series with a 1% per annum increase in longline efficiency over time; 4% for purse seines). Natural mortality rates were either estimated constant with age (MEST) or fixed in an age-specific curve on the basis of biological data (MFIX). The three CPUE series were fit with each of the M options, for a total of 6 scenarios. The GLM-MFIX scenario was defined as the base case.

42. Overall, the GLM-based analyses were judged to be the most reliable, and intermediate in terms of assessment inferences to the optimistic SHBS and the pessimistic FPOW. The alternative CPUE interpretations had a much greater effect on results than the alternative M assumptions. It was

[10] Current estimate of 2003 catch; not the estimate used in the 2004 assessment.

noted that the values chosen for the FPOW analysis were somewhat arbitrary, but consistent with studies from other fisheries.

43. Biomass has declined to 0.33-0.52 of unfished levels, with exploitation rates rising steeply in the last decade. The dominant equatorial regions were the most heavily impacted by fishing (particularly the purse seine and Indonesia/Philippines fleets), while the peripheral sub-tropical regions were not estimated to be highly depleted. The main reference points from the stock assessment indicate that overfishing is probably occurring ($F_{current} \geq F_{MSY}$) while biomass is probably above that capable of producing MSY, except in the case of the FPOW sensitivity analyses. This is considerably more pessimistic than the 2004 assessment. Recruitment levels are estimated to have been marginally higher than the average in recent years, and the biomass will decline at current levels or recruitment and fishing mortality.

CHANGES TO 2005 ASSESSMENT MODEL

44. It was noted that the 2005 assessment was somewhat more pessimistic than 2004, and the relative importance of the structural modifications and updated data was questioned. The changes to the CPUE weightings among regions were recognised as being by far the most influential change, and it was agreed that the new methodology represented a substantial improvement over the previous year. It was clarified that these CPUE implications are directly applicable only to the Japanese catch rates, such that targeting issues in the other fleets would have a minimal effect on the assessment. A comparison between the Region 3 abundance (the biggest region) in the 2004 and 2005 assessments suggested that they were actually quite similar, with changes to the marginal areas accounting for the bulk of the differences in results for the aggregate WCPO.

45. Implications of the incomplete data for 2004 (missing Indonesia and Philippines) were thought to be minimal, because the model actually assumes effort exists for the most recent time periods, and estimates catches on this basis.

CPUE SENSITIVITY

46. The values of the FPOW assessment scenarios (1% per annum efficiency increases in longline and 4% for purse seine fleets) were questioned. These were recognised as arbitrary but plausible tests to examine the effects of industry developments that cannot be accounted for in effort standardisation (technology, skipper learning, etc). The validity of these scenarios can be evaluated in the context of the model inferences: the objective function suggests that the FPOW series are slightly more consistent with the other data than the GLM series, but the estimated stock recruitment productivity seems to be biologically implausible. Estimates of catchability trends in the 2004 assessment, suggested that a 4% efficiency increase was not unreasonable for some fleets. A similar value was quoted in relation to analyses of purse seine fisheries in the Indian Ocean, while this same study suggested longline catchability trends had both increased and decreased substantially over time.

47. It was re-iterated that more satisfactory approaches for understanding the uncertain relationship between catch rates and abundance, particularly in the early years of the Japanese fishery need to be developed to address potential problems like hyper-depletion.

TAGGING DATA

48. The importance of tag returns, and the low reporting rates estimated in the assessment were questioned. It was noted that a number of fisheries were estimated to have very low tag return rates, but these fisheries tended to be in the marginal areas, where very few tag returns would have been expected and the implications were likely to be trivial. The return rate estimates on the more important Indonesia and Philippine fisheries were of more concern, given that these priors were based on experiments. The source of the discrepancy is worth examining.

MOVEMENT UNCERTAINTY

49. It was recognised that the uncertainty in movement makes the estimated dynamics in the peripheral regions much more uncertain than the core area. These movement estimates are based on data, but many of the estimates are indirect (inferred from CPUE, catch-at-size and a few tags). There was no illustration of movement sensitivity to alternative assumptions.

MANAGEMENT ADVICE

50. It was noted that reference points would be informative relative to the individual sub-regions in addition to the global populations. However, since the model assumes a single spawning population, most of the usual key reference points cannot be properly defined in the context of sub-populations (except biomass trend which are usually provided).

MORTALITY ASSUMPTIONS

51. It was noted that the Indonesian fishery for very small (<1 kg) fish is unique in the world, and studies of natural mortality rates for those ages are inadequate. This potentially has important implications for the WCPO yellowfin tuna yield per recruit analyses.

YELLOWFIN TUNA STOCK STATUS

52. On the basis of the assessment, the SA-SWG developed the following stock status description for yellowfin tuna.

KEY ATTRIBUTES

53. Yellowfin tuna are fast growing, mature at about two years of age and are highly fecund. Yellowfin can grow to 180 cm in length and weigh over 100 kg when they are about six years of age or older. The majority of the catch is taken from the equatorial region where they are harvested with a range of gear types, predominantly purse seine and longline. Catches of yellowfin tuna represent the second largest component (21–27% since 1990) of the total annual catch of the four main target tuna species in the WCPO. For stock assessment purposes, yellowfin tuna are assumed to constitute a single stock in the WCPO.

TRENDS - CATCH AND EFFORT

54. Longline fisheries developed in the early 1950s with yellowfin tuna being the principal target species, though a major change took place after the mid-1970s with the increased targeting of bigeye tuna. Large-scale industrial purse seine fisheries developed in the early 1980s, principally targeting skipjack tuna but also taking large catches of yellowfin tuna. This development, together with increased catches by Indonesia and the Philippines, resulted in the yellowfin catches in the WCPO doubling from 200,000 to 400,000 mt between 1980 and 1990. Over the past decade, 40-60% of the total yellowfin catch each year has come from the purse seine fishery.

55. Since 1980, there have been large increases in the total catch of yellowfin with the development of the purse seine fishery. This has included a considerable catch of juvenile yellowfin associated with the FADfishery. In recent years catches in the purse seine fishery overall have declined from the record catch taken in 1998. The catches of juvenile yellowfin in the Philippine and Indonesian domestic fisheries have also increased significantly since 1990, with these increases continuing to 2003, although the magnitude of these catches is not well determined.

56. The 2004 catch (413,201 mt) was the lowest for several years (Figures Y1), due to a relatively low purse seine catch. 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, as catches returned to their pre-2001 level.

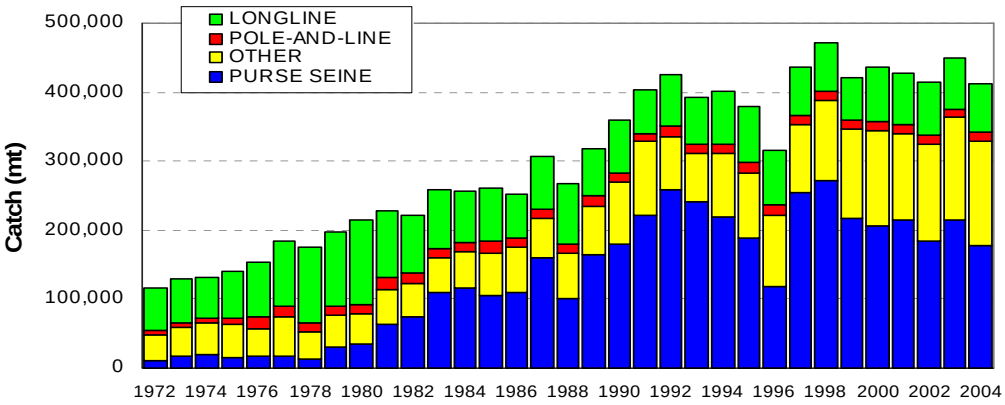

Figure Y1. Annual WCPO yellowfin catch (mt) by gear.

57. In the WCP–CA, purse seine typically harvests the majority of the yellowfin catch, which for 2004 was 179,310 mt (or 43% of the total WCP–CA yellowfin catch). The WCP–CA longline catch for 2004 was 70,757 mt (17% of the total WCP–CA yellowfin catch). In recent years, the yellowfin longline catch has ranged 61,000–80,000 mt, which is well below catches taken in the late 1970s to early 1980s (90,000–120,000 mt), presumably related to changes in targeting practices by some of the large fleets and the gradual reduction in the number of distant-water vessels. The pole-and-line fisheries took 12,253 mt (3% of the total yellowfin catch) during 2003, and 'other' category accounted for ~150,000 mt (which was 37% 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, handline and seine net) in the domestic fisheries of the Philippines and eastern Indonesia. Figure Y2 shows the distribution of yellowfin catch by gear type for the period 1990–2003 (longline data for Chinese-Taipei distant-water fleet is only available to 2003). As with skipjack, the great majority of the catch is taken in equatorial areas by large purse seine vessels, and a variety of gears in the Indonesian and Philippine fisheries.

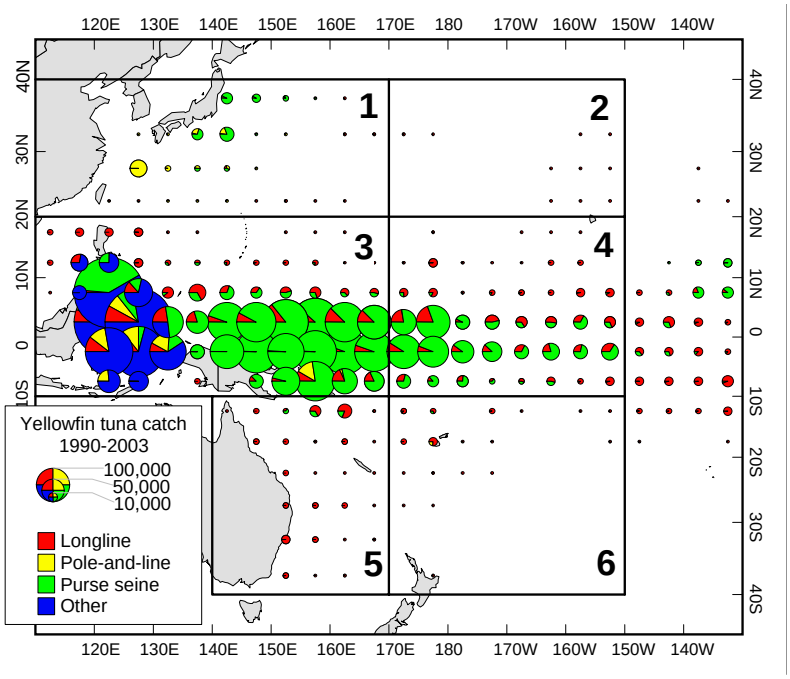

Figure Y2. Distribution of yellowfin tuna catch, 1990–2003.

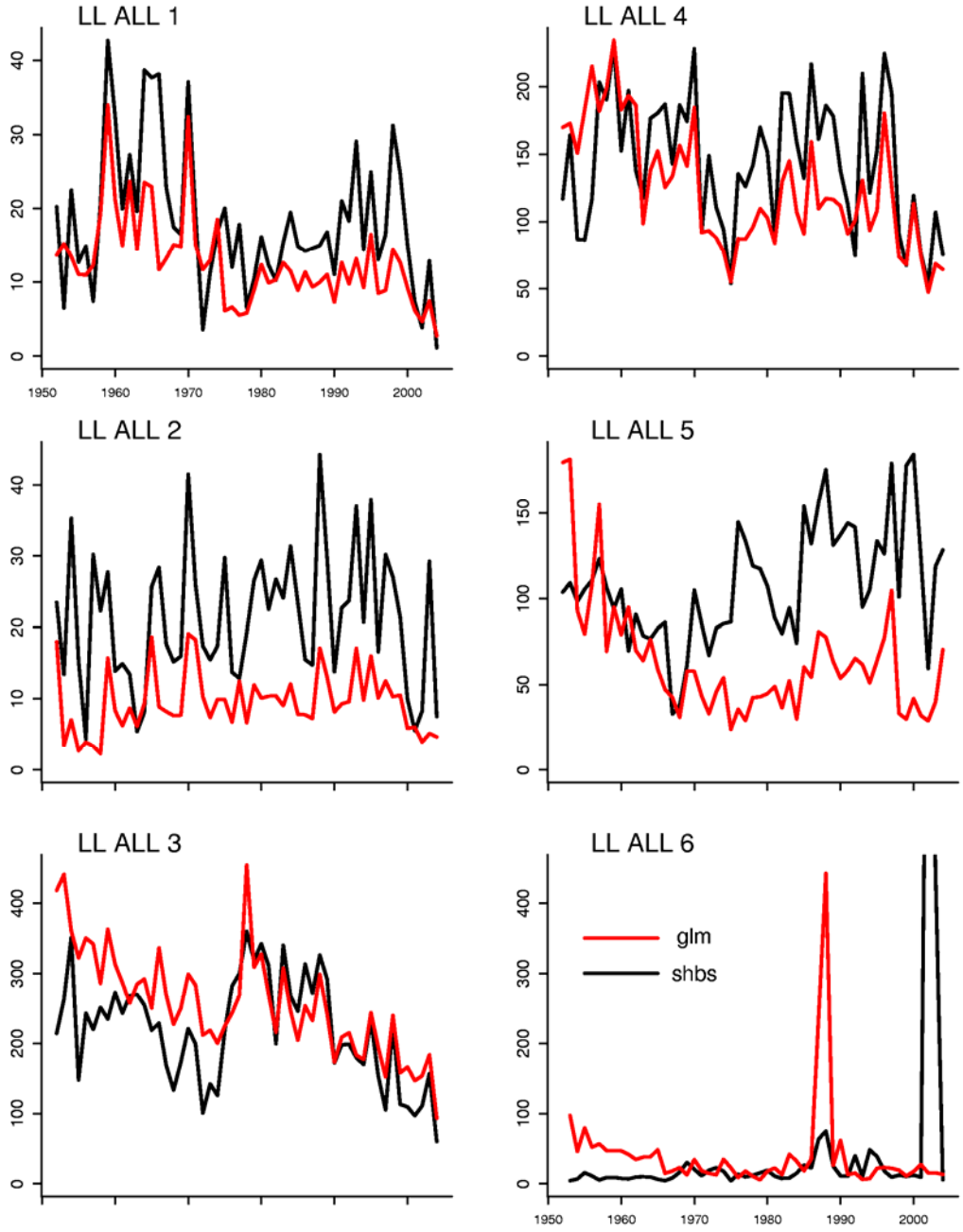

Figure Y3. Catch-per-unit-effort (CPUE) for the longline fisheries LL ALL 1–6 standardised using two different methodologies (GLM = general linear model; shbs = statistical habitat-based standardisation) and scaled by the respective region scalars.

58. Time-series of nominal catch rates for the Japanese longline fleet display high inter-annual variability and regional differences, with an overall decline since the early 1950s in the equatorial WCPO but little or no overall trend in more temperate regions. Time-series of standardised catch rates for this fleet also display regional differences, with large differences also seen between the different indices within several regions. The GLM based index displays similar (if sometimes smaller) trends to the nominal catch rates, while the statistical habitat based method (SHBS) predicted a considerable decline in effective effort and an increase in standardised CPUE (Figure Y3) from the late 1970s to the 1990s (the GLM-based standardisation was accepted as the preferable approach in 2005).

SIZE OF FISH CAUGHT

59. The domestic surface fisheries of the Philippines and Indonesia take large quantities of small yellowfin in the range 20–50 cm (Figure Y4). In the purse seine fishery, smaller yellowfin are caught in log and FADsets than in unassociated sets. A major portion of the purse seine catch in weight is adult (> 100 cm) yellowfin tuna, to the extent that the purse seine catch of adult yellowfin tuna is usually higher than the longline catch. Inter-annual variability in the size of yellowfin taken exists in all fisheries. The relatively high proportion of yellowfin taken from associated purse-seine sets during 1999 corresponds to strong recruitment, with the age class of fish taken in these years present as larger fish taken in the purse seine and longline fisheries in the following years. 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 Y2).

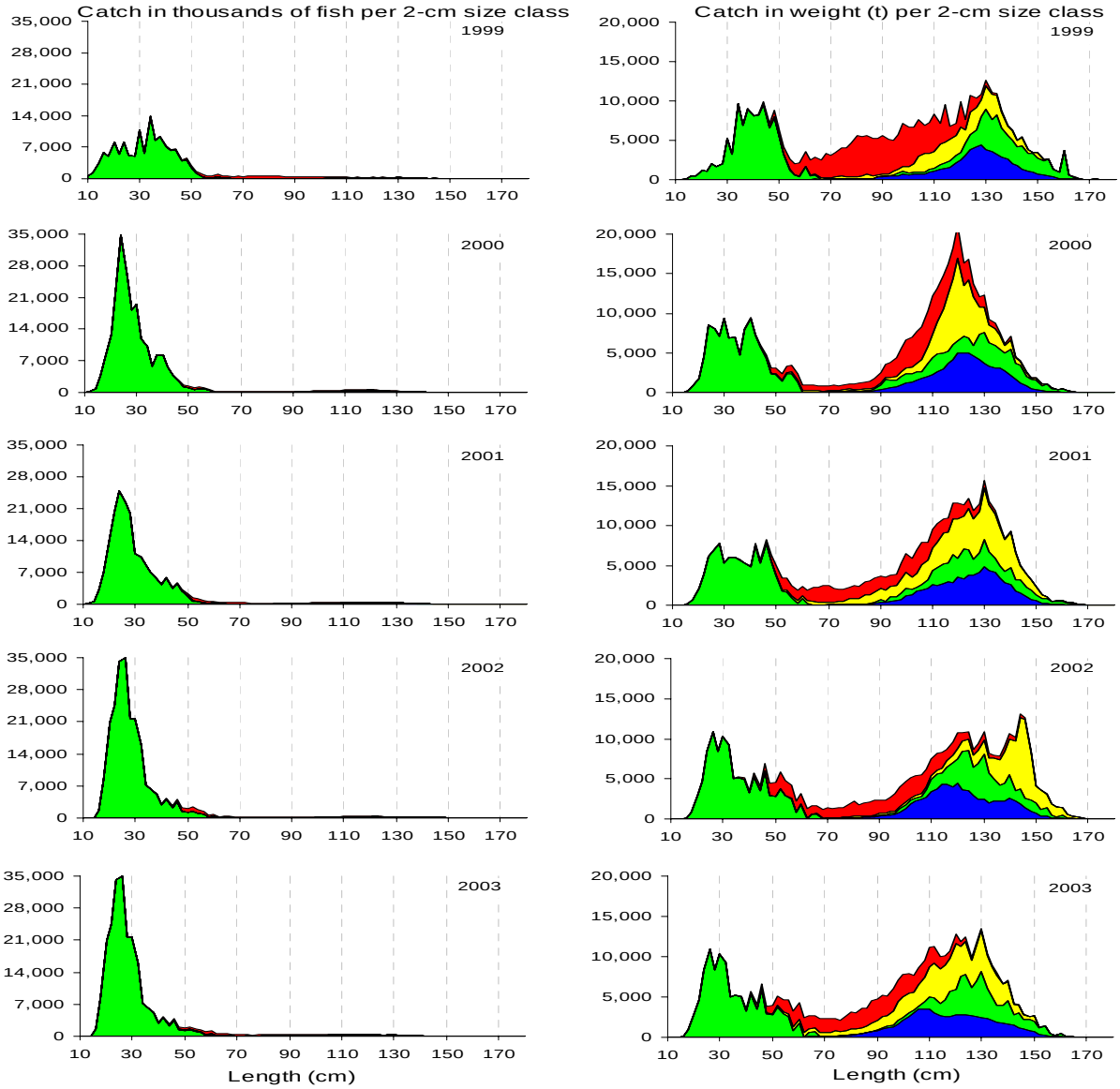

Figure Y4. Annual catches of yellowfin tuna in the WCPO by size and gear type, 1999–2003. (Blue–longline; green–Phil-Indo fisheries; red–purse seine associated; yellow–purse seine unassociated, Phil–Indo data carried over from 2002 to 2003).

STOCK ASSESSMENT

60. The stock assessment was conducted using the statistical model 'MFCL' applied to the yellowfin data for the WCPO as has been done in recent years. This year's MFCL analyses were made using three series of standardised effort based on the Japanese longline fishery, GLM, SHBS and FPOW (the latter implemented as the GLM series with a 1% per annum increase in efficiency of the longline fishery over time and a 4% per annum increase for the purse seine fishery). Natural mortality rates were either estimated constant with age (MEST) or fixed in an age-specific curve on the basis of biological data (MFIX). The three CPUE series were fitted with each of the M options, producing a total of 6 model analyses. The GLM-MFIX model was defined as the base case, and in the subsequent discussion, results and figures based on a single illustrative model refer to the estimates from this scenario unless otherwise indicated.

RECRUITMENT

61. Estimated recruitment numbers are sensitive to the standardised effort indices used in the assessment model, and assumptions made regarding natural mortality at age (Figure Y5). In general, estimates of recruitment were lower for model options using an assumption of fixed natural mortality compared to options where natural mortality at age was estimated. However, all options revealed temporal trends in recruitment. Initial recruitment was relatively high, declining to a lower level during the 1960s and early 1970s. Recruitment subsequently increased to higher levels beginning in the late 1970s (more dramatically for the SHBS models). Recruitment remained relatively high during the 1980s and 1990s. The recruitment indices also indicated that recruitment variability might have increased in recent years. The causes of the apparent changes in recruitment are unclear.

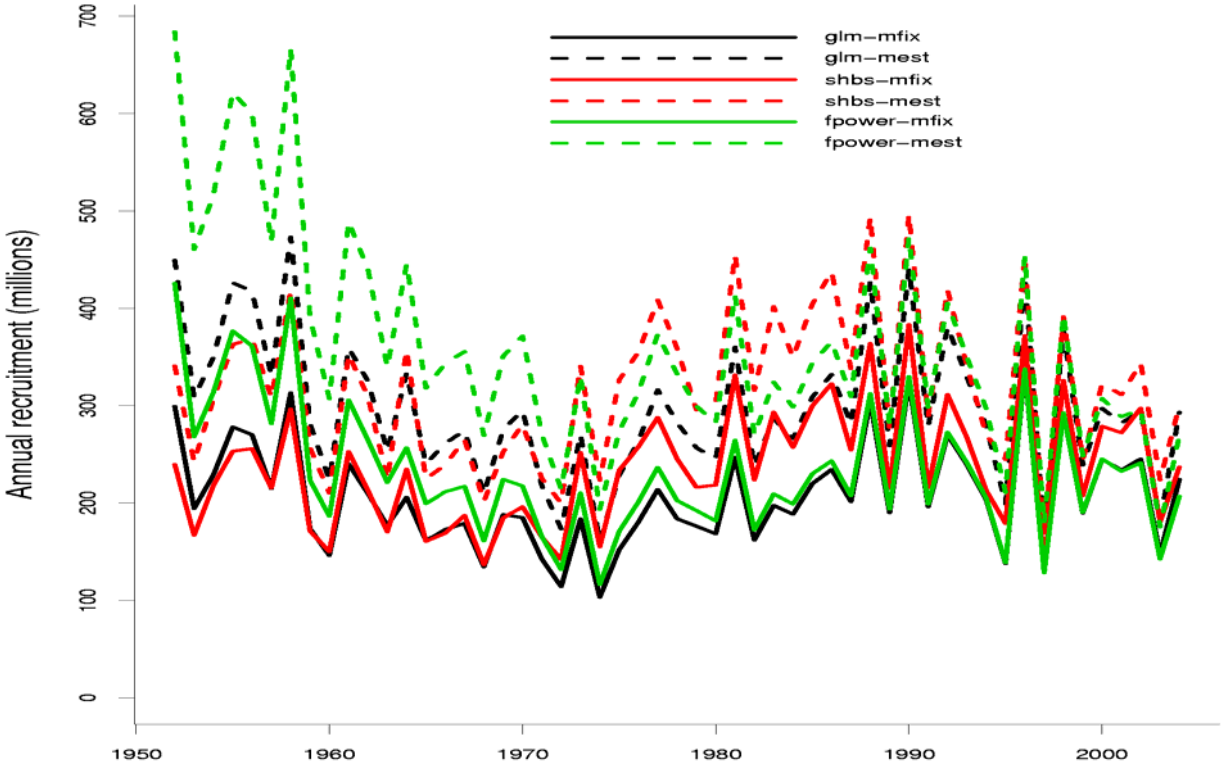

Figure Y5. Estimated annual recruitment for the WCPO obtained from the six different model options.

BIOMASS

62. The general trends in overall annual average biomass showed many similarities across the different model options, although there was considerable difference in the absolute biomass estimates (Figure Y6). The overall biomass decline was greatest for the FPOW models, and smallest for the SHBS models. Estimates of the current level of depletion of yellowfin in the WCPO indicate that the current biomass is 33-52% of the level estimated to have occurred in the absence of fishing. Depletion varies among regions, with the greatest amount in the equatorial regions.

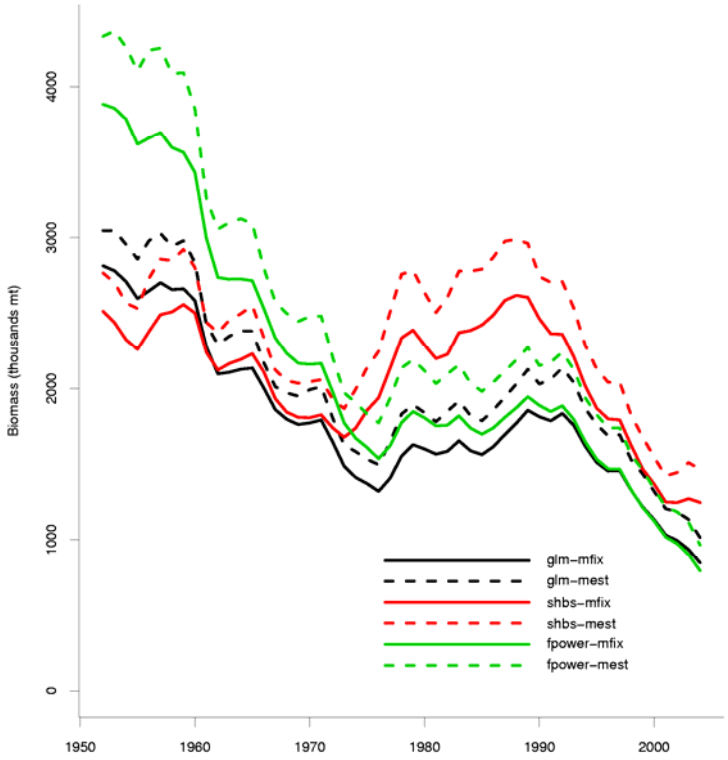

Figure Y6. Estimated annual average total biomass (thousand mt) for the WCPO obtained from the six different model options.

FISHING MORTALITY

63. Trends in estimated fishing mortality rates are shown in Figure Y7. Fishing mortality for both juveniles and adults is estimated to have increased continuously since the beginning of industrial tuna fishing, with significantly more rapid increases since the early 1990s. These increases are attributable to increased catches in purse seine fisheries and catches of juveniles in particular in the domestic Indonesian and Philippine fisheries, together with the declines in overall biomass over the past decade. Fishery impact analysis shows that the highest impacts on the yellowfin stock occur in tropical Regions 3 and 4 (Figure Y8), and the northern Region 1, although the relative biomass is lower. The longline fishery has relatively low impact on the stock, but the surface fisheries, particularly the Indonesian fishery, have high impact.

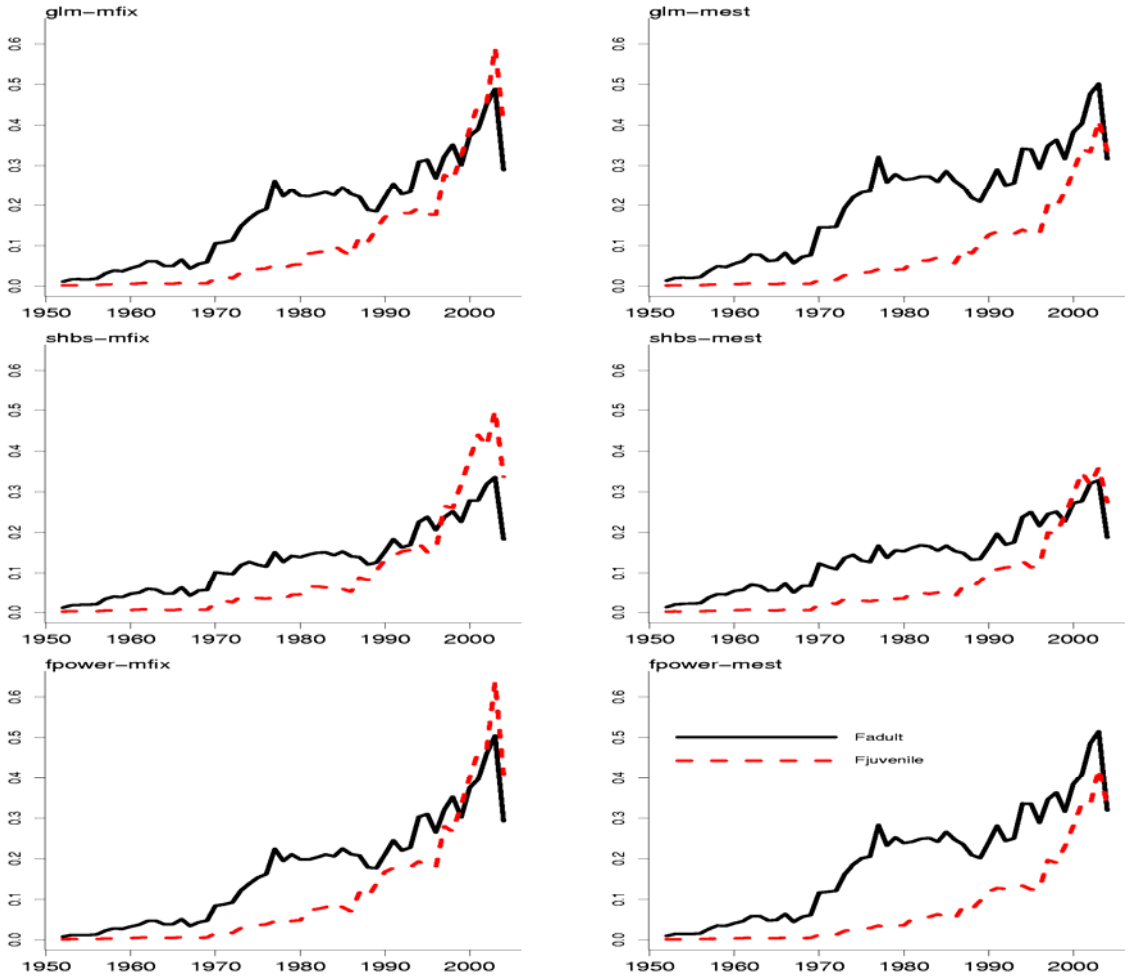

Figure Y7. Estimated annual average juvenile and adult fishing mortality for the WCPO obtained from the six separate model options. Note that the 2004 estimate is artificial, being due to incomplete data.

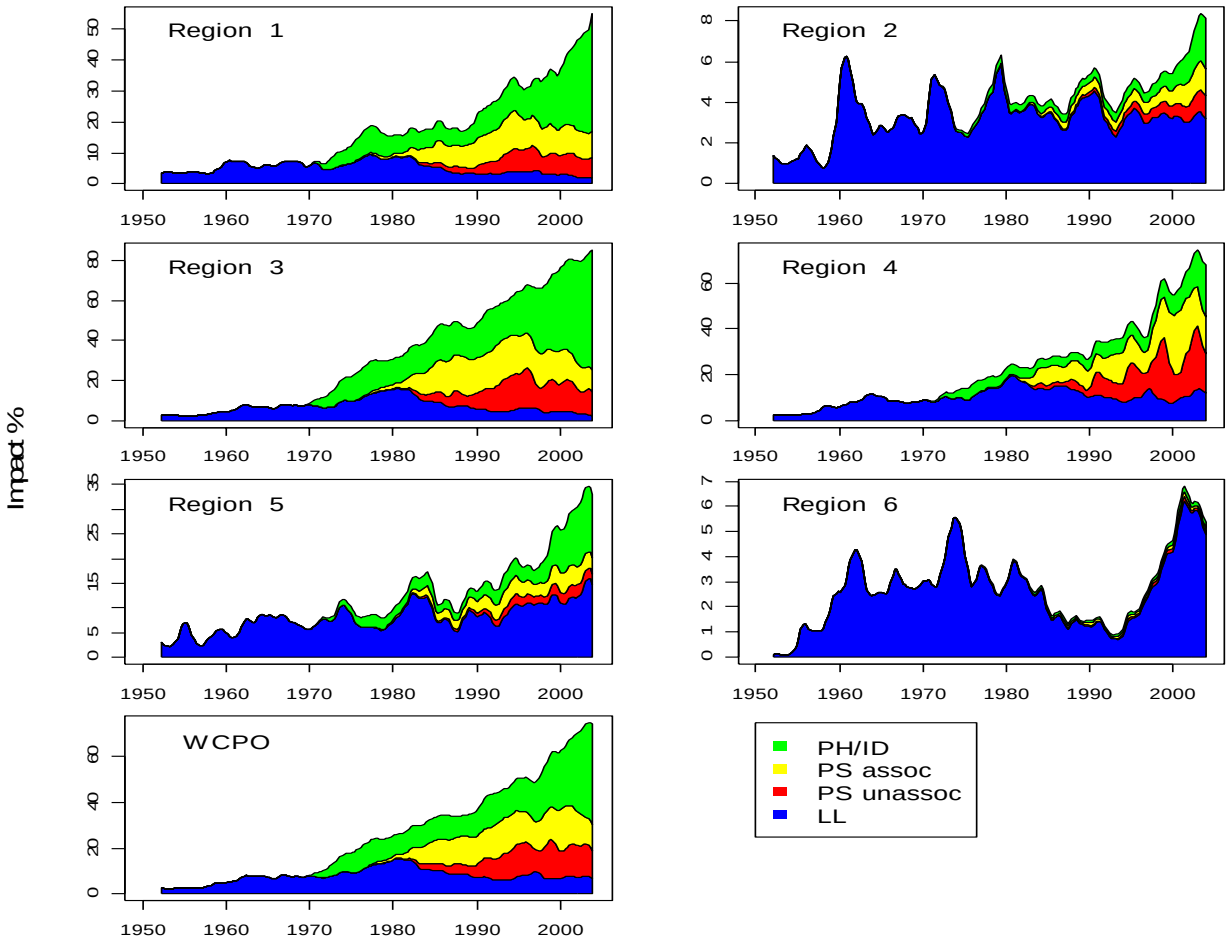

Figure Y8. Estimates of the fishery impact (fishery impact = 1-$B_t/B_{0,t}$) by region and for the WCPO attributed to various fishery groups. LL = all longline fisheries; ID = Indonesian domestic fishery; PH = Philippines domestic fisheries; PS assoc = purse seine associated sets; PS unassociated = purse seine unassociated sets.

STOCK STATUS FOR YELLOWFIN TUNA

64. The yellowfin assessment (WCPFC-SC1 SA WP-1) reviewed by the SA-SWG is more pessimistic than the previous assessment. This follows a reduction in the relative biomass attributed to the temperate areas and a change in estimated recruitment trends. Overfishing is likely occurring in the yellowfin stock in the WCPO ($F_{current}/F_{MSY} \geq 1$), but it might not yet be in an overfished state ($B_{current}/B_{MSY} > 1$ for most of the models explored) (Table Y1). This implies that fishing mortality at current levels will probably move the yellowfin stock to an overfished state.

65. Yield estimates (Figure Y9) indicate that the stock is fully or over-exploited with the current pattern of age-specific selectivity. The greatest impact from the fishery is in the equatorial region, while the temperate regions are estimated to be only lightly exploited. Furthermore, the attribution of depletion to various fisheries or groups of fisheries indicates that the Indonesian / Philippines fishery has the greatest impact, particularly in its home region (Figure Y8), but must also impact the other regions, to some extent, through migration (although the movement rates out of Region 3 are not estimated to be very large). The purse seine fishery has a lesser, but still substantial effect, particularly in the equatorial regions.

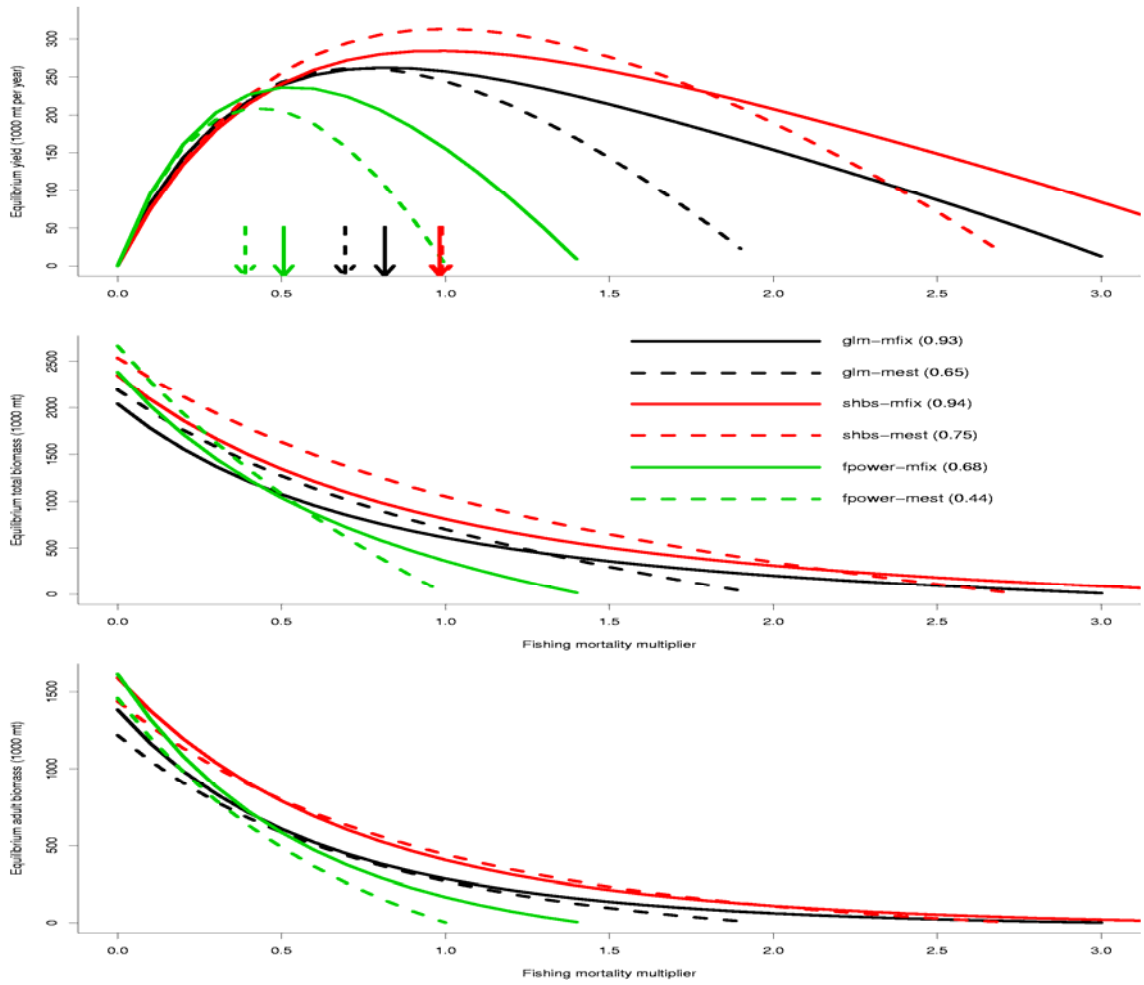

Figure Y9. Yield, equilibrium biomass and equilibrium spawning biomass as a function of fishing mortality multiplier obtained from the six separate model options. In the upper panel, the arrows indicate the value of the fishing mortality multiplier at maximum yield and the estimate of steepness associated with each analysis are provided in the figure legend.

66. It is important to note that the key reference points are sensitive to assumptions regarding the nature of the stock-recruitment relationship. An indication of the level of uncertainty is shown in the $B_{current} / \widetilde{B}_{MSY}$ likelihood profile (Figure Y10), although such an analysis does not capture all major sources of uncertainty. For future assessments, a comprehensive review of appropriate values of SRR steepness for yellowfin is required to determine appropriate values for inclusion in a range of sensitivity analyses. Another important source of uncertainty is the historical and current levels of catch from the Indonesian / Philippines fishery.

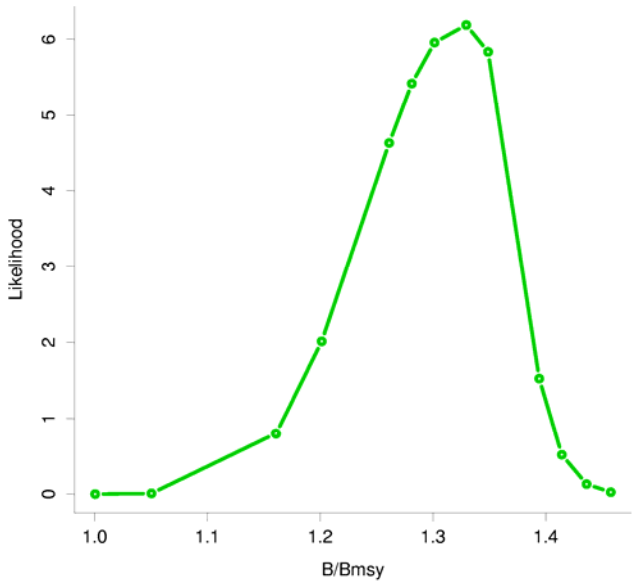

Figure Y10. Likelihood profile for $B_{current}/\widetilde{B}_{MSY}$ from the GLM-MFIX model.

67. In 2004, the SCTB made the recommendation that there be no further increases in fishing mortality (particularly on juvenile yellowfin) in the WCPO. The conclusions from the 2005 assessment are more severe in that it seems likely that catches need to be reduced to be sustainable in the long term.

Table Y1. Estimates of reference points based on the 2004 and 2005 stock assessments. Results from the model analysis, which estimated a very low value for steepness (FPOW-MEST) is not included in the table below (note that the base case used in the 2004 assessment was SHBS-MEST, whereas the base case used in the 2005 assessment was GLM-MFIX).

Management Quantity	2005 Assessment	2004 Assessment
Most Recent Catch	413,201 mt (2004) 2001-2003 range 376,000-443,000 mt	456,947 mt (2003)[11]
Maximum yield under recent average recruitment (1994-2003)	312,200 mt	-N/A-
MSY	236,000 ~ 313,000 mt	248,000 ~ 310,000 mt
$Y_{Fcurrent}$ / MSY	0.66 ~ 1.0	0.90 ~ 1.00
$B_{current}$ / $B_{current, F=0}$	0.33 ~ 0.52	0.51 ~ 0.67
Fcurrent / FMSY	Base case: 1.22 Range: 1.0 ~ 1.89	Base case: 0.63 Range: 0.63 ~ 1.11
$B_{current}$ / B_{MSY}	Base case: 1.32 Range: 0.93 ~ 1.55	Base case: 2.46 Range: 1.75 ~ 2.46

[11] Current estimate of 2003 catch; not the estimate used in the 2004 assessment

SKIPJACK TUNA STOCK ASSESSMENT

68. Adam Langley presented WCPFC-SC1 SA WP-4, the stock assessment of skipjack tuna. The large estimated biomass in region 4 was a concern as the catch is relatively minor. There is some demonstrated connectivity between the northern regions (1 & 2) and the tropical regions (5 & 6); however, the biomass in the subtropical region (4) may be unrealistic as tagging data in this region is relatively uninformative compared to the other regions.

69. Additional considerations on movement may be warranted. There are strong ENSO effects on the longitudinal distribution of skipjack, but movement is currently parameterised as seasonal with no time-series trend. Regions 5 and 6 could be combined to eliminate the ENSO movement signals, but it may be preferable to retain the disaggregated structure. The CPUE and effort standardisation for the Japanese pole and line fishery incorporates the SOI but the data are rather noisy and not necessarily related to abundance. An additional consideration was that fitted movements were contrary to the current understanding of seasonal movement. The issue of seasonal movement is confounded with seasonal catchability. Seasonal movements could be constrained in a similar manner to the 4-region albacore assessment; however, the addition of such constraints may not be necessary as the skipjack assessment in particular is influenced more by tagging information than catch and effort data.

SKIPJACK TUNA STOCK STATUS

70. On the basis of the assessment, the SA-SWG developed the following stock status description for skipjack tuna.

KEY ATTRIBUTES

71. Skipjack tuna is found year-round concentrated in the tropical waters of the WCPO. Its distribution expands seasonally into subtropical waters to the north and south. It is a species characterised by large stock size, fast growth, early maturation, high fecundity, year-round spawning over a wide area, relatively short life span (maximum age of 4 or 5 years old) and variable recruitment. It is assumed that skipjack in the WCPO constitute a separate population (for stock assessment and management purposes) to those in the EPO. The distribution of skipjack tuna catch, 1990–2003 is given in Figure S1.

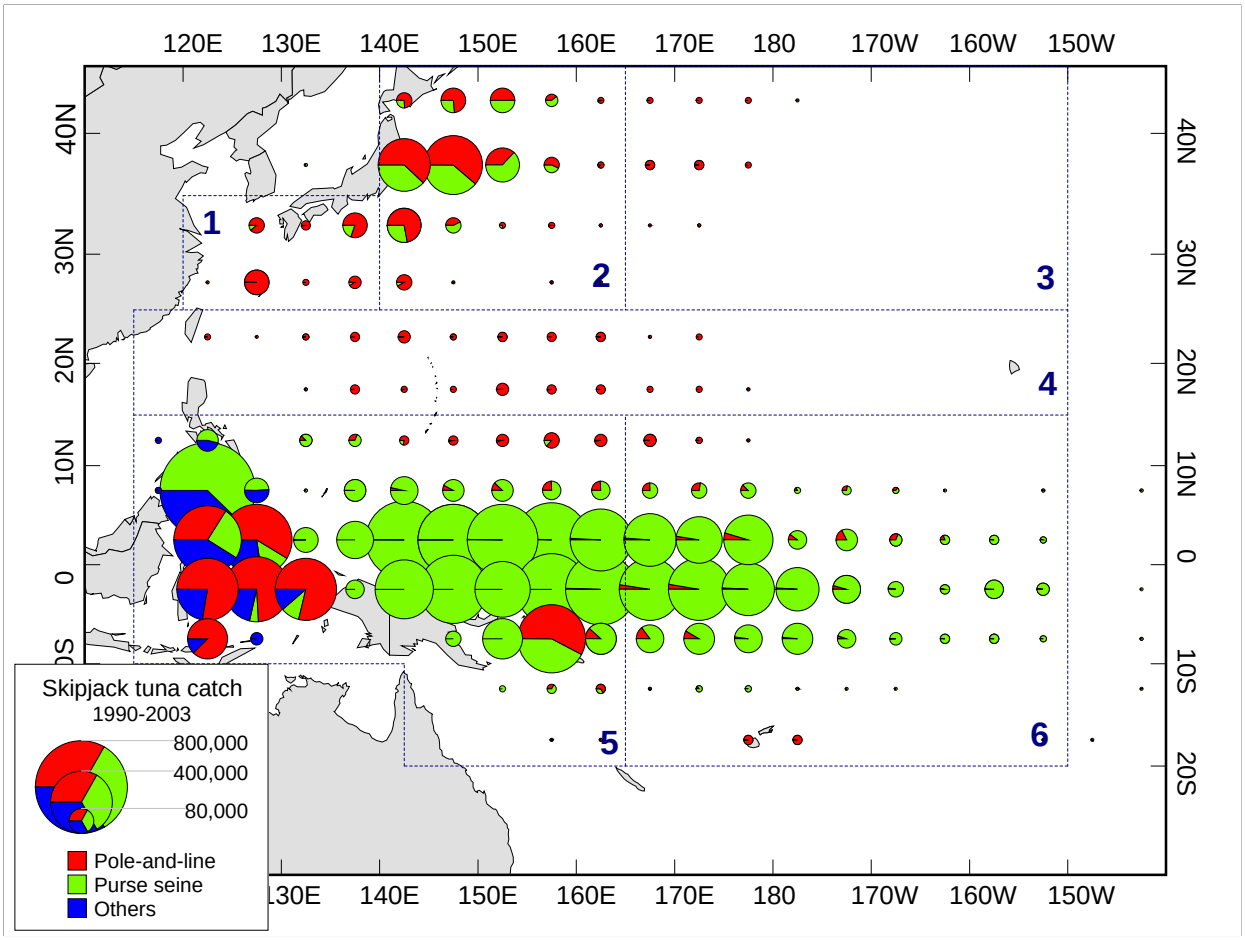

Figure S1. Distribution of skipjack tuna catch, 1990–2003.

TRENDS IN CATCH AND CPUE

72. The catch in 2004 was estimated to be 1,377,000 mt, clearly the highest on record; 78% (1,059,000 mt) was taken by purse seine gear, 18% (249,000 mt) by pole-and-line gear and 4% (approximately 57,000 mt) by other gears (Figure S2). Nominal CPUE for major purse seine fleets was similar to the 2003 level, being more than 20 mt/day, except for the USA fleet, which had an overall drop for 2004 (Figure S3). The 2004 skipjack CPUE for unassociated sets for all of the major fleets was clearly lower than in recent years. In contrast, the CPUE skipjack for associated sets for most fleets increased in 2004, and skipjack CPUE for all set types was therefore similar to the level in 2003. There was a clear shift in fishing activities to the broad area west of 160°E longitude by all fleets in 2003 compared with effort in the previous two years. The distribution of effort by the Asian fleets in 2004 was more concentrated than in 2003, with the majority of fishing activities occurring in the area 05°N–05°S and 150°E–170°E. In 2004, the USA fleet fished in an area further to the south and east, and with little overlap to the main area fished by the Asian fleets.

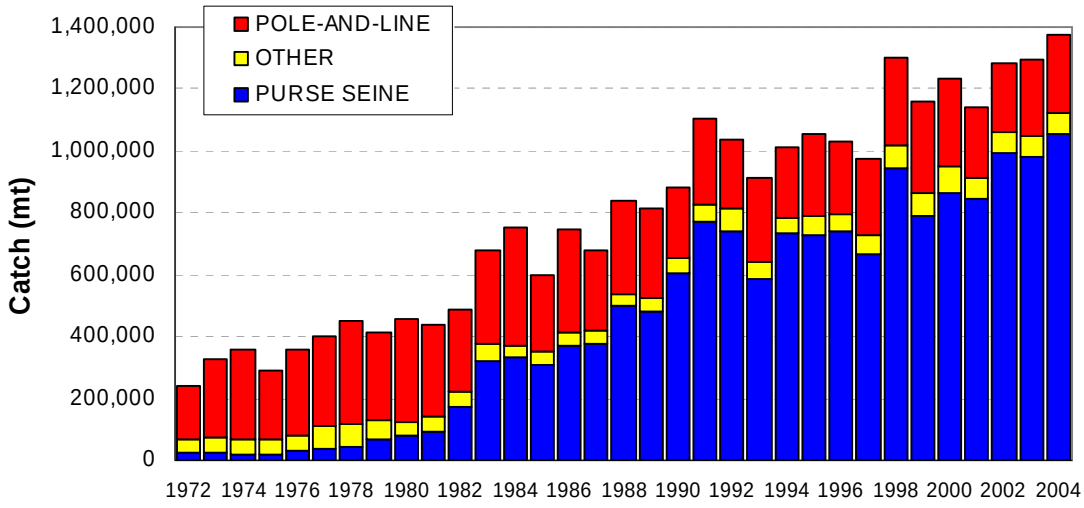

Figure S2. WCPO skipjack catch (mt) by gear for the period 1972 to 2004.

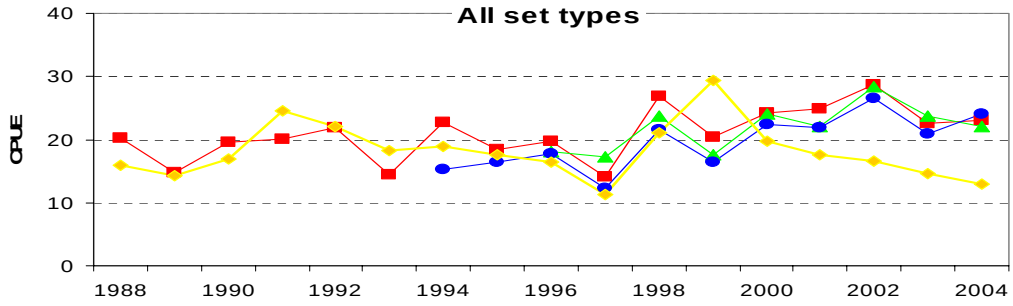

Figure S3. Nominal skipjack CPUE (mt per fishing days) for Japanese (red squares), Korean (green triangles), Taiwanese (blue circles) and USA purse seine fleets (yellow diamond).

SIZE OF FISH CAUGHT

73. Sizes of fish in the catch (based on weight) have largely been constant with a dominant mode at about 50-60 cm FL and a significantly smaller mode at about 30 cm FL (Figure S4). The larger mode consists of fish mainly caught by purse seine and pole-and-line gears and the smaller mode, by various gears of the domestic fisheries of the Philippines and Indonesia.

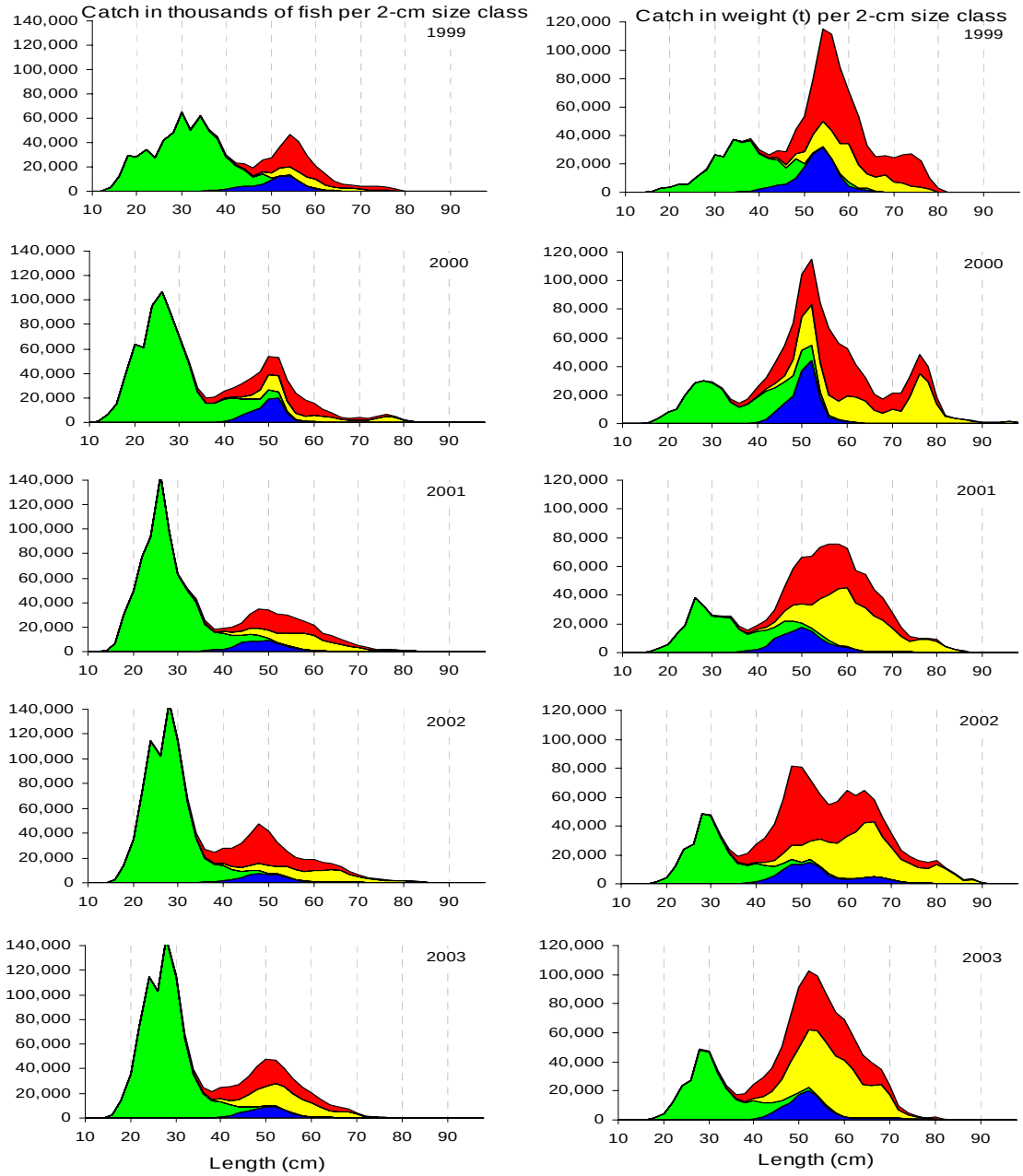

Figure S4. Annual catches of skipjack tuna in the WCPO by size and gear type, 1999–2003. (Blue–Pole-and-line; green–Phil-Indo fisheries; red–purse seine associated; yellow–purse seine unassociated, Phil–Indo data carried over from 2002 to 2003).

STOCK ASSESSMENT

74. Recruitment showed an upward shift in the mid-1980s and is estimated to have remained at a higher level since that time (Figure S5). Recruitment was also estimated to have been very high during the late 1990s. The strong El Niño at around that time and the high frequency of such events during the 1990s is suspected to have had a positive effect on skipjack recruitment. Recent recruitment is estimated to be exceptionally high, but is poorly determined due to limited observations from the fishery.

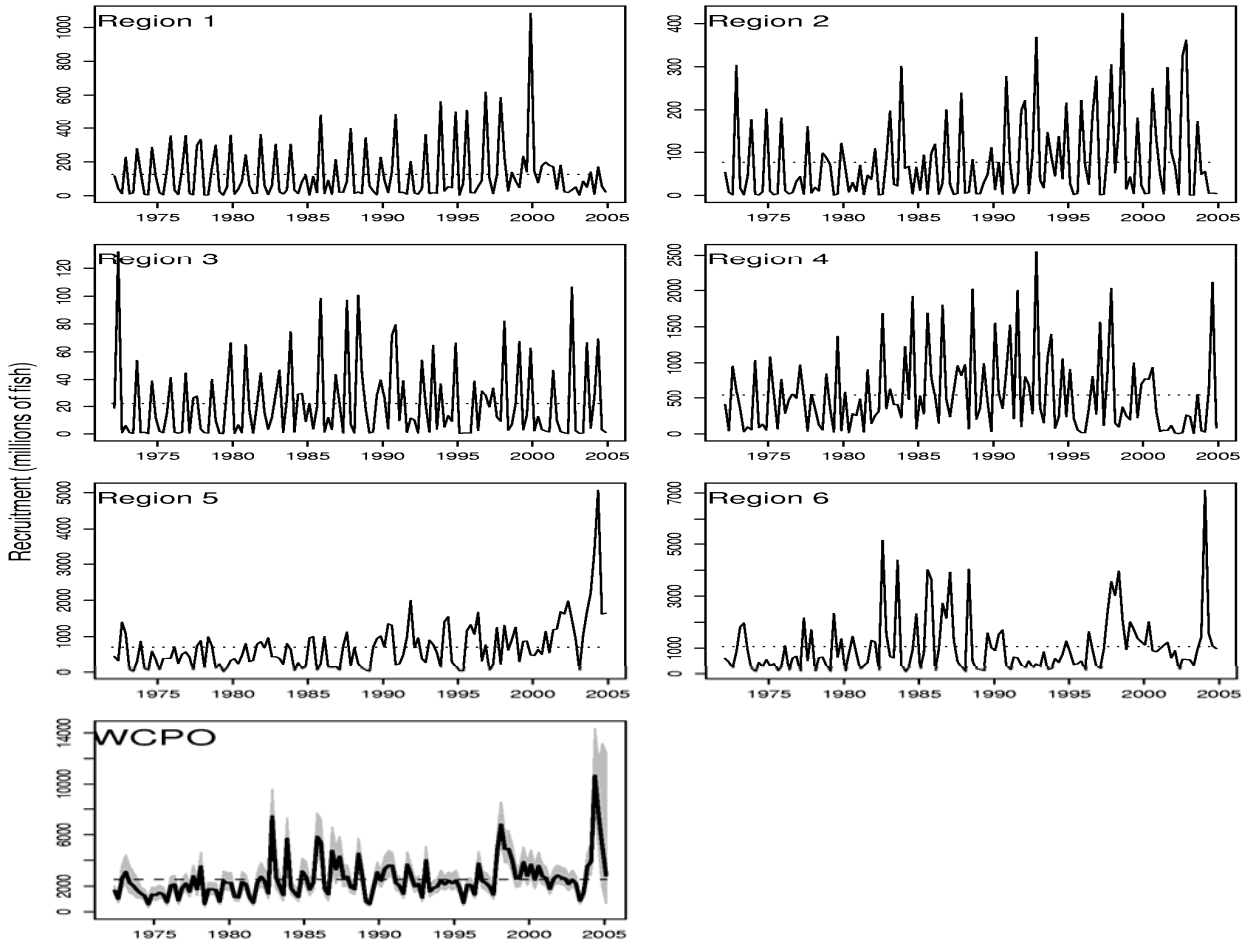

Figure S5. Estimated quarterly recruitment (millions) by region and for the WCPO for the base case analysis. The dashed line represents the average recruitment for the entire period. The shaded area for the WCPO indicates the approximate 95% confidence intervals.

BIOMASS

75. The biomass trends are driven largely by recruitment. The highest biomass estimates for the model period occurred in 1983–88 and 1998–2000, immediately following periods of sustained high recruitment (Figure S6). The model results suggest that the skipjack population in the WCPO in recent years has been considerably higher (about 20%) than the overall average level for the model period.

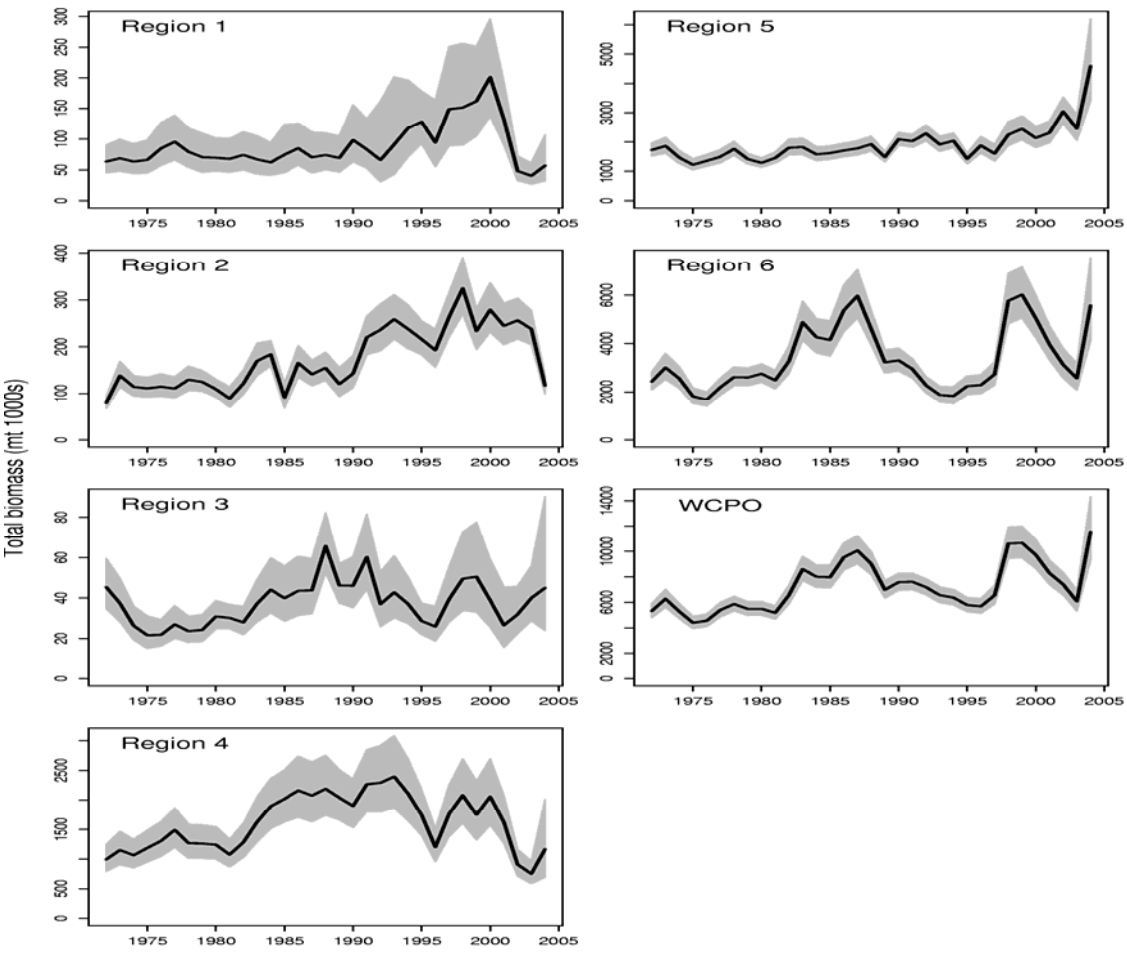

Figure S6. Estimated annual average total biomass (thousand mt) by region and for the WCPO for the base-case analysis. The shaded areas indicate the approximate 95% confidence intervals.

FISHING MORTALITY

76. Annual average fishing mortality rates for juvenile and adult age-classes are shown in Figure S7 for each region. Fishing mortality for the juvenile skipjack is very low in all regions; although it has tended to increase slightly over time within region 5 mainly due to the steady increase in catch from the Philippines fishery. For adult skipjack, fishing mortality rates vary considerably between regions. For region 5, fishing mortality rates for adult skipjack have steadily increased over the model period consistent with the increase in total catch. Since the early 1990s, there has also been a general increase in fishing mortality rates in region 6, although exploitation rates are much lower than region 5 due to the higher overall level of biomass in region 6.

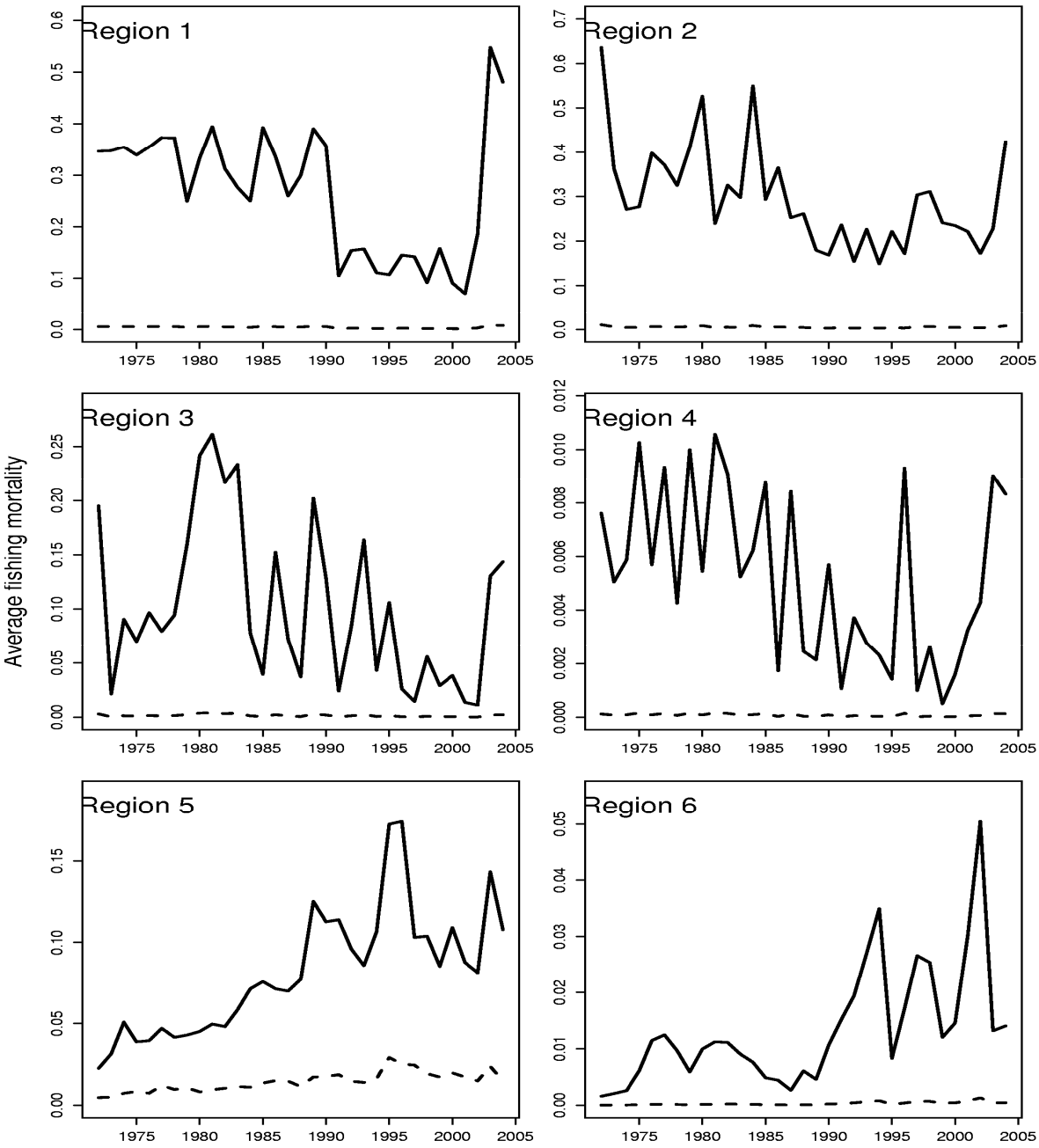

Figure S7. Estimated quarterly average fishing mortality rates for juvenile (age classes 1 and 2) (dashed line) and adult age-classes (solid line).

STOCK STATUS

77. The principal conclusions are that skipjack is currently exploited at a modest level relative to its biological potential. Furthermore, the estimates of $F_{current}/\widetilde{F}_{MSY}$ and $B_{current}/\widetilde{B}_{MSY}$ reveals that overfishing of skipjack is not occurring in the WCPO, nor is the stock in an overfished state (Figure S8). Recruitment variability, influenced by environmental conditions, will continue to be the primary influence on stock size and fishery performance.

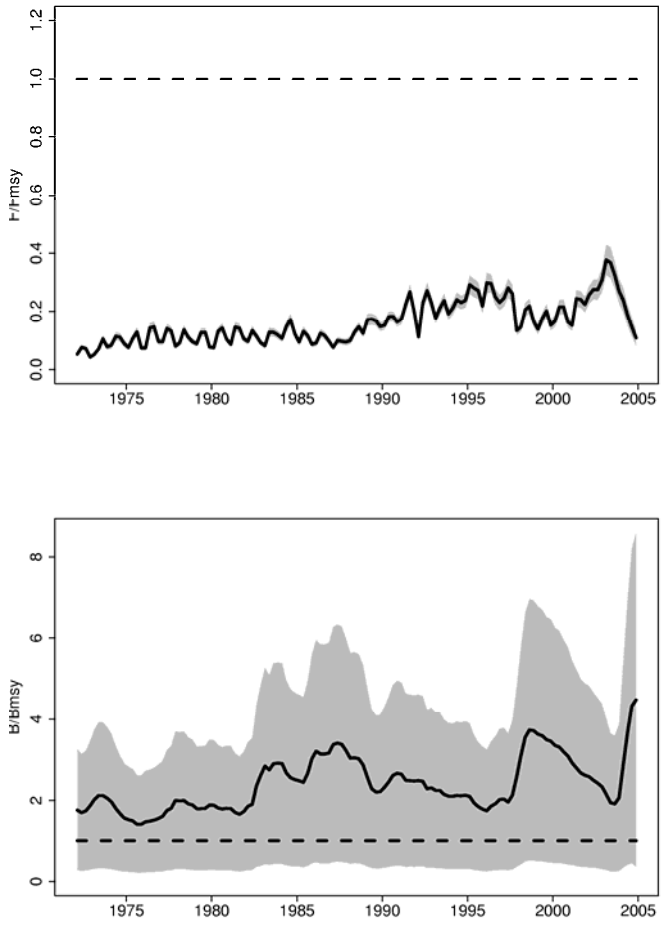

Figure S8. Ratios of $F_t/\widetilde{F}_{MSY}$ (top) and $B_t/\widetilde{B}_{MSY}$ (bottom) with 95% confidence intervals for the base-case assessment (prior on steepness mode = 0.85, sd = 0.16). The horizontal lines at 1.0 in each case indicate the overfishing (a) and overfished state (b) reference points.

SOUTH PACIFIC ALBACORE STOCK ASSESSMENT

78. Adam Langley presented WCPFC-SC1 SA-WP3 Stock assessment of albacore tuna in the South Pacific Ocean, which describes the results of the 2005 assessment.

79. The 2005 MFCL assessment was based on analytical conditions that differed from those of the 2003 assessment. The most recent assessment included 2 years of new catch and effort data, and a modified spatial structure for aggregating catch and effort data of 23 fisheries up to 2003. The Taiwanese nominal CPUE series was still used as the main index of abundance. Attempts to standardise this CPUE data need to be undertaken, particularly to account for the possible increased targeting of bigeye by this fleet. Also no longline catch/effort series for the EPO were used in the analysis since these were unavailable to SPC when the analysis was conducted. Preliminary estimates of movement were considered to be inconsistent with the expected seasonal movement pattern based on biological grounds, and do not account for differences in movement patterns between juveniles and adults, so assessments were made using a single region model with no movement across sub-regions. Assessments were also conducted using a hypothesised, constant natural mortality at age, since the estimates obtained with the MFCL model were not considered to be realistic based on biological and other statistical considerations.

80. Recent trends in albacore catch rates were examined for the main domestic longline fisheries operating in the sub-equatorial area, including Fiji, Tonga, French Polynesia, Samoa, American Samoa, Cook Islands, and New Caledonia. Catch rates in these fisheries started declining in 2002 and have not yet rebounded in all regions. In previous assessments low catch rates had been attributed to unfavourable oceanographic conditions, with reduced densities of strong fronts in some time/area strata. However the recent assessment suggests that low catch rates may be cause by the recent, below average, recruitment levels, and perhaps even through localised biomass depletions caused by deploying excessive fishing effort in small regions.

81. Based on the results, the actual levels of fishing effort are considered to be sustainable, both economically and biologically, but that is contingent on maintaining the existing structure of the fishery, in terms of how effort impacts on the different size components of the population. Current yields could potentially be tripled by increasing effort is selectivity remains constant, but not via a proportional expansion of all fisheries as they exist. The hypothetical consequence of adopting MSY levels of effort suggest that the exploitable biomass of albacore would be impacted more strongly in the Fiji and northern TW longline fishery, than in the NZ troll and southern Taiwanese fishery. Consequently, effective management measures should focus on areas with the greatest catches, and not be constrained by regional boundaries and jurisdictions.

82. It was noted that albacore stock assessments results and future projections are still characterised by considerable uncertainty. This is partly due to the fact that the existing longline catch and effort time series is not particularly informative (insufficient contrast). Also the [old] tagging data are not particularly informative either as it was too limited in space/time. Some tagging of large fish is being conducted in Samoa, but at this stage, it doubtful that this will eventually yield large numbers of releases/recaptures. Tagging should be done to provide more information on exploitation rate in northern areas. Also to ensure that future analyses will be more revealing, efforts should be made to obtain more data that are indicative of recruitment patterns. It was also noted that albacore probably spawn 5-6 times before they are caught in the longline fishery. Additional tagging and bio sampling would help revise estimates growth, maturity rates, maximum longevity and time at liberty. Recent studies conducted by New Zealand scientists have included environmental data from remote censing operations to analyse trends in catch rates, but have not yet identified the nature of the factor responsible for the reduction in the domestic troll fishery CPUE observed during 1998-2000. It is hoped that further analyses using additional variables as co-factors in GLMs (such as chlorophyll).

SOUTH PACIFIC ALBACORE STOCK STATUS

83. Prior to the first scientific meeting of the WCPFC, the last formal assessment of albacore stock status was conducted in 2003. The present assessment is thus based on 2 years of additional data, improvements to the main stock assessment model used (MFCL, or MFCL for short), and revisions of the spatial stratification used for analytical purposes, and new constraints concerning tuna movement patterns. The latest spatial structure consists of a single region for the assessment, using 4 sub-regions for the purpose of fishery definition, with the east-west longitudinal separation at 180o, and a north-south separation at 30oS. The eastern boundary of the area is set at 110oW. The new spatial stratification is thought to be more representative of the fishing patterns for the different fleets, allowing for a greater distinction between the northern and southern longline fisheries, and the coastal and high seas fisheries. The latest analysis accounts for the impacts of 23 fisheries, with the Taiwanese fishery CPUE trend serving as the main CPUE index for analysis of albacore abundance.

KEY ATTRIBUTES

84. Albacore tuna comprise a discrete stock in the South Pacific Ocean. Mature albacore (age at first maturity, 4-5 yr; ~ 90 cm FL) spawn in and around the sub-tropical region (10°-25°S) during the austral summer, with juveniles recruiting to surface fisheries in New Zealand coastal waters and near the sub-tropical convergence zone (STCZ, near 40°S) in the central Pacific about one year later (≈

45–50 cm FL). From this region, albacore progressively move into northern areas, but may still make seasonal migrations between tropical and sub-tropical waters. Albacore are relatively slow growing, and have a maximum fork length of about 120 cm. Natural mortality is low compared to tropical tunas, with significant numbers reaching 10+ years of age.

TRENDS IN CATCH AND EFFORT

85. Total catch in 2004 was about 55,000 mt, less than the peak obtained 62,000 mt in 2002 (Figure A1). Since drift netting ceased in 1991, most catches come from the New Zealand and USA troll fleets south of 30°S, and by longline fleets that operated in waters 10°-50°S (Figure A2).

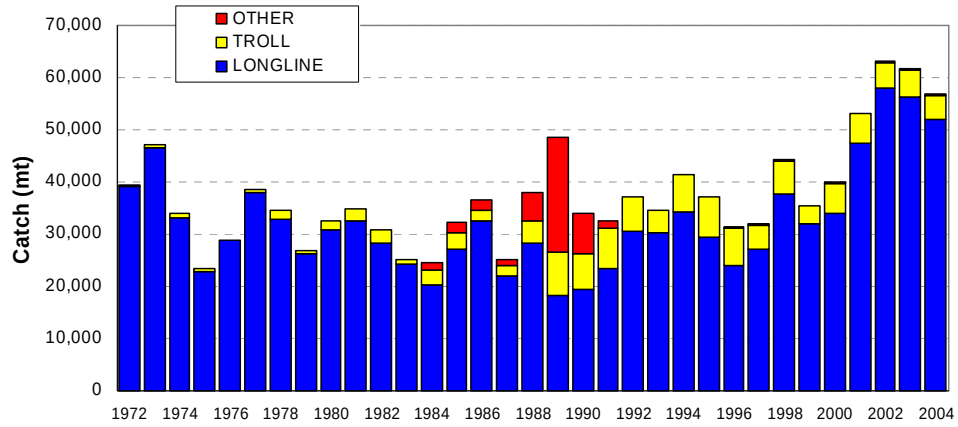

Figure A1. South Pacific albacore catch by gear type. 'Other' is primarily catch by the driftnet fishery.

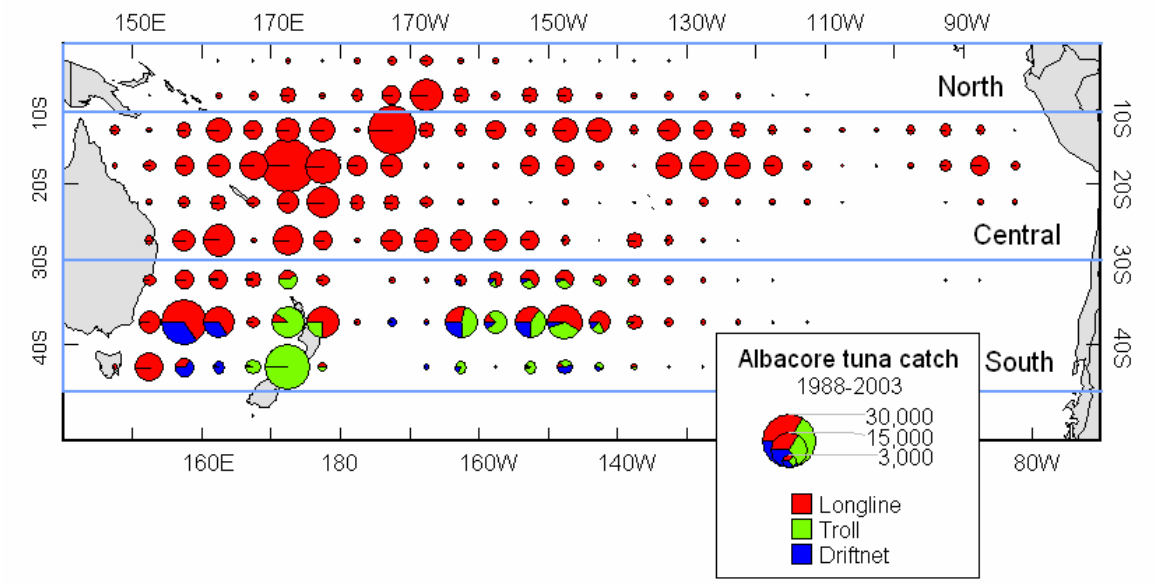

Figure A2. Distribution of South Pacific albacore tuna catch, 1988–2003. Aggregated catch figures for 2004 (and particularly for the EPO) had not yet been provided to the SPC when this report was produced.

86. Catches from the Pacific Island Country (PIC) longline fleets have increased in recent years, accounted for 50% of the total longline catch in 2002. The Taiwanese fleet has traditionally targeted albacore, and accounted for most of the longline catch historically. In recent years, this fleet redirected some effort to seasonally target albacore in northern temperate waters or bigeye in the tropical waters of the WCPO. Consequently, the albacore catch of this fleet has fallen slightly in recent years.

87. CPUE has been fairly stable in the central zone (10°–30°S), where the PIC fleets have concentrated their activities in recent years. The current CPUE in several PIC longline fleets is significantly less than the levels attained in the early years. In some cases, high CPUE has been maintained by expanding the area of fishing to the edges of the EEZs and beyond. There has been a decline in the catch rates, which has been more gradual in some areas and stronger in others such Western Samoa, American Samoa and French Polynesia. However, the CPUE for fleets near Samoa remain higher than others despite these declines. Some degree of convergence in CPUE is also noted for the New Zealand and the USA Troll fleets, although CPUE for the USA vessels has generally been higher and more variable. The latest results indicate that on an overall basis, longline CPUE has been declining in the north (sub-regions 1-2) and in the south (sub-regions 3-4).

SIZE OF FISH CAUGHT

88. Longliners catch larger albacore, with the size distribution typically comprising a single multi-age-class mode with a modal length of 90–100 cm (Figure A3). Troll catches are of smaller albacore, typically 50–85 cm in length. There are some annual variations in the size composition, with the most recent analysis revealing a progressive increase in the size of the fish caught over time in regions 2 and 4 (data not shown), which may indicate slight changes in the longline selectivity of Asian fleets since the 1960s.

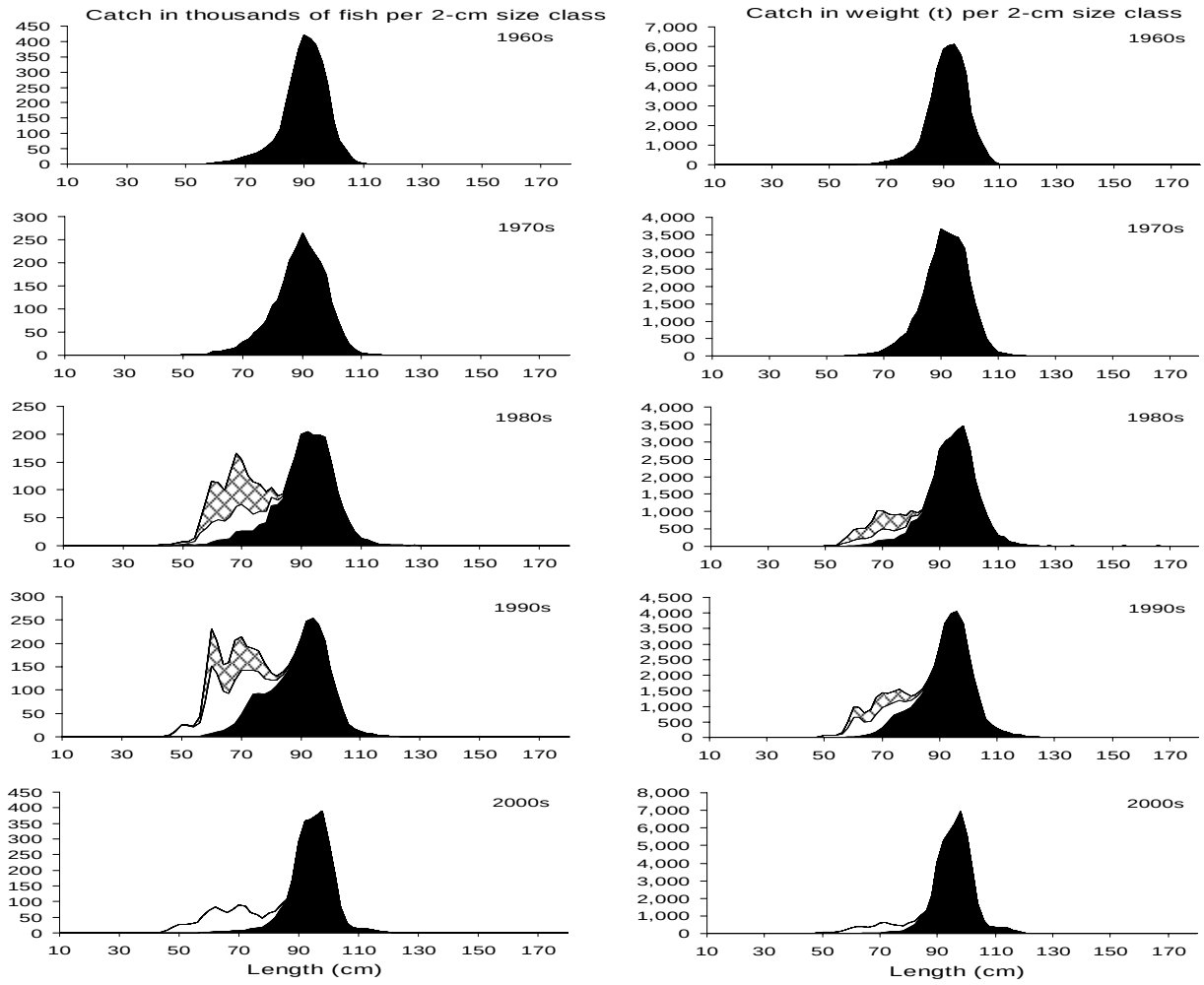

Figure A3. Average annual catches of albacore in the south Pacific by size and gear type by decade (black is longline; white is troll; hatched is driftnet).

RECRUITMENT

89. MFCL predicts low recruitment at the start of the data series (1952), increased to peak in the mid-1970s, and has since declined to the 1950s level (Figure A4). Previous application of a high resolution environmental and population dynamics simulation model (SEAPODYM) to South Pacific albacore has provided information on the possible mechanisms for recruitment variability, with recruitment levels negatively correlated with El Nino events. This may explain low recruitment rates in the 1980s and 90s. It is proposed to include albacore in the next multi-species SEAPODYM simulation model.

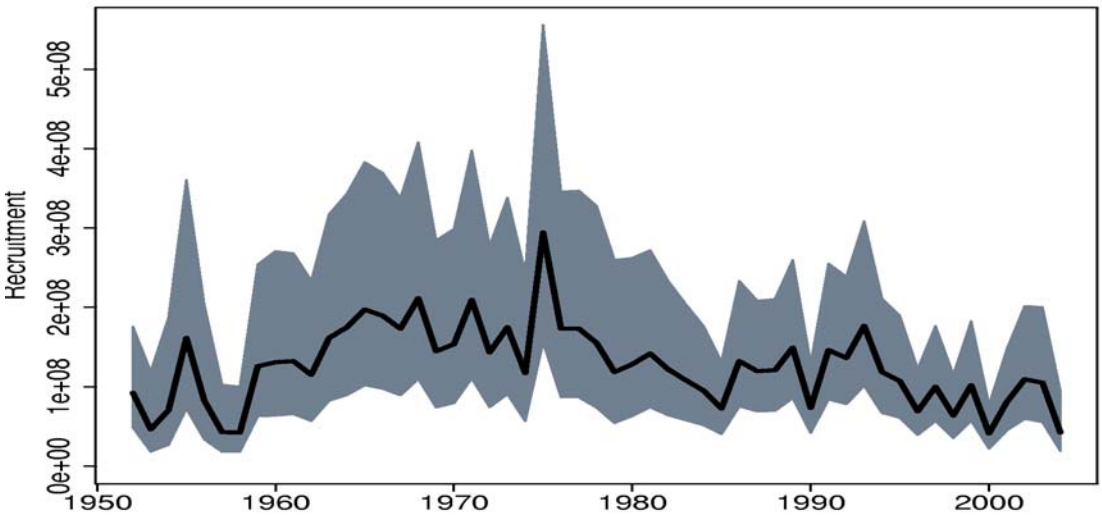

Figure A4. Annual recruitment (number of fish) estimates from the one region model. The shaded area indicates the approximate 95% confidence intervals.

BIOMASS

90. Biomass levels peaked in the late 1980s, and have now declined to levels similar to the start of the series (Figure A5). Biomass trends reflected the predicted recruitment trends (with some time lag), but this is partly due to the fact that MFCL allows for higher recruitments at certain times to ensure better fits to the larger length frequency data of mature albacore.

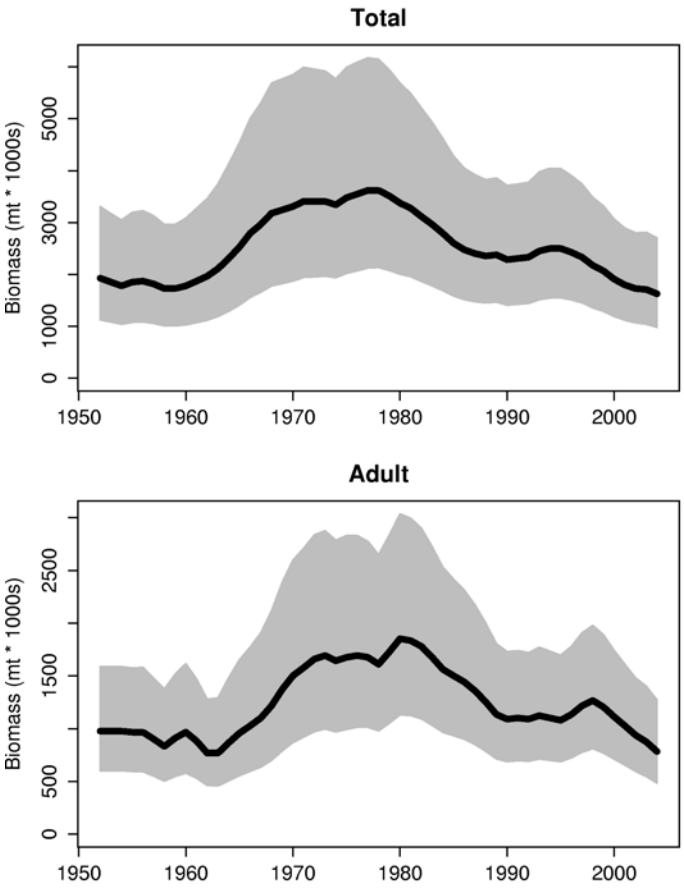

Figure A5. Estimates of relative total and adult biomass.

FISHING MORTALITY

91. Fishing mortality is higher for adult albacore than for juveniles, reflecting the predominantly longline exploitation (Figure A6). Adult exploitation rates increased initially, but declined in the 1960-70s when adult biomass increased following high recruitment. Exploitation rates increased in recent years in response to lower adult biomass (see Figure A5). Total fishing mortality appears to be considerably lower than natural mortality. The impact of the fisheries on total biomass is estimated to have increased over time, but is likely to be low to moderate across a plausible range of model assumptions.

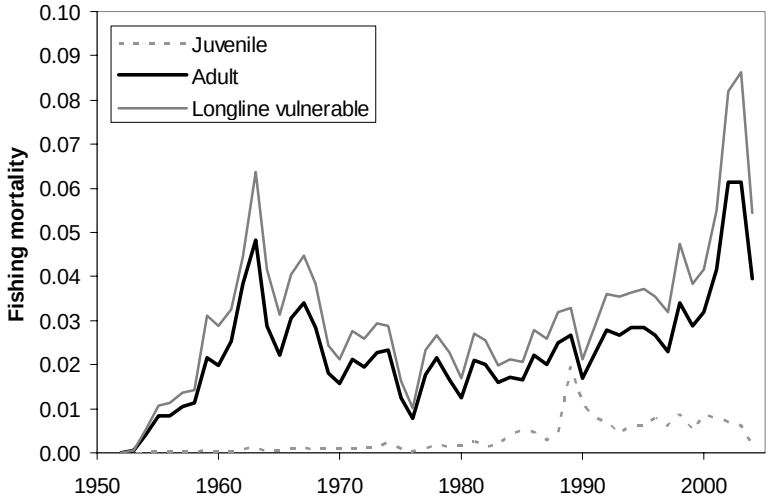

Figure A6. Annual estimates of fishing mortality for juveniles (ages 1-5), adults (ages 6-12) and longline vulnerable south Pacific albacore from the one region model.

STOCK STATUS

92. There are clear differences in the biomass trajectories between the 2003 assessment and the current assessment, with recent fishery impacts on total biomass estimated to be higher in the current study (10% compared to 3%). The previous study also estimated a much higher MSY for the fishery (in excess of 300,000 mt). However, despite these differences the general conclusions of the 2005 assessment agreed with those of the 2003 assessment ($B_{recent} > B_{MSY}$, $F_{recent} < F_{MSY}$), which supports the notion the south Pacific albacore stock is not overexploited. However, there remains considerable uncertainty regarding the overall level of stock size.

93. A few key observations should be taken into account when evaluating future fishery management plans. The more recent investigations revealed that the main component of the longline exploitable biomass resides in a relatively small area, suggesting a modest stock size. The significant declines observed recently in the domestic longline fisheries of Samoa and French Polynesia may indicate excessive effort causing localised depletion, or a reduction in exploitable biomass in those regions induced by oceanographic conditions.

MANAGEMENT INFORMATION REQUEST

94. John Hampton presented WCPFC-SC1 SA WP-10, describing analyses undertaken in response to the request from WCPFC-1. The paper described levels of sustainable catch and effort for bigeye, yellowfin, and south Pacific albacore, and projections for bigeye and yellowfin tuna under alternative management measures.

95. John Sibert (convener of the Methods SWG) provided a summary of the discussions of this paper held in the ME-SWG. The ME-SWG concluded that the analyses undertaken were satisfactory given the time available and the TOR provided by WCPFC-1. Further, it was felt that the relativity in the performance of different methods should be well estimated by these analyses, but the outcomes of the measures in absolute terms (in levels of catch and biomass) were highly uncertain. It was noted that this uncertainty should be clearly communicated to the Commission.

96. Other issues raised by the ME-SWG included: the Commission needs to provide more specific guidance to the Scientific Committee for future analyses, e.g. what is meant by sustainability; the

uncertainty in these sorts of analyses should be estimated (both statistical uncertainty and structural uncertainty) and communicated to the Commission; and choosing a single year for comparisons was not recommended as the analyses could be biased by anomalous years. On this issue the working group felt that an average (over years 2001 to 2003) would be more appropriate.

97. It was noted that given the uncertainty in mixing of bigeye between the EPO and WCPO, that this should be considered in the interpretation of results.

CONTRIBUTED PAPERS

98. Nick Davies presented WCPFC-SC1 SA WP-5, describing time series of CPUE indices for New Zealand albacore caught in the longline and troll fisheries that were standardised using remotely sensed environmental data. Detailed fishing operation location information was linked to high resolution sea surface temperature (SST) data which is combined with physical oceanographic models to represent meso- and synoptic-scale variation in ocean climatology. The general additive model for the longline CPUE explained 46% of the deviance. Extremely tight confidence intervals were estimated for the clear non-linear relationship with SST. The negative binomial general linear model for troll CPUE explained 24% of the deviance. Given the coarse spatial scale over which the environmental variables were summarised, only a weak relationship with the SST-anomaly covariate was evident. The optimal SST was around 18°C.

99. Both the nominal and standardised annual indices of longline CPUE were dominated by a significant decline from 1998 to 2000. This feature is considered to be highly uncertain. During this period there was a corresponding rapid increase in longline catches of swordfish that indicates a shift the dominant species caught. Further work is proposed before these indices may be of utility for albacore stock assessment.

100. Although consistent, there are differences between the nominal and standardised year-quarter CPUE indices for the troll fishery. Clear peaks are evident in the troll CPUE year-quarter indices in 1995 and another in 1999-2000. These peaks can be related to dominant modes in the time series of port sampling length frequencies that may infer strong cohorts entering the fishery. This consistency between the length frequency and CPUE series appears promising for the utility of the troll CPUE time series in albacore stock assessment.

101. Dale Kolody presented preliminary work on South-West Pacific swordfish assessment and development objectives over the next 12 months (WCPFC-SC1 SA WP-7). The South-West Pacific Swordfish fishery has undergone a number of substantial changes over the last decade. The swordfish catch (in numbers) over the last 10 years have been almost double the previous 25 year period, with large increases in Australian, New Zealand and Pacific Island Nation catches, and declines in the Japanese catch. Australian inshore catch rates have declined substantially, and the fishery has responded with a progressive expansion further offshore. Available fisheries and biological data were described in the context of alternative migration dynamics hypotheses, notably the competing hypotheses of continuous diffusive migration, versus spawning grounds migrations with foraging grounds site fidelity. Initial results were presented from fitting MFCL to observations of swordfish catch in numbers, effort and catch-at-size, disaggregated into 20 fishing fleets in 7 regions, operating quarterly from 1952-2004. These preliminary results were presented to illustrate the methodology, and identify problems to be addressed in the coming year.

REVIEW OF THE SA-SWG DRAFT TOR

102. The SA-SWG reviewed the draft TOR proposed by the conveners and approved the following revision:

The overall purpose of the Stock Assessment Specialist Working Group is to evaluate the status of stocks of interest to the WCPFC and the impact of fishing. The assessments underpin the scientific advice for management that is provided by the WCPFC Scientific Committee to the Commission.

The functions of the Stock Assessment Specialist Working Group shall be, in consultation with other Specialist Working Groups, to:

a. Critically review assessments for target and non-target stocks;
b. Provide statements of stock status, and the impact of fishing, based on assessments, and other pertinent information;
c. Evaluate current and proposed future harvest practices in light of the Commission's objectives (Article 2) and requests;
d. Make recommendations regarding the content of future assessments and any supporting analysis; and
e. Make recommendations regarding research and data required to support stock assessments.

FUTURE WORK PROGRAMME OF SA-SWG

103. During the discussion of the SA-SWG, a number of research recommendations were raised. Because the stock assessment itself is an integral part of all SWGs, some of these are inter-related and might be tabled in other SWGs. Most of these recommendations are meant to improve future assessments:

a. Review length-weight conversion factors in those longline fisheries for which weight frequency data were obtained and used in MFCL analysis;
b. Review and document the technological and operational changes of the longline fisheries, especially those for the Japanese fleet, with the intention of better standardising effort in these fisheries;
c. Review reproductive biology (maturity ogive, batch fecundity) for bigeye and albacore;
d. Investigate alternative regional structure for the yellowfin tuna assessment (in light of the high proportion of the catch taken in Region 3);
e. Develop regional scaling factors for the South Pacific albacore assessment;
f. Investigate alternative parameterisations of movement in the MFCL assessment models, especially for skipjack;
g. Conduct spatial analysis on longline CPUE to help investigate the sharp declines at the initial stage of fishery (such as hyper-depletion);
h. Continue the collaborative work on the Pacific-wide assessment of bigeye with IATTC;
i. Support Pacific-wide tagging program for tropical tunas with special emphasis on bigeye tuna movements near the current boundary of stock assessment (150°W); and
j. Review stock assessments of other species of interest to the Commission (e.g. South Pacific swordfish).

SELECTION OF A CONVENOR

104. M. Stocker and N. Miyabe were nominated and accepted as future conveners for the Stock Assessment Specialist Working Group.

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APPENDIX I – AGENDA ADOPTED FOR USE AT THE FIRST MEETING OF THE STOCK ASSESSMENT SWG

STOCK ASSESSMENT – SPECIALIST WORKING GROUP
AUGUST 2005

Thursday August 11, 2005

1. Introduction – Stocker/Miyabe
2. Selection of rapporteurs
3. Adoption of agenda
4. CPUE analysis for bigeye and yellowfin tuna
    SA WP-8: *Longline CPUE indices for yellowfin and bigeye in the Pacific Ocean using GLM and statistical habitat standardisation methods* – Langley, Bigelow, Maunder & Miyabe
    Discussion & conclusions
5. Bigeye assessment
    SA WP-2: *Stock assessment of bigeye tuna in the western and central pacific ocean, with comparison to results of the pacific-wide assessment* – Hampton, Kleiber, Langley, Takeuchi, Ichinokawa & Maunder
    Discussion & conclusions

Friday August 12, 2005

6. Yellowfin assessment
    SA WP-1: *Stock assessment of yellowfin tuna in the western and central pacific ocean* – Hampton, Kleiber, Langley, Takeuchi & Ichinokawa
    Discussion & conclusions
7. Albacore assessment
    SA WP-3: *Stock assessment of albacore tuna in the South Pacific Ocean* – Langley & Hampton
    Discussion & conclusions
8. Skipjack assessment
    SA WP-4: *Stock assessment of skipjack tuna in the western and central pacific ocean* – Langley, Hampton & Ogura
    Discussion & conclusions
9. Sustainable catch and effort levels/management measures
    SA WP-10: *Estimates of sustainable catch and effort levels for target species and the impacts on stocks of potential management measures* – Hampton et al.
    Discussion
    Conclusions
10. Future work program
11. Other business
    Review of provisional TOR
    Nomination of co-conveners
    Response to IATTC proposal
12. Preparation of report
13. Contributed papers
    SA WP-5: *Standardised CPUE for the New Zealand albacore troll and longline fisheries* – Unwin, Richardson, Davies & Griggs
    SA WP-6: *Swordfish CPUE indices in the southwest pacific and investigation of management options in the Australian eastern tuna and billfish fishery* – Campbell
    SA WP-7: *Southwest pacific swordfish assessment: 2005-06 objectives and preliminary results* – Kolody, Campbell, Jumppanen & Davies

ANNEX X - REPORT OF THE ECOSYSTEM & BYCATCH SPECIALIST WORKING GROUP

REPORT OF THE ECOSYSTEMS AND BYCATCH SPECIALIST WORKING GROUP

INTRODUCTION AND PRELIMINARIES

1. The convener of the Ecosystems and Bycatch Specialist Working Group (EB-SWG) opened the meeting. Rapporteurs for the session were Brett Molony and Simon Hoyle.

2. The participants in the EB-SWG were Robert Campbell, Shui-kai Chong, Chouky Cuewapur, Sylvester Diake, Regis Etaix-Bonin, Ulunga Fa'anunu, Alain Fonteneau, David Itano, Charles Karnella, Holly Koehler, Ludwig Kumoru, Chung-Hai Kwoh, Antony Lewis, Lara Manarangi-Trott, Sione Vailala Matoto, Naozumi Miyabe, Peter Miyake, Joshua Mitchell, Augustine Mobiha, Dae-Yeon Moon, Toni Mulipola, Hioaki Okamoto, Brendon Pasisi, Cedric Ponsonnet, Tekirua Riinga, Roberto Sarralde, Sangaa Clark, John Sibert, Bob Skillman, SungKwon Soh, Ziro Suzuki, Chi-Lu Sun, Emanuel Tardy, Bernard Thoulag, Saimoni Tuilaucala, Koji Uosaki, Yuji Uozumi, Peter Ward.

3. The convener reviewed the agenda and noted changes in the order of presentations (Appendix I). The convener noted that any remaining time at the end of the meeting could be devoted to discussion of the TOR, although these had been widely circulated and comments received incorporated into the draft before the meeting.

4. Twelve presentations were made in the meeting covering a range of issues concerned with bycatch and ecosystem modelling. Two papers that could not be presented, but considered important to report are abstracted in Appendix II.

REQUEST FROM THE COMMISSION: ESTIMATES OF THE MORTALITY OF NON-TARGET SPECIES WITH AN INITIAL FOCUS ON SEABIRDS, TURTLES AND SHARKS.

5. Brett Molony presented estimates of the total numbers of individuals captured and the total number of mortalities of birds, sharks and turtles estimated for the central region of Western and Central Pacific Fisheries Commission (WCPFC) area. In addition, total catches of marine mammals were also estimated.

6. While abundant logsheet data exists, the reporting rates of these four taxa are relatively low and observer data were used in order to generate estimates. Observer coverage of the WCPFC region varies among flags, fleets and areas and observer data for the WCPFC region is not centrally available from a single location. As a result, observer data held at the Secretariat of the Pacific Community (SPC) were used.

7. Four fisheries were defined for the region of the WCPFC between 15ºN–31ºS, tropical shallow longline (TSL, 15ºN–10ºS, less than 10 hooks between floats (HBF)), tropical deep longline (TDL, 15ºN–10ºS, 10 or more HBF), temperate albacore longline (TAL, 10ºS–31ºS) and a single purse-seine fishery. Annual catches and mortality of each taxa for each of the four fisheries were estimated and raised by the estimated total effort in these fisheries to generate total annual catches and mortalities for each taxa.

8. Relatively few observer records of birds existed for the fisheries examined. Total annual catches of birds by these fisheries were less than 1,593 (0–10,307)(95% confidence intervals) birds per year between 1990 and 2004, with most birds suffering mortality. Most birds were reported from the TAL with fewer records of bird catches reported from the other fisheries. However, it is estimated that these four fisheries captured less than 100 birds per year since 1998. Few birds were identified to species.

9. Observers in these fisheries reported fewer mammals and total annual catches were less than 1,362 (0–88,714) mammals per year during the period 1990–2004. In contrast to birds, most mammals were

released alive by all fisheries, with annual mortalities estimated at 300 (0–4,286) mammals per year. The highest catches were reported from the TSL and purse seine fisheries. Most fishery-mammal captures in the purse-seine fishery were a result of deliberately setting upon whales in order to capture associated tuna schools. Most mammals were not identified to species.

10. As expected, the total annual catches of sharks were much higher than for the other taxa examined due to the high number of shark species, relatively high abundance of sharks compared to the other taxa, the existence of dedicated shark longline fisheries and that sharks and shark products (e.g. fins) are part of the commercial catch of all fleets. An annual estimated catch of 696,401 (0–1,604,249) sharks per year were captured by these four fisheries between 1990 and 2004, mainly by the TSL fishery. Annual estimated mortalities were relatively low but were likely to be underestimated due to the relatively low levels of observers reporting condition and fate of sharks. It is likely that estimated total shark mortalities for these four fisheries were similar to the estimated total catch. Most sharks were identified to species and catches were dominated by blue sharks, silky sharks, oceanic whitetip sharks and pelagic stingrays, although the relative abundances of shark species varied among fisheries and years.

11. An estimated 6,962 (0–29,529) turtles were captured by the four fisheries each year between 1990 and 2004, with an estimated total annual mortality of 931 (0–8,323) turtles per year. The highest catches were estimated from the TSL fishery as most turtles spend their time in the upper regions of the water column (less than 120 m). However, the highest turtle mortalities were estimated for the TDL fishery, likely a result of turtles being unable to surface if hooked on this deeper gear. Most turtles were not identified to species but observers reported a high proportion of olive ridley turtles.

12. Purse seine set type was a major factor influencing catch rates of all taxa examined. Higher CPUEs of mammals, sharks and turtles were estimated from sets upon floating objects (i.e. associated sets), especially sets on logs and aFADS. Any management measures designed to reduce catches and mortalities of these taxa by the purse-seine fishery of the WCPFC should consider the influence of set-type.

13. While total annual catches and moralities were estimated for all taxa, confidence intervals around each estimate were relatively large. This is a result of the small number of records for each taxa (especially birds, mammals, turtles and individual species of sharks) and due low observer coverage rates. Increasing observer coverage rates for all fleets would result in more-robust estimates of catches and mortalities. Additionally, improving the rate of identification to the level of species and increasing the rates of observers reporting condition and fate of captured animals would also assist in the generation of more robust estimates of mortality. Additionally, centralising all observer data would provide a larger dataset in order to better estimate total catches and mortalities of all taxa.

14. Current observer programmes are primarily designed to record information on tuna catches. In future, specific observer programmes should be designed to address specific catch and bycatch issues, as has been done in other areas. For example, specific observer programmes could be designed to address the issues of interactions between birds, mammals and turtles with the newly developed shark and swordfish fisheries within the WCPFC area.

15. Finally, the large number of shark species and identifying target and non-target species of sharks complicated analyses of shark data for each of the four fisheries. More thorough research could be achieved by identifying and prioritising specific species of sharks important within each fishery, either by reviewing the shark species of Annex 1 of UNCLOS and/or by prioritising the list of species.

16. Recommendations:

a. Increase observer coverage rates;
b. Centralise and expand observer data;
c. Consider designing specific observer programmes to address specific objectives;

d. Improve the identification and reporting of catch to species level;
e. Increase recording rates for fate and condition of bycatch;
f. Review potential for stock assessment of shark species in UNCLOS Annex 1;
g. Carry out an ecological risk analysis in order to prioritise species of sea turtles, sharks and seabirds and non-target fish species for future research; and
h. Study interactions between newly developing fisheries and these four taxa.

17. Initial discussion focused on the terminology used to describe bycatch, and whether it was more appropriate to use the term incidental catch or incidental take? It was also noted that it was important to assess bycatch in terms of what proportion it represents of the stock or population. This will assist in assessing the impacts of incidental catches of species such as seabirds, turtles, marine mammals or sharks. It may also be useful to look at bycatch per tonne of tuna, as carried out in a recent PFRP-funded study (see PFRP website).

18. Other discussion centred on the distinction between bycatch taken on day versus night sets, and on different lunar phases, which may be important for animals such as turtles. There was also comment on the unrepresentative nature of the spatial coverage of the observer data for many years, especially for the longline fleets, and how this is likely to introduce a bias into the analyses. This emphasises the need for a representative observer programme across all fisheries in order for good estimates of catch and mortality of non-target species to be obtained.

BYCATCH

A REVIEW OF THE EFFECTIVENESS OF THE DEEP LONGLINE SETTING TECHNIQUE IN MITIGATING BYCATCH

19. Steve Beverly presented the results of a deep setting longline project to test a new method for setting monofilament longlines where all of the baited hooks were set at a prescribed range of depths, in the intermediate layer and down to the thermocline. This method avoids having any baited hooks in the critical top 100 m of the water column. The new setting technique involves weighting the mainline so that the entire basket (one section of mainline between floats with normally six to 40 hooks) fishes below the critical 100 m depth. Normally a basket of longline gear is suspended between two floats and sags in a catenary curve that fishes a variety of depths ranging from near the surface to 300 meters or more. Trials with this new gear configuration proved to be successful but not without some drawbacks. More longline gear was needed, more time was spent on deck, and fewer valuable by-product species were caught. Recommendations arising from the study include further testing to collect more data, testing to see if the technique will be useful for deep daytime swordfish fishing, and using the technique as a research tool for studying foraging behaviour of deep day swimming species.

SUMMARY OF THE BIOLOGY, ECOLOGY AND STOCK STATUS OF BILLFISHES IN THE WCPFC WITH A REVIEW OF MAJOR VARIABLES INFLUENCING LONGLINE FISHERY PERFORMANCE

20. Brett Molony presented information on the six species of billfishes reside in the Pacific Ocean. All species have been reported over wide geographical areas of the Pacific Ocean. While some species such as black marlin and blue marlin are thought to comprise single stocks in the Pacific Ocean, other species are likely to be composed of several independent stocks or sub-stocks. However, details of biology and ecology of all species are limited.

21. The growth rates of all species are relatively rapid, with most species exceeding 100 cm in length with the first year of life. Maturity is obtained within 2–5 years in most species, with females generally attaining larger sizes than males. Most species of billfishes are capable of spawning year-round in some areas of the Pacific Ocean. However, spawning areas of black, blue and striped marlins

have only been identified in the western Pacific Ocean. This infers that spawning of these three species in the WCPFC supports Pacific-wide stocks and fisheries.

22. Tagging studies have demonstrated the ability of all species to cover great distances, although clear migration pathways have yet to be identified. Tagging has also revealed that most billfish species spend much of their time in the upper 100 m of the water column, making them vulnerable to all commercial method fisheries. Swordfish are the exception and tend to spend daylight hours at depths greater than 200 m, entering surface waters at night, likely in response to prey availability. Other billfishes also shown diurnal patterns of movements.

23. Blue marlin and swordfish, with lesser amounts of striped marlin, dominated catches of billfishes by the longline method fisheries of the WCPFC. Other species were captured in much lower amounts. Recently, fisheries specifically targeting swordfish and striped marlin have developed in several countries within the WCPFC area. Sport fisheries also rely heavily on most billfish species.

24. A range of variables influenced catches of billfishes. Variations in CPUEs were noted among flags, likely a result of gear configurations and geographical distributions of fleets within the WCPFC region. For example, some billfish species displayed temperate patterns of distribution (e.g. striped marlin) while other species were more tropical (e.g. black and blue marlins). Thus the areas of operations of longline fleets influenced billfish CPUEs.

25. The configuration of longline gears (i.e. the number of hooks between floats (HBF)) greatly influenced CPUEs. Highest CPUEs for most species were reported from sets with less than seven HBF. However, CPUEs for individual species varied between day and night sets using similar HBFs. The CPUEs of most species were much lower at night.

26. Billfishes have contributed a small but important component of the longline catches of the WCPFC area. However, stock assessments of billfishes from the Pacific Ocean are rare. A MFCL assessment of the Pacific wide blue marlin stock indicated that the stock was not overfished but was likely to be approaching full exploitation. Assessments of swordfish stocks in the eastern Pacific indicated that the stocks are experiencing effort levels well below full exploitation. While assessments for southwestern Pacific swordfish and northern and southwestern Pacific striped marlin are underway, assessments for other species are not currently planned. The Commission should consider the assessment of other species of billfish and the re-evaluation of the blue marlin assessments.

27. Assessments are limited by relatively low amounts of data and uncertainties in basic biological parameters. For example, age, growth rates, movements and habitat preferences of many species are poorly known. The structure of the stocks in the WCPFC area and Pacific Ocean are also poorly understood. Efforts to redress these uncertainties would greatly benefit future assessments of billfish species.

28. Recommendations:

a. Future stock assessments and management would be assisted by accurate information on:
   i. Age-estimates;
   ii. Growth rates (sizes-at-age for biological processes);
   iii. Movements and habitat preferences;
   iv. Stock structure; and
   v. Identification and reporting of catch to species level.

29. Initial discussion focused on the need to have good operation-level logbook data as well as observer data. There was also discussion about the problems with identification of billfish. It was noted that in Hawaii there were problems with fishermen recording different species of billfish as ‘blue marlin’. This was not so much a problem with fishermen being unable to distinguish different

species but due to similar price obtained for blue and striped marlin, so that there was no real incentive for fishermen to take the time to correctly report the different species.

THE EFFECTS OF SOAK TIME AND DEPTH ON LONGLINE CATCH RATES

30. Peter Ward presented an analysis of observer records, which showed that abundance estimates are influenced by hook depth and the timing of longline operations in relation to dawn and dusk and soak time. The effects of soak time and timing vary considerably between species. For example, longline segments with soak times of 20 hours were retrieved with fewer skipjack tuna and seabirds than segments with soak times of 5 hours. By contrast, soak time and exposure to dusk periods have strong positive effects on the catch rates of most shark and billfish species. At the end of longline retrieval, for example, expected catch rates of broadbill swordfish are four times those at the beginning of retrieval. Survival of the animal while it is hooked on the longline may be an important factor determining whether it is eventually brought on board the vessel. Catch rates of species that survive being hooked (e.g. blue shark) increase with soak time. In contrast, skipjack and seabirds are usually dead at the time of retrieval. Their catch rates decline with time, perhaps because scavengers can easily remove them. Observer longline data were also analysed with generalised linear mixed models to infer the depth distribution of various target and non-target species. The analyses provide estimates of the depth distribution for 37 fish species that are caught on pelagic longlines in the tropical Pacific Ocean. The depth distribution does not always match depth preferences derived from tracking studies. The estimates can be used to correct abundance indices for variations in longline depth. The method facilitates the inclusion of data from early surveys in the time series of commercial catch rates used to estimate abundance. It also resolves inconsistencies in the time series caused by a rapid switch to deep longlining in the 1970s.

31. Ward was asked if he had interviewed any fishermen to see if his results and conclusions matched fishermen experiences. Ward indicated that he had discussed the results with fishermen and their comments supported the results obtained in this study. There was further discussion on the differences obtained between yellowfin and bigeye tuna, as the study did not include depth of hooks. There was also some discussion on the spatial effects since thermocline depth might be critical to the effects of soak time.

OVERVIEW OF USA PROTECTED SPECIES BYCATCH MITIGATION RESEARCH

32. Paul Dalzell presented an overview of USA research on the bycatch of protected species in longline fisheries being conducted in the Pacific Ocean. USA longline vessels operating from Hawaii interact with albatrosses, sea turtles and cetaceans. USA longliners in the Pacific target either swordfish, setting 3-5 hooks between floats at depths between 25-75 m, or bigeye tuna setting up to 30 hooks between floats at depths between 40 to 350 m. Dalzell outlined methods which had been successful at minimising seabird and sea-turtle interactions. These included the conversion of longliners to side setting, where seabird interactions had been shown to nearly zero out sea bird takes, and night setting, which reduced hooking of bird by 90-99%. Turtle interactions had been greatly reduced by the adoption of large circle hooks and mackerel bait for swordfish longlining. Interactions with small toothed whales, primarily false killer whales, were problematic, more from depredation of target fish on longlines than from impacts on populations. Measures to minimise interactions had not been developed for cetaceans but might include ensuring that hooks were set below the usual depths occupied by these animals.

33. Discussion initially focused on the impacts of the use of circle hooks on catches of other species. It was noted that in experiments in the Atlantic catch rates of swordfish had been 30% higher with circle hooks, but bigeye catch rates had been markedly reduced. Hook type will effect catch rates and need to be recorded on catch forms. Future experiments with circle hooks in tuna fisheries will focus on looking at CPUEs of target species since the catches of turtles on tuna sets are so rare as to make statistical comparisons impossible. Recent observations on longliners from the observer programme of Chinese Taipei during 2002-2003 showed no turtle encounters and recent experimental sets using

circle hooks in 2005 had encountered few turtles. This led to a discussion about seasonality of turtle takes. In the Hawaii fishery, loggerhead takes tend to highest in the second quarter of the year, while leatherback takes were thought to be higher in April and May, but this was not certain and may change annually depending on environmental influences.

ECOSYSTEM RESEARCH AND MODELLING

ECOSYSTEM DELINEATION

34. John Sibert made a short presentation on the ecosystem approach to fisheries being a place-based approach to resource management. The first step in implementing an Ecosystem Approach to Fisheries is to identify the "place" to be managed. This paper summarised definitions of places frequently seen in the deliberations of the Commission for the Conservation and Management of Highly Migratory Fish Stocks in the Western and Central Pacific Ocean. Means of refining the notion of place in the context of applying Ecosystem Approach to Fisheries to the WCPFC were discussed.

35. Recommendations:

a. Identify potential indicators;
b. Examine spatial variability of each indicator;
c. Define boundaries over which to measure and report indicators; and
d. Establish reference points for each indicator.

36. It was noted that a recent ecosystem-based fishery management workshop in Honolulu had identified a long list of potential indicators but had not established definitive reference points for fishery management. It was noted that catching millions of tonnes of tuna must have ecosystem effects and this should be a concern of the Scientific Committee. An ecosystem approach to fishery management would help to structure the activities of the EB-SWG, but this does not obviate the need for single species stock assessments. Indeed, an ecosystem approach actually requires the Science Committee to pay greater attention to single species assessments and the relative impacts of biomass reductions of target species on the biomass of other species, i.e. to describe the ecosystem effects of tuna fisheries.

POTENTIAL ECOSYSTEM INDICATORS FOR THE WCPO

37. David Kirby presented a paper written in collaboration with Valerie Allain and Brett Molony (WCPFC-SC1 EB WP–5), providing a review of ecosystem indicators and their relevance to WCPO tuna fisheries, based on a synthesis of the outcomes of various international meetings on the topic. The paper recognises that ecosystem science is complex, but as information is passed on to management, effective communication of knowledge and uncertainty becomes paramount, therefore this complexity must be reduced: ecosystem indicators serve this purpose. An indicator is a metric describing the state or dynamics of the system of interest. Trends and threshold values provide potential reference points for management action. Indicators should be developed for environmental and fishing pressures and for the response exhibited by indicators of ecosystem state. Vulnerability indicators should be developed for bycatch, including species of special concern, based on an ecological risk assessment. Analytical methods used in the development of indicators should be discussed in the Methods SWG, with the results of ecosystem monitoring using indicators reported to the Ecosystems and Bycatch SWG. The Commission can then consider how to link management action to information derived from ecosystem indicators.

38. Recommendations:

a. Indicators should be developed for environmental and fishing pressures and for the response of the ecosystem state to these pressures;

b. Vulnerability indicators should be developed for bycatch, including species of special concern, based on an ecological risk assessment;
c. Monitoring of ecosystem indicators should be carried out, with reporting through the Scientific Committee; and
d. The Commission can then consider how to base management action on information from fisheries, socio-economic and ecosystem indicators.

39. There was discussion about the critical need for fisheries management to develop indicators that monitored the changes wrought by fisheries themselves. Further discussion focused on correlates of environment and fisheries. There were also comments about the need for community level indicators, although there was also criticism about the incorrect use of this term. Currently, investigations are looking at the impacts of fishing on target species on elements of the entire ecosystem. However, there is a need to identify important ecosystem components and associated indicators for the purpose of monitoring. There was a reference to John Hampton's paper on size spectrum shifts presented at SCTB 17, which showed some size shifts of tunas, similar to those noted for billfish during this meeting. What was required is to be able to measure variables across species and scales, which may tell us about state of the ocean and the impact of fisheries.

PREY CONSUMPTION ESTIMATES FOR WCPO TUNAS

40. David Kirby presented a paper (WCPFC-SC1 EB WP–4) estimating total prey consumption by age class, consumption to biomass ratio and daily ration for tunas in the WCPO, using biomass estimates from the most recent stock assessments coupled with bioenergetics models based on field and laboratory observation and on hydrodynamic theory. The results demonstrate the extent to which top-down control is exerted by these oceanic top predators, improve the paramaterisation of ecosystem models and highlight areas of biological uncertainty that must be addressed in future studies of tunas and their prey; specifically, there is a need for better estimation of predator swimming speeds and assimilation efficiency and prey energy density. This work is illustrative of the ongoing utility of single species stock assessment results in the development of an ecosystem approach to fisheries management. It also demonstrates the importance of physiological understanding of predator and prey species when trying to determine ecosystem structure and function, and highlights the uncertainty that prevails as we seek to develop quantitative models for exploited ecosystems.

41. Recommendations:

a. Scaling up of understanding of basic biology in order to understand ecosystem properties;
b. Stock assessment results for tuna biomass may be combined with energy budgets in order to estimate prey consumption;
c. The results in terms of Q/B ratios and Daily Ration may be used to refine ecosystem models;
d. Uncertainty remains large and further experiments to determine tuna swimming speeds and assimilation efficiencies are needed.

42. The potential for the incorporation of data from tuna aquaculture into this study was discussed.

A COMPARISON OF HISTORICAL AND RECENT ESTIMATES OF THE BODY-SIZE AND ABUNDANCE OF PELAGIC SPECIES TAKEN BY LONGLINE

43. Peter Ward presented a summary of a study of recent data collected by observers on longline fishing vessels with data from a 1950s scientific survey when industrial fishing commenced in the tropical Pacific Ocean. Nominal CPUE in the 1950s was considerably higher than in the 1990s. Detailed, hook-level data were used to standardise catch rates for variables such as soak time, estimated depth, area and season for target and non-target species in each period. The size composition of catches and standardised catch rates changed significantly between the two periods. The largest and most abundant predators, such as sharks and large tunas, showed the largest declines in standardised catch rates. Those species also showed reductions in mean body size. By contrast, the catch rates of several small and formerly rare species increased, e.g., pelagic stingray.

44. There was a wide-ranging and spirited discussion of Peter Ward's presentation. Differences in spatial area between the two time periods may confound comparisons. This included fishing around islands and seamounts where catches were expected to be better, and latitudinal and longitudinal variations, where larger bigeye and in the 1990s yellowfin tunas are found the east. There were also comments about the differences in gear between the 1950s versus the 1990s. However, hook size, bait type and the use of wire leaders were consistent between the two time periods; the main difference was in the use of tarred rope versus present-day monofilament line. The study initially explored the sensitivity of results to latitude and longitude, but constraining the study area to the area fished in the 1990s had only increased confidence intervals.

45. It was noted that declines in CPUE and mean size were expected with fishing on a virgin stock. What was more important was how much of the change was due to a decrease in biomass, and how much to other factors such as environmental variability, changes in selectivity and the way the fishing gear was deployed. It was noted however, that few small yellowfin were captured in the 1950s versus the present. Was this due to movement or expansion of smaller fish into habitat previously used by larger fish? Did removal of larger fish free up additional habitat for smaller fish? Market demand for smaller fish was also advanced as another potentially confounding influence on this study. However, it was thought that over time longline gear had been set deeper to target larger fish, which had become scarce. Changes in hook size over time to smaller hooks should not have limited the catch of larger fish. A basic premise of the study is that commercial longliners in the 1990s endeavoured to maximise the total weight of their catch of commercial species.

46. Additional comments on the presentation included the lack of overlap between the 1950 and 1990 data with regard to areas of effort, and in particular, little or no overlap of depth of operations and times. Doubts were expressed that the GLM model could not really standardise the lack of overlap in the data. Further, the setting of longer mainlines would result in a lower CPUE due to the way tunas aggregate. Although these results were not consistent with the stock assessment for yellowfin, it was noted that both studies indicate a significant reduction in yellowfin tuna biomass in this region with time. Further, there were some overlaps of soak time; hook depths etc. between the two data sets (1950s and 1990s), and the data were adjusted using these overlaps. However, longline effort may not be as powerful if hooks are spread over a longer longline. Further, there were indications that once more than 800 million hooks per quarter were set, there may be some saturation effect in the catch rates for yellowfin tuna.

47. There were several comments about the dangers of interpreting CPUE data, particularly from two widely separated periods in time. Reference was made to John Hampton's paper for SCTB17 on size spectra changes of tunas over the past half century, which showed that changes in tuna size due to fishing were not evident until the 1970s and 1980s. The appearance of several new species (e.g. pomfrets) was due to operational differences, such as deeper longlines. The appearance of other species like pelagic stingrays could not be so easily attributed to operational changes.

48. The area of this study was adjacent to the main concentration of biomass for yellowfin tuna, which is more abundant to the west in Region 2. It would be interesting to compare the results for bigeye tuna, which did not show the same dramatic changes as yellowfin CPUE and size frequency. The use of widely separated point estimates was repeated, noting that 1970s yellowfin mean size was only about 50% of those in the 1950s and 1990s.

49. Final comments on this presentation noted the differences in the expertise of fishermen. In the Japanese fishery in the 1950s, crews comprised Japanese career fishermen with a great deal of experience, who could out-perform all other crews and fleets. The advent of monofilament gear meant that such expertise was no longer such a competitive advantage. However, it was also noted that the 1950s data were from a systematic survey versus commercial fishing in the 1990s where crews were searching for fish, thus the changes observed in this study might be conservative.

LONG-TERM CHANGES IN CPUE OF SHARKS AND SIZE OF BLUE SHARKS CAUGHT BY TUNA LONGLINES IN THE WESTERN NORTH PACIFIC OCEAN

50. Ziro Suzuki presented a study motivated by a recent paper by Peter Ward and Ransom Myers, which claimed higher impact of longline fishery on large pelagic community including blue shark. Long-term comparisons of shark CPUE were made using recent and historical data collected by Japanese research and training vessels in the western North Pacific. Standardised species combined shark CPUE in the 1930's, 1960's and 1990's did not show any difference but were comparable between these periods. It was assumed in this paper that the combined shark CPUE represents blue shark CPUE, which was the predominant shark, caught by research and training vessels. Average body lengths of blue sharks showed a minor decline in some area. The maximum decline of 13% was recorded at higher latitudes, which corresponded to 36 % reduction in body weight, but for the rest of the area there were no declines. Results of the analysis indicated that both CPUE and body size of blue shark varied temporally and spatially, but did not show statistically significant difference in most cases. It was concluded; therefore, that tuna longline fishery did not have a significant impact on blue shark stock, which is the predominant shark species caught by longliners in the western North Pacific Ocean.

51. Comments on this paper questioned the use of combined shark catch as representative of blue shark. More operational data such as soak time, time of set, etc. would be useful for this study. There was also a comment made that many major changes in the pelagic fish community occurred early on when fishing commenced and would thus be missed by this study. The EB-SWG encouraged further compilation and analysis of historical data sets like this.

APPLICATION OF SEAPODYM TO THE PACIFIC PELAGIC ECOSYSTEM – RECENT RESULTS AND PERSPECTIVES

52. Patrick Lehodey presented a study of the application of the ecosystem model, SEAPODYM, to the Pacific Pelagic Ecosystem. Since its early development in 1995, the spatial ecosystem and population dynamics model SEAPODYM has been continuously enhanced to provide a general framework allowing integrating the knowledge on the biology and ecology of tuna species within a comprehensive description of the pelagic ecosystem. The model is now fully operational for running multi-species, multi-fisheries simulations and a first application comparing single-species simulations of skipjack, yellowfin and bigeye tuna populations and fisheries with a multi-species simulation of these 3 species was presented for the period 1950-2004, based on predicted environment (temperature, currents, and primary production) from an ocean-biogeochemical model developed at ESSIC (Univ. of Maryland, USA).

53. A reasonable parameterisation of all components (mid-trophic components, tuna species and their fisheries) was achieved. Results appear coherent together, capture the main features described from (limited) observations for the pelagic micro nekton and tuna larvae distribution, converge fairly well with statistical estimates, and produce relatively high levels of correlation of spatial catch distributions. Previous conclusions on the impact of ENSO on the recruitment (Lehodey et al. 2003) are confirmed and point to a clear link between tuna recruitment and climatic fluctuations.

54. The multi-species simulation largely increases the convergence between recruitment and biomass estimates from SEAPODYM with those of the statistical model MFCL for bigeye tuna, suggesting that biomass of this species would have continuously declined in the late 1950's and during the 1960's due to both environmental variability and interactions with other predator species, especially skipjack that is controlling the epi-pelagic component of the pelagic ecosystem in the WCPO. Feedbacks mechanisms at the origin of these interactions still need to be analysed in details. From the 1970's, the increasing fishing impact was added to the natural decreasing trend, but thanks to a more productive regime of the bigeye stock during the period 1980-98, the biomass remained relatively stable. It is still difficult to assert that a new regime shift occurred since 1999, though evidence for such a shift in the North Pacific is increasing. In addition, even if this decadal climate regime shift is actually occurring,

it does not mean necessarily that the situation will return to the one existing in the period 1950-1975, especially since the global warming due to greenhouse effect can substantially modify the physical oceanic environment and then the pelagic ecosystem.

55. A reference version of the model SEAPODYM will be released on a dedicated web site (www.seapodym.org) and details of the model with the necessary information to run simulations are provided in a reference manual (ME-IP 1). Once the best paramaterisation of the model will be obtained and the predicted results fully evaluated, it will be possible to use this model for many different management scenarios taking advantage of its spatial multi-species multi-fisheries structure.

56. Recommendation:

a. Continue improvements in the paramaterisation;
b. Develop a version with an optimisation function;
c. Include albacore in the model;
d. Test management scenarios;
e. Export the model to other Ocean: GLOBEC CLIOTOP Modelling working group;
f. Test first simulation with climate change scenario (1860-2100) and carry out; and
g. Exploratory analysis to identify the main mechanisms that need more studies (for WG 1 2 3 in CLIOTOP).

57. Initial discussion focused on the declines in bigeye biomass in the model during the 1950s, which were thought to be due to species interactions. While there were no definitive answers on which species were interacting with bigeye, the introduction of skipjack into the model suggests that they compete with bigeye tuna. Moreover, there is also an increase in the skipjack population as bigeye biomasses decline. This may be due to some form of feedback mechanism, possibly due to skipjack-induced mortality on bigeye tunas through competition, stemming from the shorter time to reproduction of skipjack, which may allow it to exploit changing conditions more rapidly than bigeye. Difficulties in the model with regard to purse seine catches may be due to an assumption of constant catchability, which may require revisions within the model. Nevertheless, this model may be a useful tool for management especially when the Commission addresses bigeye tuna issues, with respect to management strategies and outcomes.

ECOPATH MODEL OF THE PELAGIC ECOSYSTEM OF THE WESTERN AND CENTRAL PACIFIC OCEAN

58. Valerie Allain presented a summary of a study to develop an ECOPATH model of the pelagic ecosystem of the western and central Pacific Ocean. In the context of ecosystem approach to fisheries management, ecosystem modeling is needed to help understand ecosystem functioning and to investigate impact of fisheries and environmental factors on this ecosystem. An Ecopath model of the Pacific warm pool has been developed including 24 components among which the three tropical tunas (split into adults and juveniles components) and 6 forage components classified according to their vertical distribution and behavior. This mass-balanced model is based on both local data (diet, catch, biomass, production) and estimates from the literature. After a large number of successive changes mainly in the diet matrix, the model could not be balanced and simulations to assess fisheries and environment impact could not be run. Improvements of the model are needed to balance it: variability into the diet matrix and other parameter and more accurate data on critical components of the ecosystem such as piscivorous predators and forage components. ECOPATH is still potentially an interesting tool to provide documented information on the impact on non-target species and on the ecosystem.

59. Recommendations:

a. Introducing variability into input parameters to assess uncertainty in the diet matrix and other parameters; and

b. Improve data for paramaterisation of the model.

FUTURE WORK PLAN

COLLABORATION WITH THE IATTC

60. With reference to agenda item 11.2 there is a proposal from the IATTC for collaboration between IATTC and WCPFC on a preliminary investigation of the status of Pacific shark stocks, and development of a research plan for a comprehensive assessment. A useful starting point would be a review of stock assessments for sharks elsewhere in the Pacific, including blue sharks in the North Pacific. A parallel review of shark bycatch also needs to be conducted to identify the priority species for formal stock assessments.

61. The Scientific Committee recognises that biological studies and assessing the status of sharks stocks within the Western and Central Pacific Ocean are important issues for the Commission, particularly as it has been shown that some shark species may be particularly vulnerable to over-exploitation. The Scientific Committee notes that the different spatial distributions of some shark species within the Pacific and regional differences in the priorities among member states makes it difficult to determine a single set of priorities for assessing sharks species at this time. Nevertheless, the Scientific Committee encourages member states to cooperate on carrying out research into sharks including stock assessments.

62. If agreement can be made on a small set of shark species of higher priorities, and the budget of the WCPFC allows, the Commission should also consider undertaking assessments of high priority shark species. Given the pan-Pacific distribution of some of these species, strong collaboration between the IATTC and the WCPFC and its respective contracting parties is recommended.

WORK PROGRAMME

63. Recommendations arising from work requested by the Commission included:

a. Improvement of observer coverage of Western and Central Pacific pelagic fisheries by increasing coverage rates, centralising and expanding observer data collection, designing specific observer programs to address specific objectives, and improving the identification and reporting of catch to species level and recording of fate and condition;
b. Carrying out an ecological risk analysis in order to prioritise species of sea turtles, sharks and seabirds and non-target fish species for future research;
c. Reviewing the potential for stock assessment of shark species in UNCLOS Annex 1; and
d. Studying interactions between newly developing fisheries and non-target species

64. Recommendations arising from contributed papers were:

a. With respect to non-target catch, further testing of the deep-setting longline techniques to validate the method and to see if the technique is useful for deep daytime swordfish fishing;
b. With respect to non-target catch, derive accurate information on key biological parameters for billfishes (age-estimates, growth rates, sizes-at-age, maturity schedules, movements and habitat preferences, stock structure, identification and reporting of catch to species level);
c. With respect to ecosystem indicators, potential ecosystem indicators should be developed and monitored, with examination of the spatial variability of each indicator and consideration of the boundaries over which to measure and report indicators;

d. Monitoring of ecosystem indicators should be carried out, with reporting through the Scientific Committee; the Commission can then consider how to base management action on information from fisheries, socio-economic and ecosystem indicators; and
e. Ecosystem reference points for management purposes should be developed.

36. Research recommendations with respect to ecological modelling included:

a. Scaling up of understanding of basic biology in order to develop ecological models;
b. The uncertainty in ecological models remains large and additional experiments are needed, e.g. to determine tuna swimming speeds and assimilation efficiencies;
c. Parameterisation of ecological models by statistical optimisation is also an important approach;
d. Ecosystem models should be used to explore management scenarios and the effects of climate variability and change; and
e. Improved data on the diet of target and non-target species will improve the parameterisation of ecosystem models.

TERMS OF REFERENCE

37. The EB-SWG reviewed its TOR and adopted the working version noted below:

The overarching purpose of the Ecosystem and Bycatch Specialist Working Group (EB-SWG) is to provide information to the WCPFC to fulfil Articles 5 (d & e) of the Commission's *Principles and measures for conservation and management*. To achieve this, the EB-SWG will review the impact on fishing on components of the ecosystem not targeted by fisheries; the interactions between climate and environmental factors and the target and non-target species; and the development of ecosystem-based models to assist the Commission with the development of management decisions. The functions of the Ecosystem and Bycatch Specialist Working Group shall be to:

Bycatch

- Review catch estimates for non-target species;
- Assess the impacts of fishing, other human activities and environmental factors on the ecosystem and biodiversity, including non-target, associated and dependent species, and habitats of special concern;
- Evaluate measures to minimise impacts of fishing on non-target, associated and dependent species and habitats of special concern;

Ecosystem analysis and modelling

- Review the results of research projects to support ecosystem analysis and modelling such as trophic studies and species interactions;
- Review impacts of pelagic fisheries on the pelagic ecosystem through ecosystem analysis and modelling;
- Review impacts of the environment on pelagic fisheries and stocks e.g., large scale work on pelagic ecosystem modelling, and more local scale ecosystem modelling at national level, including impacts on seamounts;
- Promote the development of new analysis and modelling approaches to investigate ecosystem impacts from fishing and environmentally driven processes, and ultimately to provide reliable prediction of changes in the spatio-temporal dynamics of the stocks and main components of the pelagic ecosystem;

Links with other SWGs and other organisations

- Note the linkages between the EBSWG and the other SWGs as follows;

- Bycatch mitigation methods, which minimise the selectivity of non target and protected species will also of interest to FT-SWG;
- The fundamental biological properties of incidentally caught species such as sharks and billfish relate to interactions structuring ecosystems and will be of interest to the BI-SWG;
- Technical aspects of ecological models should also be scrutinised by the ME-SWG (as occurs for stock assessment models);
- Environmental variability discussed in EBSWG will also be of interest to the SA-SWG and may need to be explicitly accounted for in the assessments themselves; and
- Other organisations will carry out research on ecosystems and bycatch that will be of interest to this group.

SELECTION OF A CONVENOR

38. The EB-SWG recommended that P. Dalzell and P. Ward convene the EB-SWG in 2005-2007.

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APPENDIX I – AGENDA ADOPTED FOR USE AT THE FIRST MEETING OF THE ECOSYSTEMS AND BYCATCH SWG

ECOSYSTEMS AND BYCATCH – SPECIALIST WORKING GROUP
AUGUST 2005

1. Introduction – P. Dalzell

2. Adoption of agenda

3. TOR for EB-SWG – P. Dalzell

4. Request from WCPFC-1
   a. Estimates of the mortality of non-target species with an initial focus on seabirds, turtles and sharks – B. Molony

5. Bycatch
   a. A review of the effectiveness of the deep longline setting technique in mitigating bycatch – S. Beverly
   b. Summary of the biology, ecology and stock status of billfishes in the WCPFC with a review of major variables influencing longline fishery performance – B. Molony
   c. The effects of soak time and depth on longline catch rates – P. Ward
   d. Overview of USA protected species bycatch mitigation research – P. Dalzell
   e. Long-term changes in CPUE of sharks and size of blue sharks caught by tuna longlines in the western North Pacific Ocean - H. Matsunaga, H. Shono, M. Kiyota and Z. Suzuki

6. Ecosystem Research and Modelling
   a. Prey consumption estimates for WCPO tunas - David Kirby, V. Allain & P. Lehodey
   b. Ecosystem delineation – John Sibert
   c. Potential ecosystem indicators for the WCPO. D. Kirby, V. Allain & B. Molony.
   d. A comparison of historical and recent estimates of the body-size and abundance of pelagic species taken by longline – Peter Ward
   e. Application of SEAPODYM to the Pacific Pelagic Ecosystem. Recent results and perspectives – Patrick Lehodey
   f. ECOPATH model of the pelagic ecosystem of the western and central Pacific Ocean - Valerie Allain

7. Proposed workplan/priorities for EBSWG for 2005/06 and beyond

8. Recommendations for EBSWG conveners to the Scientific Committee

9. Other business

APPENDIX II INFORMATION PAPERS - NOT PRESENTED

1. By-product in Australia's longline fishery

Don Bromhead, Australian Fisheries Management Authority

Longliners off eastern Australia incidentally take over 80 non-target species. A significant amount of this is retained as by-product. Total retained by-product increased through the 1990s to peak at just over 1300 mt (20% of total retained catch) in 2002. Due to the difficult economic outlook faced by these fisheries (resulting from overcapacity, localised depletions, increased fuel prices, lowered availability of target species and reduced access to export markets) by-product has become a relatively more important part of some fishers' catch and income. This paper reviews the catch and economics of 19 key by-product species taken in the domestic longline fishery, and identifies opportunities and threats for sustainable fisheries management associated with these trends. Comparison of observer and logbook data suggested under-reporting of catches and discarding for a significant number of these species. There are five key by-product species, albacore tuna (*Thunnus alalunga*), shortfin mako shark (*Isurus oxyrinchus*), dolphinfish (*Coryphaena hippurus*), rudderfish (*Centrolophus niger*) and black oilfish (*Lepidocybium flavobrunneum*) which comprise over 90% of the total catch and value of by-product. With the exception of albacore tuna, the status of most by-product species is unknown, but with falling catch rates in recent years and significant retention rates, some concern is held for the status of pelagic shark species, such as blue shark and shortfin mako. On the other hand, albacore tuna may offer some opportunity for further fishery development.

2. Distribution of albatrosses and petrels in the Western and Central Pacific and overlap with WCPFC longline fisheries

Cleo Small, Birdlife International Global Seabird Programme)

The WCPFC area includes 46% of the global breeding distribution of albatrosses, making it a highly important are for the conservation of these vulnerable species. Distribution is concentrated below 30 deg S and above 20 deg, and a substantial proportion is in the high seas areas. WCPFC longline fisheries set approximately 100 million hooks below 30 deg S and above 20 deg N per year. Overlap in the North Pacific is greatest in the 1st and 4th quarters. Overlap around Australia and New Zealand is greatest in the 2nd quarter. Available bycatch data indicate that seabird bycatch mitigation measures are highly likely to be necessary in the WCPFC areas. Birdlife strongly supports WCPFC's commitment to developing a regional observer program and hopes that WCPFC will collaborate with seabird bycatch mitigation experts in developing appropriate data-collection methods for recording seabird bycatch within this program. Birdlife offers its assistance to WCPFC to undertake detailed analysis of spatial and temporal overlap between WCPFC longline fisheries and distribution of albatrosses and petrels.

ANNEX XI –PAPERS RELATING TO THE RESOLUTION ON "CONSERVATION AND MANAGEMENT MEASURES"

WCPFC-SC1 SA WP-10 and WCPFC-SC1 EB WP-1

ANNEX XII – STATEMENT BY GREENPEACE

STATEMENT TO THE 1ST REGULAR SCIENTIFIC COMMITTEE MEETING OF THE WCPFC BY GREENPEACE

Honourable Chairman of the Scientific Committee, Distinguished representatives of member governments of the WCPFC, Executive Director of the WCPFC, Delegates of the Committee, fellow observers, Ladies and Gentlemen:

Greenpeace would like to take this opportunity to thank this distinguished Committee for allowing us the opportunity to observe and address your meeting. We are very honoured to be here today.

Greenpeace has campaigned on fisheries issues for the past few decades advocating at different levels ranging from scientific research, political engagement to grass root development. Our three ships (SV Rainbow Warrior, MV Esperanza and the MV Artic Sunrise) continue to travel the world, working with communities and governments to protect our environment and develop sustainable solutions to problems such as Over-fishing and IUU fishing.

We have a long term and growing interest in the management and, more importantly, conservation of Pacific oceanic tuna populations. It is largely on the basis of this interest, that Greenpeace has requested, and been granted, observer status to meetings arranged under the auspices of the Western and Central Pacific Fisheries Commission (WCPFC) to regulate fishing activity over the Western and Central Pacific Ocean.

In February 2004, we launched our Pacific Fisheries Campaign. The campaign is led by our staff based in offices in Fiji, Solomon Islands, Papua New Guinea, with assistance from offices in Australia, New Zealand and Europe. Our guiding vision for the campaign is to promote sustainable and equitable fisheries in the Pacific. We are confident that this is a vision shared by these Committee under your directive from the Commission and we certainly regard your scientific advice as critical to achieving this vision through your direct regional and international work within the Western and Central Pacific Fisheries Commission (WCPFC) and the United Nations

This Committee has an important mandate in providing the best scientific advice to the Commission in ensuring good and sound management decision are made for the Conservation of Highly Migratory Fish Stocks. We recognise the early stages of this Committee in your efforts in recommending concrete management options for the Commission to consider in December. We would like to also commend this Committee for the tasks you have all develop throughout the course of this meeting in developing a Workplan for this Committee for more scientific research and data gathering.

We welcome your commitment and advice to influence limits to fishing efforts at the upcoming 2nd Commission meeting. With some fish species showing signs of concerns, we urge this Committee to advocate strong leadership and guidance based on the scientific advice you will be recommending to the Commission. We would also like to reiterate the need and your support in ensuring that member of the WCPFC embrace the precautionary approach that we have long committed to since Rio. The precautionary approach as you are all well aware, tells us that whenever threats to the natural environment are identified and whenever there is high scientific uncertainty regarding the effects of an activity on the natural environment, we should constrain such activity until proof, of either no effect or a negative impact, is obtained. The resources after all in the
ocean do not belong to the fishing industry or to governments alone. They belong to all of us and it is the interest of our Pacific people that must be place before all else.

It is no secret that as fish stocks collapse around the world, our ocean, The Western and Central Pacific Ocean is being immensely pressured and preyed upon by Distant Water Fishing Nations. The oceans are in crisis and we have an opportunity to ensure that the mistakes of other regions are not

repeated here. We are custodians of the Pacific Ocean and it is important that we are relentless in performing this duty whether that may be in your capacity of scientific advisers or as custodians of the Pacific.

Greenpeace is committed to advocating for this under the work and vision of the Commission. We are dedicated to working on this at the international, regional and national level and we remain willing to listen, share information and engage in dialogue with you, over issues of common interest.

Greenpeace would like to bring your attention to some areas of interest to us:

Conservation and Management of Highly Migratory Fish Stocks:

We are concerned about the status of Bigeye and Yellowfin Tuna in our region. The status of these two key highly vulnerable and valuable tuna species as showing signs of Overfishing and that has been reiterated in presentations made during this meeting. We had circulated our temporary science position paper that outlines general effort reduction options for the Western and Central Pacific Ocean in ensuring recovery of Bigeye and Yellowfin Tuna and we thank this Committee for allowing our paper to be noted in the final distribution of official papers. We acknowledge the concrete recommendation that has been developed by this Committee in response to the status of these two tuna species and we urge your collaborative effort in ensuring that these are observed at the Commission level and is not overtaken by political will. We will be making available towards the 2nd Commission meeting in December a more comprehensive scientific report that will outline detailed effort reduction options for the WCPO. We seek the support and collaboration of this Committee in our efforts to ensure sustainability of bigeye and yellowfin.

We have an active IUU program in our campaign as we feel that this is one of the key threats to the sustainability of fish stocks in our region. IUU operations by their nature, are vague, secretive and thrive on loopholes that make it hard to detect. We urge this Committee to seek collaboration with other RFMOs and organisations that are well advanced into trying to identify, eliminate and eradicate IUU. Under the mandate of this Committee, we recommend that work is undertaken in addressing IUU in the Convention Area through proposing management measures and research that will minimise the impacts of IUU in our region and increasingly enhance the uncertainty that exists in relation to catch and effort data that are taken by these operations unaccounted for.

The Pacific Ocean is believed to contain half of the estimated 100,000 seamounts worldwide. To date less than one percent of known seamounts have been studied. These studies have shown that the long life cycles and slow sexual maturation of deep-sea fish, makes them particularly vulnerable to large-scale fishing activities. Seamounts are remarkably food-rich. They accumulate enormous amounts of plankton which in turn attracts countless known and un-known species of deep-sea marine life. Acknowledging that there have been reference to seamounts in this meeting, we would like it noted in this Committee to consider research into this issue particularly on the relationship and impact of highly migratory fish species including tuna aggregating around seamounts. Understanding the impacts on the reckless plunder of this rich underwater world by destructive fishing practices like Bottom Trawling is something that this committee may like to consider in the future.

We would like to thank and commend the SPC-OFP for their fundamental efforts in providing a good scientific analysis in all their three capacity as deliberated yesterday (i.e. as an Independent observer, Service provider to the Commission & regional scientific body) , we would like to thank all those that have prepared detailed scientific papers to this meeting, the Specialist working group in your hard work to develop recommendation based on the analysis of scientific data provided by members and observers, participants in the deliberation and endorsement of papers and recommendations to the Commission, the Chair in his capacity as facilitator, the secretariat and organisers for all their hard work and for their assistance on logistics.

We note that most of the papers for this meeting were on your web-site well ahead of time and it allowed us to peruse them before coming to Noumea. This transparent approach is much appreciated. We wish you luck in the implementation of your proposed 2005-2006 workplan.

Finally, I wish to take this opportunity to extend our gratitude to the wonderful people and the Government of New Caledonia for the memorable hospitality provided to all of us here.

We thank you for your time and we look forward to working closely with you for the greater good for our region.

Vinaka Vakalevu

(*delivered by*)

Lagi Toribau

Pacific Oceans Campaigner

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