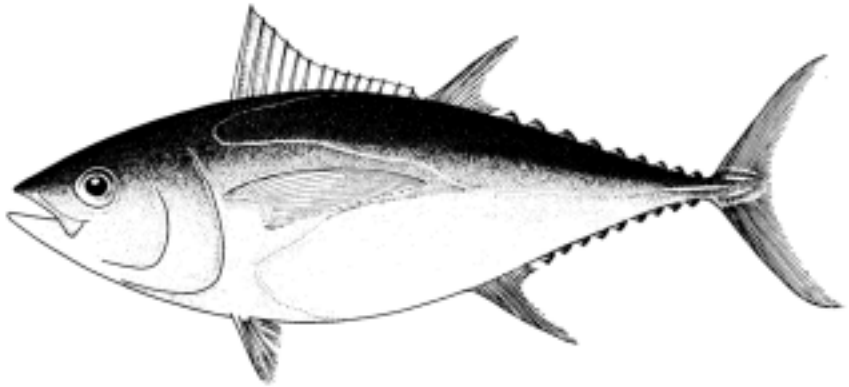
Sixteenth Meeting of the
STANDING COMMITTEE ON TUNA AND BILLFISH
Mooloolaba, Queensland, Australia
9–16 July 2003

EXECUTIVE SUMMARY



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The sixteenth meeting of the Standing Committee on Tuna and Billfish (SCTB 16) was held on 9-16 July 2003 in Mooloolaba, Australia at the invitation of the Chairman, and hosted by the Commonwealth Scientific and Industrial Research Organisation and Agriculture, Forestry, Fisheries - Australia. SCTB 16 was attended by participants from Australia, Canada, Cook Islands, European Union, Federated States of Micronesia, Fiji, France, Indonesia, Japan, Korea, Marshall Islands, New Caledonia, New Zealand, Niue, Palau, Papua New Guinea, the Peoples Republic of China, Philippines, Taiwan, Tonga, United States of America, Vanuatu and Vietnam. Representatives from various regional and international organizations also attended the meeting. These included the Forum Fisheries Agency (FFA), the Inter-American Tropical Tuna Commission (IATTC) and the Secretariat of the Pacific Community (SPC).

The SCTB provides a forum for scientists and others with an interest in the tuna and billfish stocks of the western and central Pacific Ocean (WCPO) to meet to discuss scientific issues related to data, research, and stock assessment. Its aims are to:

1. coordinate fisheries data collection, compilation and dissemination according to agreed principles and procedures;
2. review research on the biology, ecology, environment and fisheries for tunas and associated species in the WCPO;
3. identify research needs and provide a means of coordination, including the fostering of collaborative research, to most efficiently and effectively meet those needs;
4. review information pertaining to the status of the stocks of tunas and associated species in the WCPO, and to provide statements on stock status were appropriate, and;
5. provide opinion on various scientific issues related to data, research and stock assessment of WCPO tuna fisheries.

The SCTB Chairman and Working Group and Research Group Coordinators for SCTB 16 were as follows.

SCTB Chairman:	Dr. SungKwon Soh
Fishing Technology WG:	Mr. David Itano
Methods WG:	Dr. John Sibert
Statistics WG:	Mr. Tim Lawson
Albacore RG:	Mr. Régis Etaix-Bonnin
Bigeye RG:	Dr. Naozumi Miyabe
Skipjack RG:	Dr. Gary Sakagawa
Yellowfin RG:	Dr. Robert Campbell
Billfish and Bycatch RG:	Mr. Paul Dalzell

The meeting agenda, working papers presented at the meeting and list of participants are provided in Appendices 1, 2 and 3, respectively. The meeting convened as eight working groups; the Statistics Working Group (SWG), the Fishing Technology Working Group (FTWG), the Methods Working Group (MWG), the Skipjack Research Group (SRG), the Albacore Research Group (ARG), the Yellowfin Research Group (YRG), the Bigeye Research Group (BRG), and the Billfish and Bycatch Research Group (BBRG).

The initial overview of Western and Central Pacific Ocean (WCPO) tuna fisheries noted that the estimated total catch for 2002 for the four main tuna species was 1,982,000 mt, the second highest annual catch on record after 1998 (2,037,600 mt). The 2002 WCPO catch of skipjack (1,321,900 mt) was the highest ever, eclipsing the previous record catch attained in 1998 (1,314,200mt), and as usual dominated the total catch. The WCPO yellowfin catch (438,000 mt; 22%) was the lowest for six years and about 65,000 mt lower than the record catch in 1998 (503,000 mt). The WCPO bigeye catch for 2002 (107,600 mt; 5%) was slightly higher than in 2001, while the WCPO albacore catch (114,500 mt; 6%) was slightly down on that taken in 2001. The record catches for these species are 111,000 mt and 148,000 mt, respectively and were taken during 1999. In contrast to the WCPO, the EPO yellowfin catch for 2002 was the highest ever (427,700 mt), but the EPO bigeye catch was the lowest since 1984.

Reports on relevant activities of other organizations were received from IATTC and PFRP.

The three Working Groups (Statistics, Methods and Fishing Technology) held a series of meeting in the two days prior to SCTB16 and considered a range of issues relevant to their respective terms of reference. Summaries of these meetings were presented to SCTB16 and summary statements for each Working Group are provided.

The five Research Groups considered regional fishery developments, advances in research, stock assessment and research coordination and planning for those species or groups of species. Summary statements on these matters are provided for each research group.

Cross-cutting issues arising from discussion in the three Working Groups and five Research Groups were considered in a separate session of SCTB for the first time. The discussion, which considered issues relating to estimation of catch, catch rates and size/species composition, biological and ecological, stock assessment and emerging management issues, identified certain research issue as priorities with time frames for implementation. Those issues which were identified as being of a high priority included:

- Better estimates of current catch from Indonesia, Philippines and Vietnam, noting that some progress had been achieved in this area;
- Reconstruction of early catch history (catch, effort, size composition) for all fisheries;
- Further development of methods to standardise effort, including the better use of vessel operational details, environmental data and archival tagging data;
- General efforts to reduce uncertainty in assessments, through improved data inputs, sensitivity analysis and simulations;
- Evaluation of possible regime shifts/changes in productivity and development of improved/alternative estimates of recruitment where possible;
- Development of appropriate formats to frame advice for managers.

The session also reaffirmed the recommendation from previous SCTB meetings that large scale tagging experiments for the main target tuna species in the WCPO be carried out, and in coordination with

tagging experiments in the eastern Pacific Ocean (EPO). Such an experiment was seen as being crucial to helping the estimation of movement and fishing mortality rates in the assessment models and providing an independent means of validating models results, and as such should be regarded as the appropriate regular monitoring approach for highly migratory species in the WCPO. Finally, the session reaffirmed the value of directed fisheries research, and its central role in the quality of management advice provided and in reducing uncertainty in the advice provided. The session also noted the likely negative consequences to both the management of the fishery and the status of stocks (mainly bigeye and yellowfin tuna) if such research is delayed.

The meeting held initial discussions on defining and measuring fishing capacity in WCPO tuna fisheries and what role SCTB might have given other regional and international initiatives. The meeting noted that the primary focus of SCTB was stock assessment and in this regard were interested in measures of effective fishing effort. SCTB was unable to agree on a definition of fishing capacity. While it remained unclear what SCTB could do in relation to measuring fishing capacity it was noted that there were contributions it could make in areas of improving data availability, in fishing effort standardization and possibly others. Having noted that other agencies were still grappling with how to address the issue after several years of consideration, it was recognised that fishing capacity issues were broader than what could be resolved in this initial discussion. SCTB members were encouraged to consider this issue over the coming year, and to consider discussing fishing capacity again at SCTB 17.

The meeting also considered proposals for improving the organisation of future SCTB meetings. A number of options were discussed and adopted. In acknowledgement of the time required to undertake the assessments, a recommendation to hold the SCTB meeting at a later date (possibly in August) was also adopted.

Finally, the meeting considered the arrangements for 17th SCTB meeting. Dr Sung Kwon Soh was thanked for his outstanding performance in chairing SCTB 16 and reaffirmed as the chair for SCTB 17. Dr Max Stocker was elected as the new chair for the Albacore Research Group while all other chairs of the Working and Research Groups remained unchanged. The meeting also considered the venue for the next meeting and accepted an offer from the Marshall Islands to host SCTB 17 in Majuro in 2004 (exact dates to be advised). The meeting closed on Wednesday 16 July at 17:00 hrs.

STATISTICS WORKING GROUP – SUMMARY STATEMENT

The objective of the Statistics Working Group is to coordinate the collection, compilation and dissemination of tuna fishery data. Highlights of the current status of data collection, compilation and dissemination include the following:

- In recent years, estimates of the annual catches of the target tuna species (albacore, bigeye, skipjack and yellowfin) have been provided within six months following the end of the calendar year for all fleets, except those covering the longline and pole-and-line fleets of Japan; however, most of these estimates do not include discards. Estimates of annual catches of billfish are less complete. The availability of data (primarily observer data) to estimate the annual catches of other highly migratory species covered by the WCPF Convention, and species of special interest (marine turtles, sea birds and marine mammals), will be reviewed by the SPC Oceanic Fisheries Programme.

- For 2001, the most recent year for which all or most data have been compiled, the OFP holds catch and effort logsheet data covering 44.3% of the catch of target species in the WCPO. These data cover catches taken by the domestic fleets of SPC member countries and territories, catches by distant-water fleets fishing with the EEZs of SPC members, and catches of certain distant-water fleets on the high seas (such as the purse-seine fleets of Korea and Taiwan, but not Korean and Taiwanese distant-water longline fleets or any Japanese fleets). Excluding the domestic fisheries of Indonesia and the Philippines, for which no catch and effort data have been provided, and the coastal fisheries of Japan, the logsheet coverage is 64.3%.

- Coverage by catch and effort data aggregated by time and area (5° latitude by 5° longitude by month for longline and 1° by 1° by month for pole-and-line and purse seine), which are derived from data held by the OFP or provided by distant-water fishing nations, is complete for 1950–2001, except for those covering certain fleets in the early part of the times series. The National Research Institute of Far Seas Fisheries of Japan recently provided historical longline catch and effort data, aggregated by 5° by 5° and month, for 1952–1961. Aggregated catch data covering the domestic fleets of Indonesia and the Philippines are based on estimates of annual catches that are highly uncertain and effort data for these fleets have not been collected.

- The coverage by length or weight data is currently sufficient for all gear types, except for the domestic fleets of Indonesia, the domestic fleets of the Philippines and the coastal fleets of Japan. Size sampling should be established for these fleets.

- Information regarding the coverage by catch and effort logsheet data and size data that are not held by the OFP – primarily data held by Japan, Korea and Taiwan – has not been provided in most cases.

- Estimates of annual catches for the domestic fleets of Indonesia and the Philippines have been provided on a timely basis; however, annual catch estimates in recent years (1992–2002 for Indonesia and 1997–2002 for the Philippines) have not been broken down by gear type and estimates of annual bigeye and yellowfin catches for all years have been reported as a combined catch. Catch data at a higher resolution and effort data have not been provided. Species composition and size data have been collected in the Philippines since 1997, but this programme was interrupted in 2002 due to funding constraints. No sampling is being conducted in the Pacific Ocean waters of Indonesia. The SWG, in collaboration with the relevant national authorities, will continue to

develop project proposals and seek sources of funding to establish sampling programmes in the Pacific Ocean waters of Indonesia and to provide support for ongoing sampling programmes in the Philippines.

- Uncertainties remain regarding the past and present species composition of small tropical tunas caught by purse seiners in association with floating objects, particularly in regard to bigeye.

A one-day meeting of the SWG on standards for the design of national and regional observer programmes was held immediately prior to SCTB16. Guidelines were established for coverage rates relating to research objectives for observer programmes covering the offshore longline fleets targeting South Pacific albacore (American Samoa, Cook Islands, Fiji, French Polynesia, New Caledonia, Samoa, Tonga). Further analyses will be conducted to establish guidelines for the offshore longline fleet targeting bigeye and yellowfin and the purse-seine fleets fishing in tropical waters on the basis of observer data held by the SPC Oceanic Fisheries Programme; however, observer data are not available to conduct similar analyses for the distant-water longline fleets.

Recent developments in port sampling and observer programmes were discussed. Port sampling programmes are currently being conducted in Australia, Cook Islands, Federated States of Micronesia, Fiji, Japan, Kiribati, Korea, Marshall Islands, New Caledonia, New Zealand, Palau, Papua New Guinea, Solomon Islands and Taiwan. Observer programmes have been developing slowly in regional and national organisations throughout the WCPO, but in recent years have expanded more rapidly in response to the need for detailed information on fishing effort, discards and catch statistics for non-target species. Observer programmes are being conducted in Australia, Cook Islands, Federated States of Micronesia, Fiji, French Polynesia, Kiribati, New Caledonia, New Zealand, Papua New Guinea, Solomon Islands and the United States (Hawaii), and the Forum Fisheries Agency manages the observer programmes covering the United States and FSM Arrangement purse seiners. Observer programmes are being developed in American Samoa, Japan, Korea and Taiwan.

The problem of the mis-identification of bigeye as yellowfin on purse-seine logsheets was addressed. In particular, an analysis of the proportion of bigeye in the combined catch of yellowfin and bigeye, based on purse-seine observer data held by the OFP for 1998–2001, was presented. Several data sets that can be used as input data for the MULTIFAN-CL assessment of bigeye were produced, based on varying assumptions regarding the statistical relatedness of the proportion of bigeye in the combined catch of yellowfin and bigeye with variables such as school association, year, quarter, area, flag and size group. A report of a review of the accuracy of species identification by port samplers in American Samoa was also presented; it was verified that the accuracy of the two samplers was 100% over the size range of fish that were examined (41 cm yellowfin, 45 cm bigeye). It was recommended that similar work be conducted to verify port sampling throughout the region, preferably when yellowfin and bigeye of smaller sizes are available.

SKIPJACK RESEARCH GROUP – SUMMARY STATEMENT

Key attributes: Skipjack tuna is found year-round concentrated in the tropical waters of the WCPO. Its distributional range expands seasonally into subtropical waters to the north and south. It is a species characterized by large stock size, fast growth, early maturing, high fecundity, year-round spawning over a wide area, relatively short life span (maximum age of 4 or 5 years old) and variable recruitment.

A single stock is assumed to reside in the WCPO. Currently, stock assessment for this stock is largely undertaken with the MULTIFAN-CL model. The Methods Working Group has noted concerns about the model's ability to produce accurate estimates for some parameters. Consequently, the Skipjack Research Group (SRG) has taken into account the concerns and has largely relied on trends and ratios instead of point estimates from the model in assessing current stock status.

Recent developments in the fishery: Skipjack tuna catches exceed any other tuna species, and a majority of the catch is taken by purse seine. Catches from purse seine sets consist of a mixture of skipjack, yellowfin, and bigeye tuna, with the proportions varying depending on whether sets are made on free schools or floating objects.

Over the past 4-5 years, the catch has been at record high levels exceeding 1.2 M mt annually (Figure 1) and accounting for more than 60% of the annual catch of principal tuna species landed from the region. Along with the record catches, the price for skipjack tuna has fallen to levels not seen since the 1970s. Since about 1996, increased use of Fish Aggregating Devices (FADs) by purse seiners has contributed to the record catches. Typically, the bulk of the catch consists of two age groups (size range 40–70 cm FL).

In 2002, an estimated catch of 1.3M mt tuna was landed, the highest on record. Seventy-three percent (962,700 mt) was taken by purse seine gear, 21% (280,600 mt) by pole-and-line gear and 6% (70,000 mt) by other gears.

CPUE trends: Nominal CPUE for all purse seine fleets, except the U.S. fleet, continues to show an upward trend, reaching a record high average rate of approximately 30 mt/day fished in 2002. This increase is due to increase in efficiency associated with setting on floating objects. Standardized CPUE for the Japanese pole-and-line fleet, on the other hand, shows no trend.

Sizes of fish trend: Sizes of fish in the catch (based on weight) has largely been constant with a dominant mode at about 50-60 cm FL and a significantly smaller mode at about 30 cm FL (Figure 2). 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.

Recruitment trend: Estimated recruitment has varied (about three fold) since 1972 and the trend has been upward. Estimated current recruitment, although less precise than estimates for earlier year classes, is among the highest in the time series (Figure 3). This high recruitment appears to be related to El Nino events.

Biomass trend: The level of biomass of skipjack tuna is largely dictated by the level of incoming recruitment to the population. Since 1972, the trend in estimated biomass has been upwards, following an apparent step-wise increase in recruitment (Figure 4). Current biomass is well above the biomass that would produce MSY.

Fishing mortality trend: The trend in estimated fishing mortality rate has been upwards since 1972, with the current overall fishing mortality rate (F) at a modest level of approximately 0.20-0.25 per year (Figure 5).

Stock status: Estimated biological reference points, particularly B-current/B-msy and F-current/F-msy, indicate that the skipjack tuna stock of the WCPO is not overfished owing to recent high levels of recruitment and a modest level of exploitation relative to the stock's biological potential (Figure 6). Continued catches at the 1.2 M mt level is sustainable with continued high levels of recruitment (Figure 7), which are believed to be determined by principally environmental factors and not owing to a strong spawner-recruit relationship

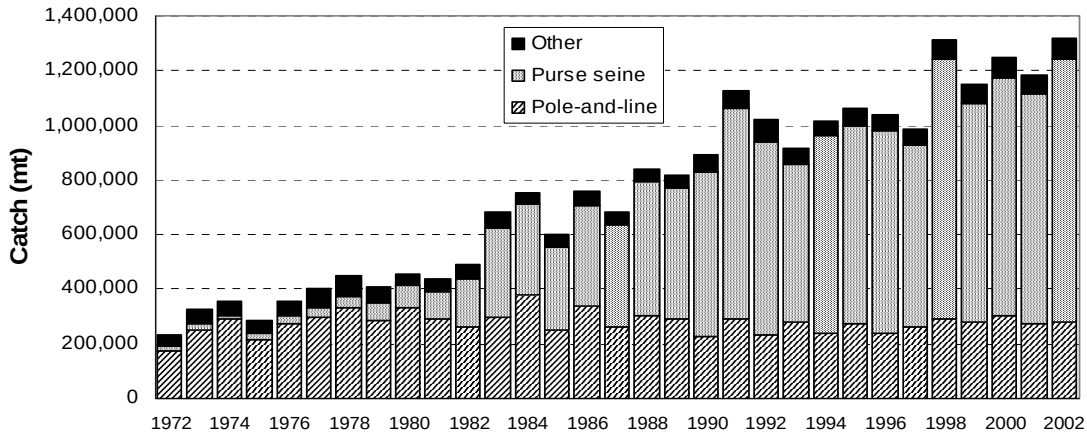


Figure 1. WCPO skipjack catch (mt) by gear

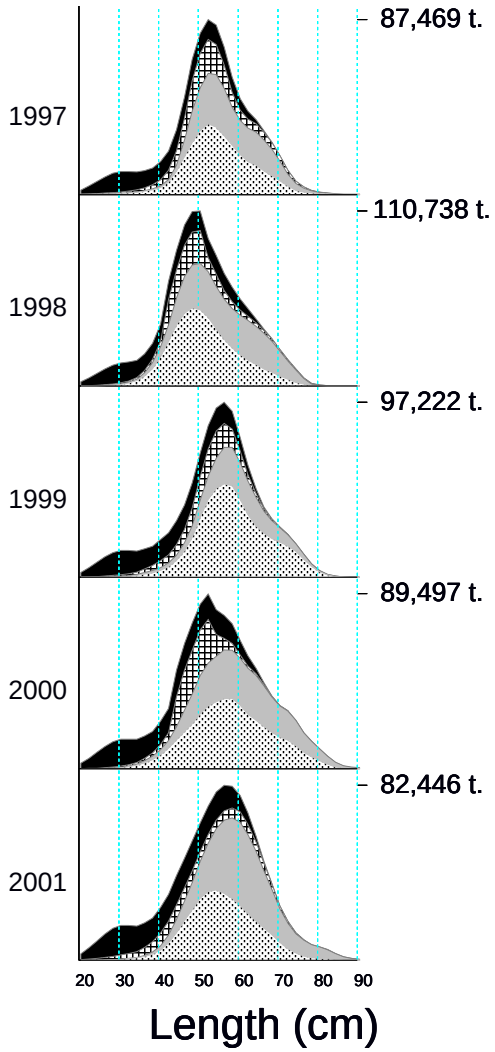


Figure 2. Annual Skipjack tuna catch-at-size in the WCPO, 1997–2001.

The catch is broken down into the Indonesian/Philippines domestic fisheries component (black), the pole-and-line fishery component (hatched), unassociated-set catch from the purse-seine fishery (grey) and associated-set catch from purse-seine fishery (dotted). The y-axis scale is in weight – the figures on the right indicate the catch weight in a 2-cm size class.

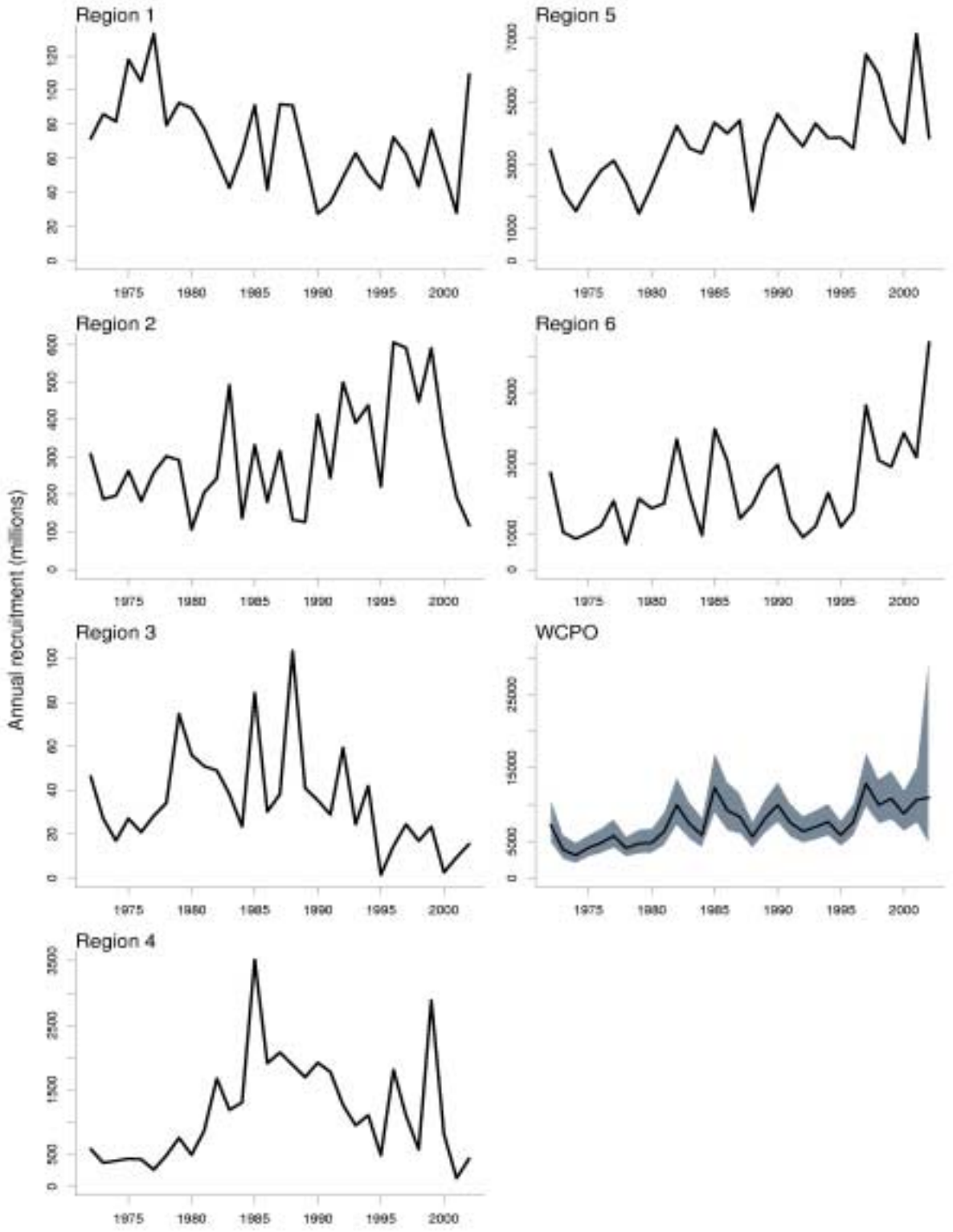


Figure 3. Estimated annual recruitment (millions) by region and for the WCPO for the base-case analysis. The shaded area for the WCPO indicates the approximate 95% confidence intervals.

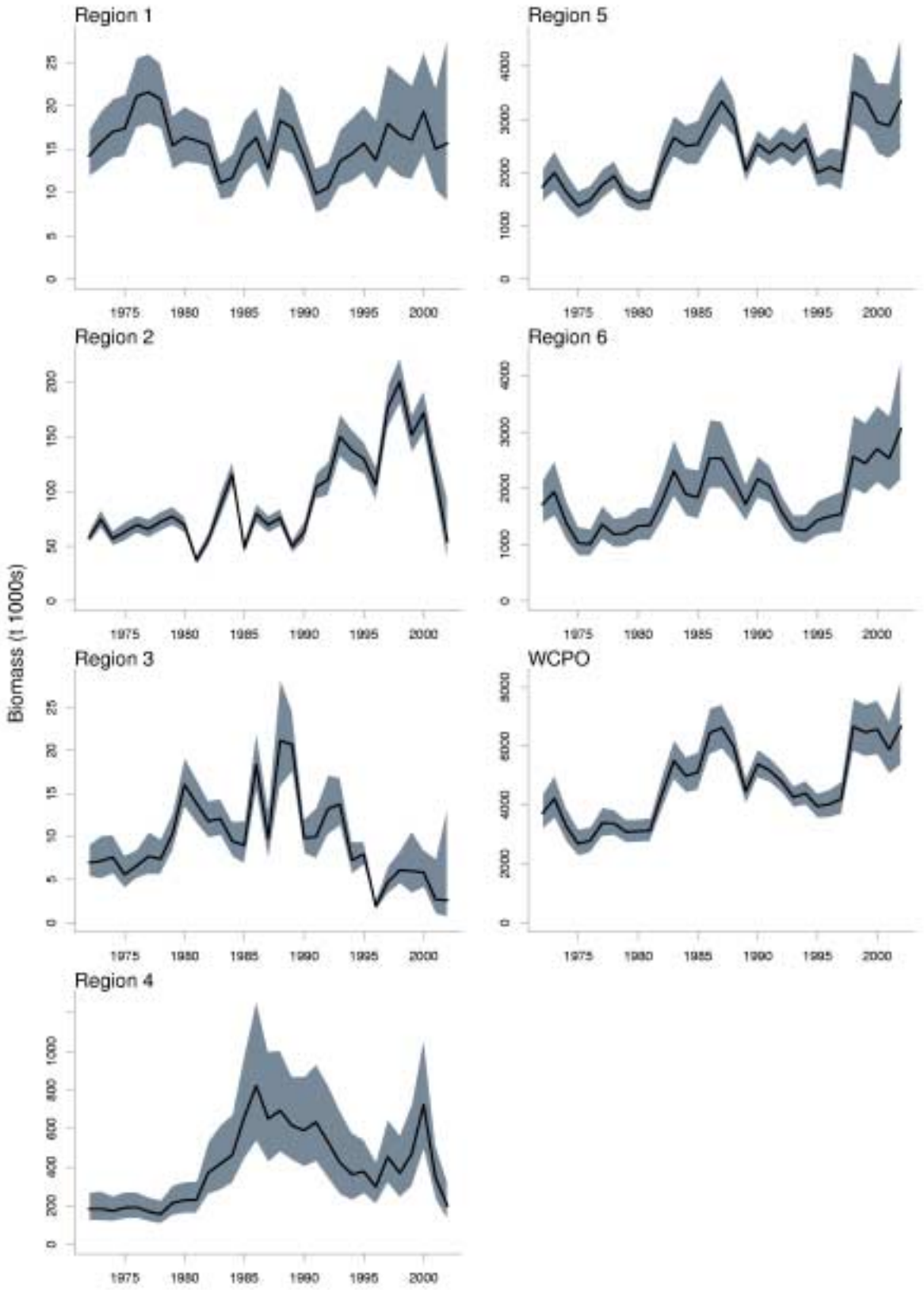


Figure 4. Estimated annual average total biomass (thousand t) by region and for the WCPO for the base-case analysis. The shaded areas indicate the approximate 95% confidence intervals.

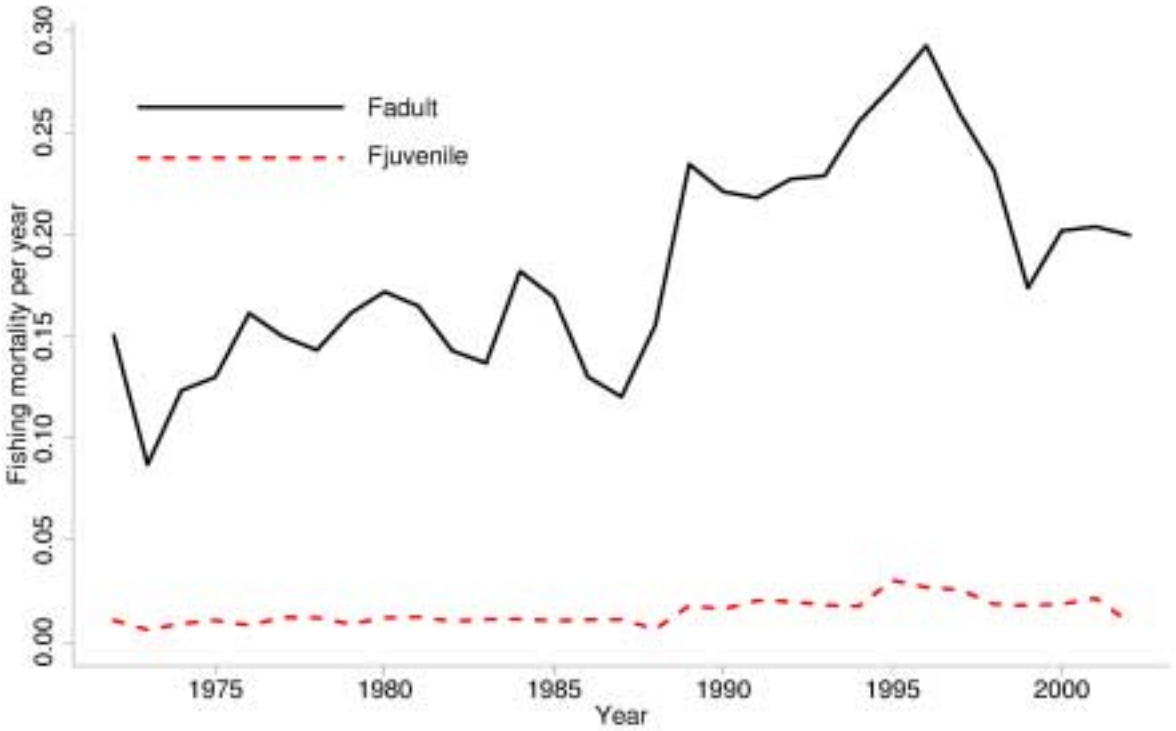


Figure 5. Estimated annual average fishing mortality rates for juvenile (age classes 1 and 2) and adult age-classes from the base-case assessment.

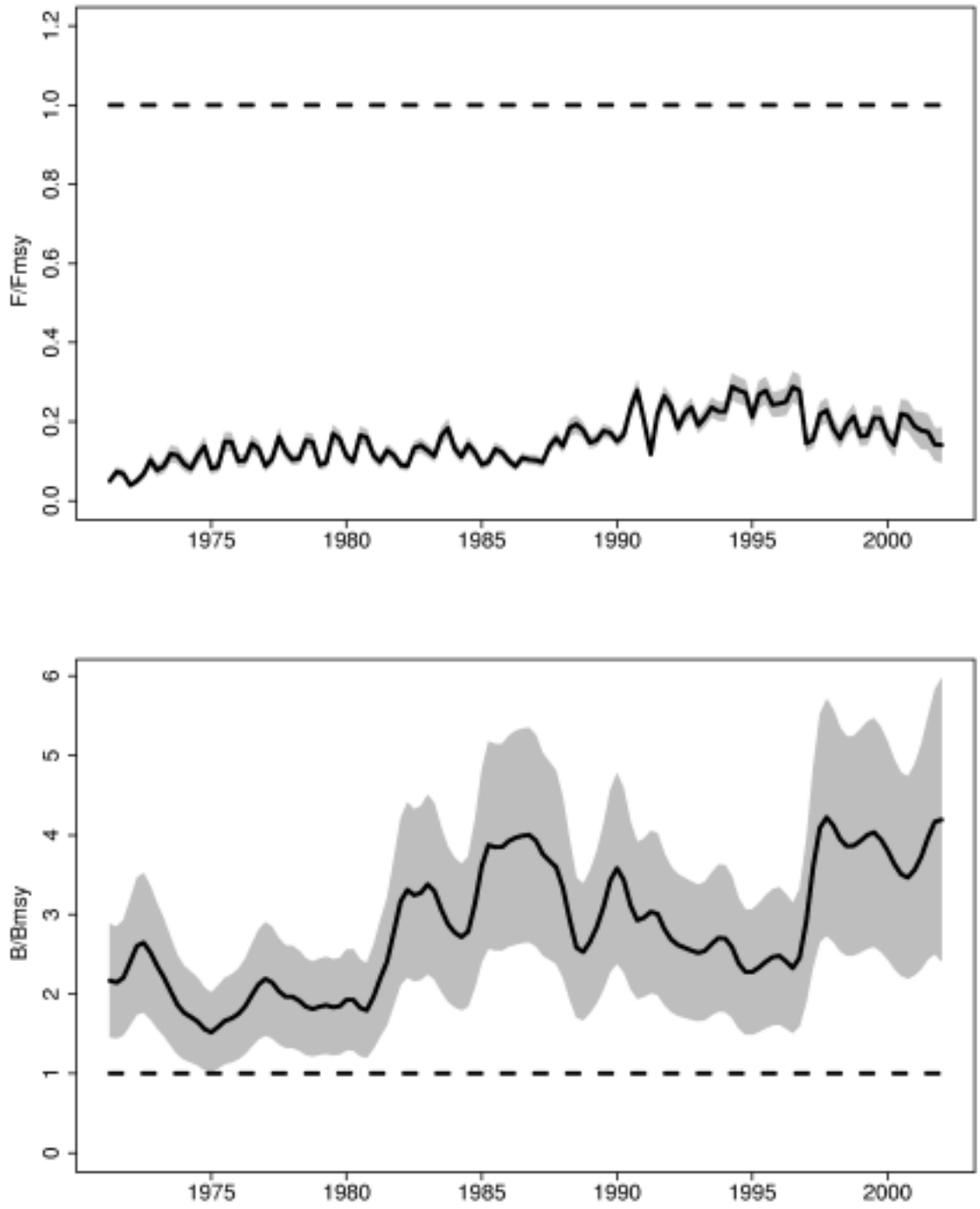


Figure 6. Ratios of F_t / F_{MSY} (top) and $B_t^{adult} / B_{MSY}^{adult}$ (bottom) with 95% confidence intervals. The horizontal lines at 1.0 in each case indicate the overfishing (a) and overfished state (b) reference points.

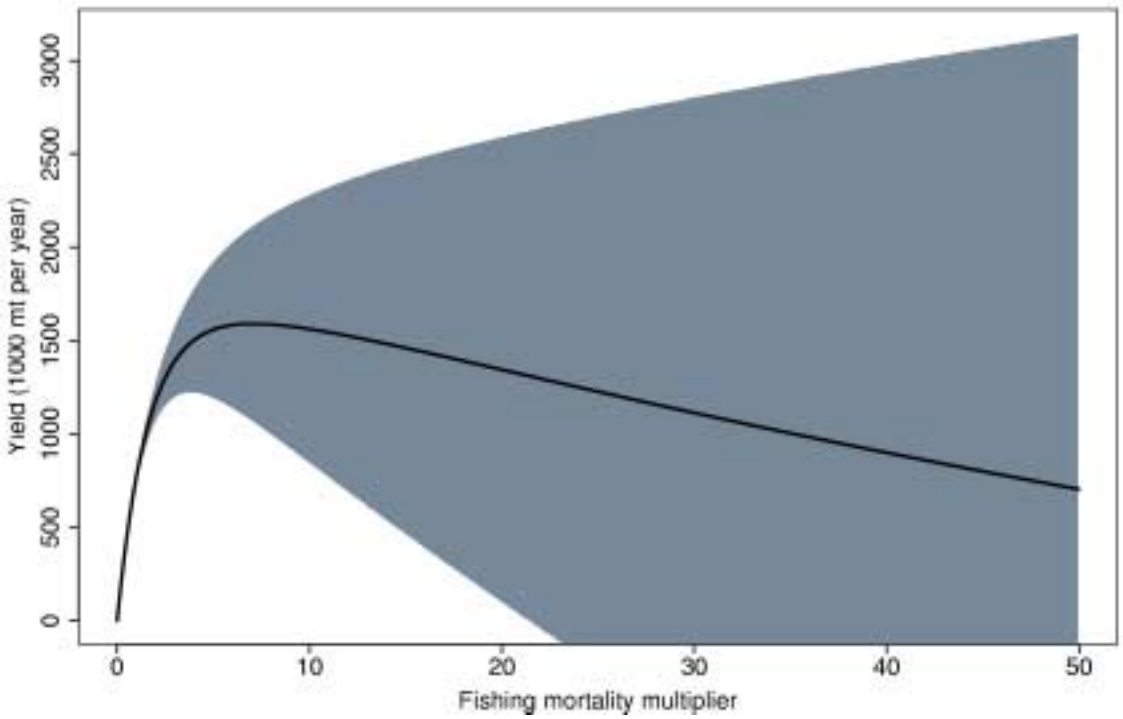


Figure 7. Predicted equilibrium yield and 95% confidence intervals as a function of fishing mortality (relative to the average fishing mortality-at-age during 1997-2001).

YELLOWFIN RESEARCH GROUP – SUMMARY STATEMENT

Key attributes

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 believed to constitute a single stock in the WCPO.

Recent developments in the fishery

Since 1990, there have been large increases in the catches of juvenile yellowfin tuna by the purse seine FAD fishery, though 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 2002.

Trends

Catch and effort

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 Indonesian 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, around 40-60% of the total yellowfin catch in any year has come from the purse seine fishery.

In 2002, the total catch of yellowfin tuna in the WCPO is estimated to have been 437,984 mt, the lowest since 1996 and down from the peak catch of 502,960 mt taken in 1998 (Figure 8). The relatively low total catch during 2002 was largely due to a decrease in the purse seine catch, which for 2002 was 171,767 mt (39% of the total). This catch was the lowest since 1996. In contrast, the EPO purse seine catch of yellowfin (417,472 mt) for 2002 was an all-time record. Nominal CPUE for purse seine fleets generally show no overall trend but high interannual variability that is believed to be due to environmental variation that affects recruitment and catchability. The low catch rates observed during 2002 are considered unusual for an El Nino event.

The longline catches since 1990 (60,000–80,000 mt) have been well below catches taken in the late 1970s to early 1980s (87,000-117,000 mt). The 2002 catch is estimated to be 77,177 mt, or 18% of the catch by all gears. 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 indices based on the statistical habitat based method (SHBS) generally indicate smaller changes in biomass over time.

During 2002, the pole-and-line fisheries took 17,770 mt (4% of the total) while 'other' fisheries (largely taken by fisheries in the Philippines and Indonesia) accounted for 171,270 mt (38% of the total).

Size of Fish Caught

The annual catch-at-size by principal fisheries are shown in Figure 9 while recent trends in quarterly catch-at -size are shown in Figure 10. The domestic surface fisheries of the Philippines and Indonesia take large quantities of small yellowfin in the range 20–50 cm. Purse seine sets on floating objects (i.e. associated schools) generally take smaller fish than sets on unassociated or free-swimming schools, which are often 'pure' schools of large yellowfin. However, the size ranges of the yellowfin taken in associated and unassociated purse seine sets vary from year to year. Yellowfin taken in unassociated purse-seine sets are of a similar size range to fish taken in the longline fishery and the handline fishery in the Philippines (both gears target adults in the range 80–160 cm). The purse-seine catch of adult yellowfin tuna is in fact higher than the longline catch in most years. There was a relative absence of medium-sized (60–100cm) yellowfin in the catches from both the longline and purse seine fisheries during most quarters of 2000 and 2001, although a "pulse" in this size range appears by the 4th quarter 2001.

Recruitment

Trends in estimated recruitment are sensitive to the standardised effort indices used in the assessment model (Figure 11). For the GLM index, recruitment displays no overall trend since the early 1950s, while under the SHBS index recruitment is estimated to have increased between the mid-1970s and the mid-1980s, with overall recruitment levels since that time being around twice the levels before this transition. The SHBS index also indicates that recruitment variability may have increased in recent years. Whether this change in the productivity of the stock is real, and if so, whether it reflects a change (or a 'regime' shift) in oceanographic conditions or is an artifact of the increased catch of juvenile fish taken in the surface fisheries over this period remains unclear.

Biomass

Trends in estimated total biomass are sensitive to the standardised effort indices used in the assessment model (Figure 12). For the GLM index there is an overall declining trend in total biomass over time, while the pattern for the SHBS index is somewhat different - declining until the mid-1970s, increasing until 1990, after which time it decreased before increasing back to 1990 levels in recent years. Estimates of the current level of depletion of yellowfin in the WCPO indicate that the current biomass is 20-35% less than the level that would have occurred in the absence of fishing. However, depletion is greater for some regions, notably the equatorial regions where recent depletion levels are near 50%.

Fishing mortality

Trends in estimated fishing mortality rates are shown in Figure 13. 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 of juvenile yellowfin in purse seine fisheries and catches in the domestic Indonesian and Philippine fisheries, together with the declines in overall biomass over the past decade.

Stock status

The assessment reviewed by SCTB16 reaffirms the result of the previous assessment that the yellowfin stock in the WCPO is presently not being overfished (ie. $F_t/F_{MSY} < 1$) and that it is not in an overfished state ($B_t/B_{MSY} > 1$). However, the stock is likely to be nearing full exploitation and any future increases in fishing mortality would not result in any long-term increase in yield and may move the yellowfin stock to an overfished state. While biomass-based reference points (Table 1) indicate that the long-term average biomass should remain above that capable of producing *MSY* if present catches are maintained, yield estimates (Figure 14) indicate that there may be limited potential to expand long-term catches

from the fishery at the current pattern of age-specific selectivity. The assessment also indicates that the equatorial regions are likely to be fully exploited, while the temperate regions are likely to be under-exploited. While these spatial patterns of exploitation remain uncertain, if true, this may indicate the potential need for different management in different regions. Furthermore, the attribution of depletion to various fisheries or groups of fisheries indicates that the Indonesian fishery has the greatest impact, particularly in its home region. The purse seine fishery also has high impact, particularly in the equatorial regions.

While recognizing continuing uncertainties associated with the present stock assessment, the SCTB reiterates the previous recommendation that there be no further increases in fishing mortality (particularly on juvenile yellowfin) in the WCPO. If future evidence supports a shift to a lower productivity regime, a decrease in total catch would be anticipated in order to maintain the stock at sustainable levels.

Table 1. Estimates of performance measures based on the 2002 and 2003 stock assessments.

Management Quantity	2003 Assessment				2002 Assessment
	GLM	HBS	SHBS	FPOW	HBS
Estimated MSY	381,000 to 554,000 (Assuming Average Recruitment)				290,000 (Low Recruitment) 372,000 (Average Recruitment) 500,000 (High Recruitment)
Y_{Fcurr}/MSY	0.91	0.82	0.71	0.89	na
$B_{curr}/B_{curr,F=0}$	0.65	0.71	0.80	0.69	~0.63
F_{curr}/F_{MSY}	0.61	0.45	0.36	0.56	~0.50
B_{curr}/B_{MSY}	1.59	2.62	2.86	1.47	na

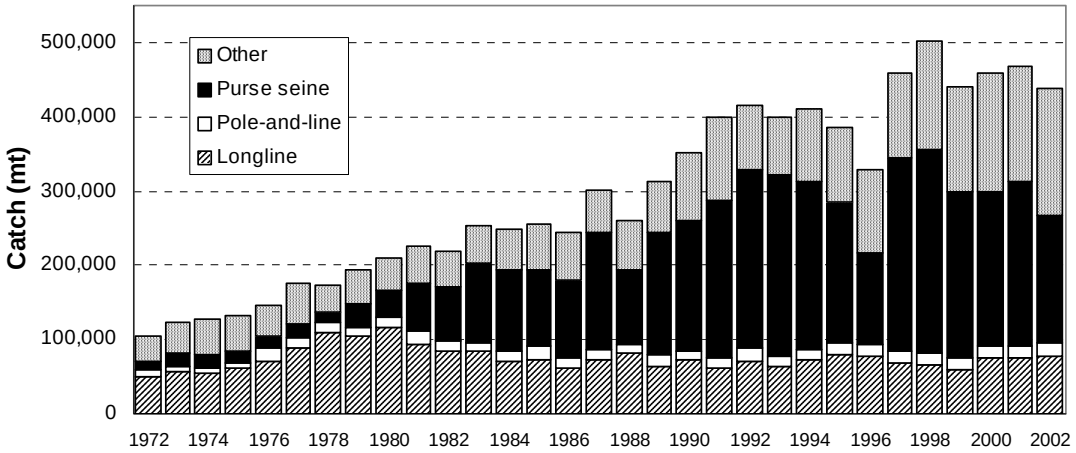


Figure 8. Annual WCPO yellowfin catch (mt) by gear.

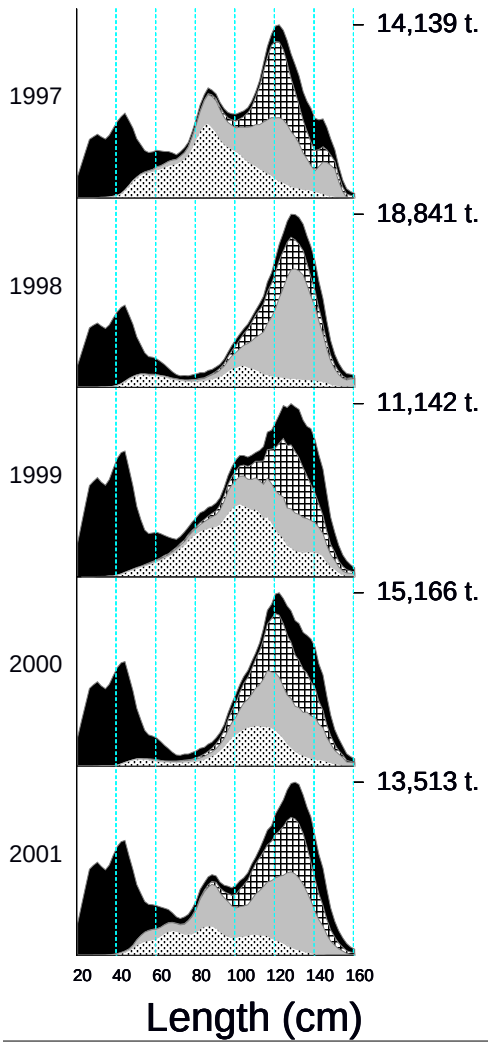


Figure 9. Annual Yellowfin tuna catch-at-size in the WCPO, 1997–2001.

The catch is broken down into the Indonesian/Philippines domestic fisheries component (black), the longline fishery component (hatched), unassociated-set catch from the purse-seine fishery (grey) and associated-set catch from purse-seine fishery (dotted). The y-axis scale is in weight – the figures on the right indicate the catch weight in a 2-cm size class.

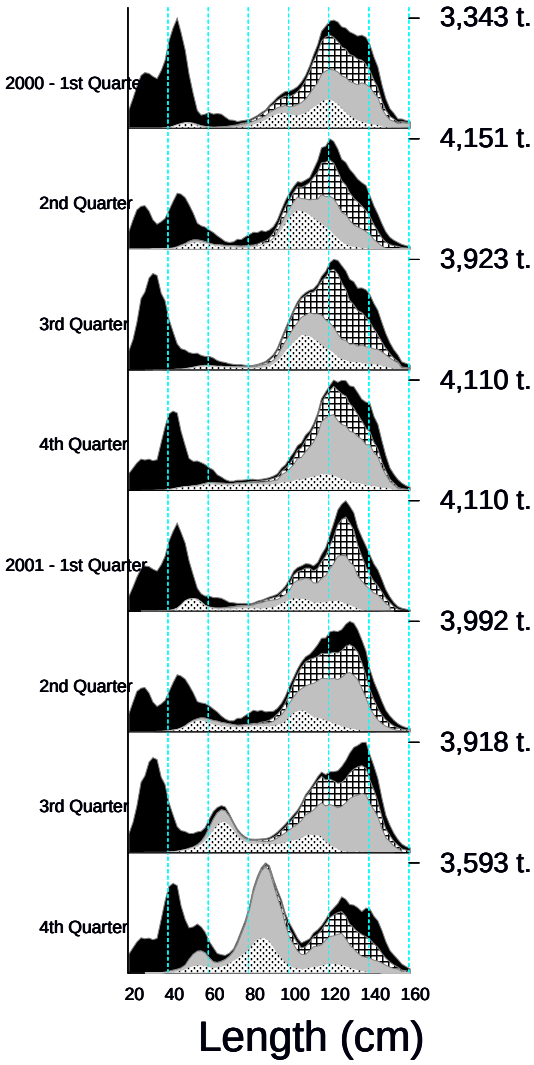


Figure 10. Quarterly Yellowfin tuna catch-at-size in the WCPO, 2000–2001.

The catch is broken down into the Indonesian/Philippines domestic fisheries component (black), the longline fishery component (hatched), unassociated-set catch from the purse-seine fishery (grey) and associated-set catch from purse-seine fishery (dotted). The y-axis scale is in weight – the figures on the right indicate the catch weight in a 2-cm size class.

Figure 11. Time-series of estimated annual recruitment of yellowfin for the WCPO.

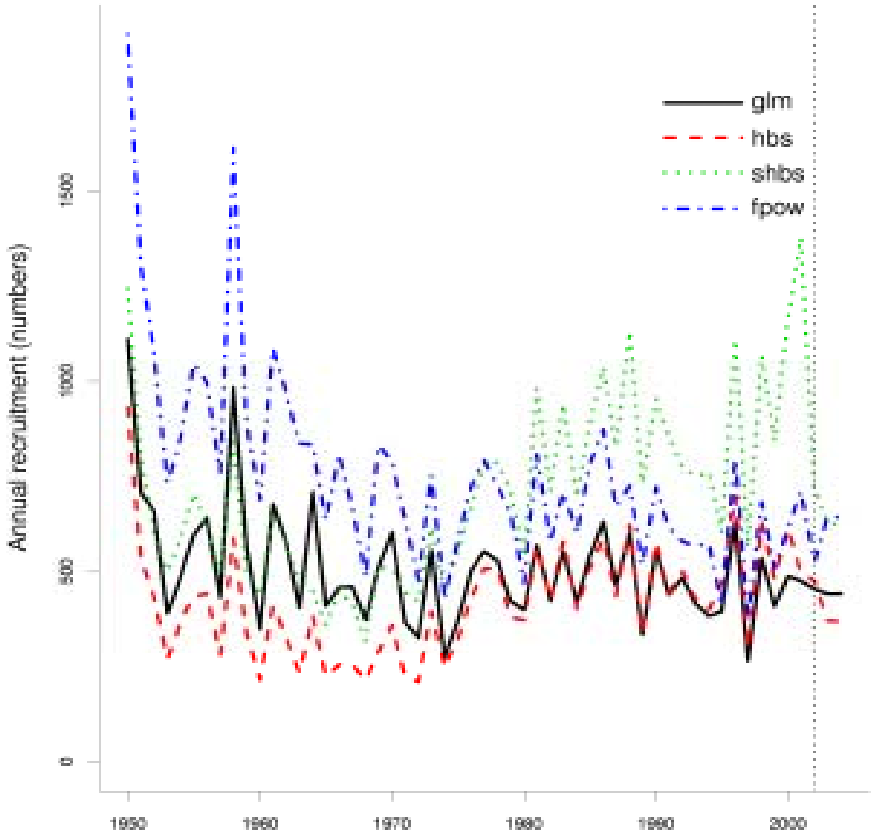


Figure 12. Time-series of estimated annual total yellowfin biomass (million t) for the WCPO.

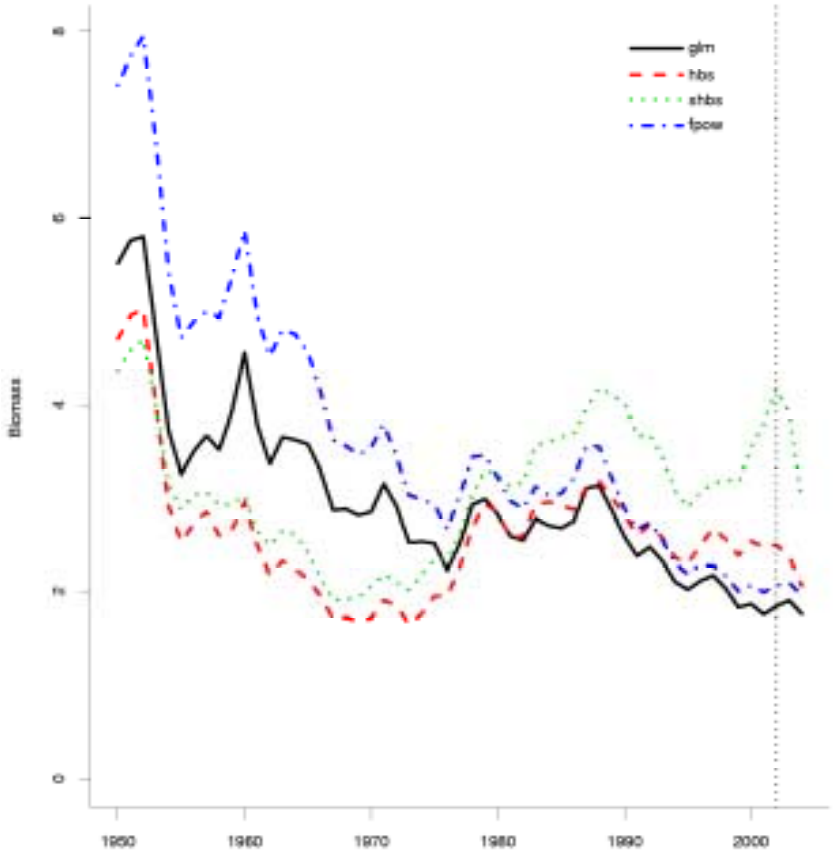


Figure 13. Time-series of estimated annual juvenile and adult fishing mortality for the WCPO.

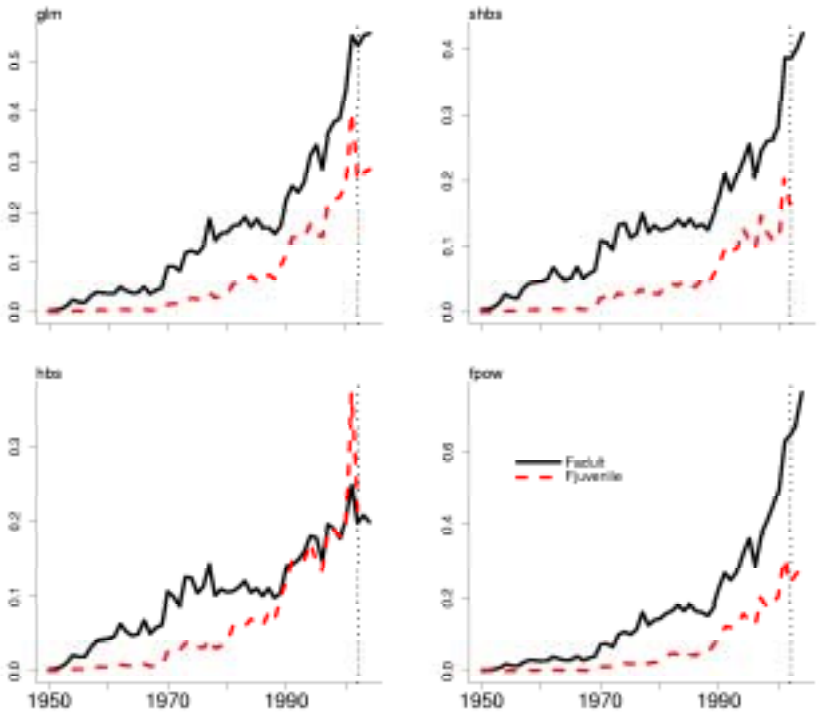
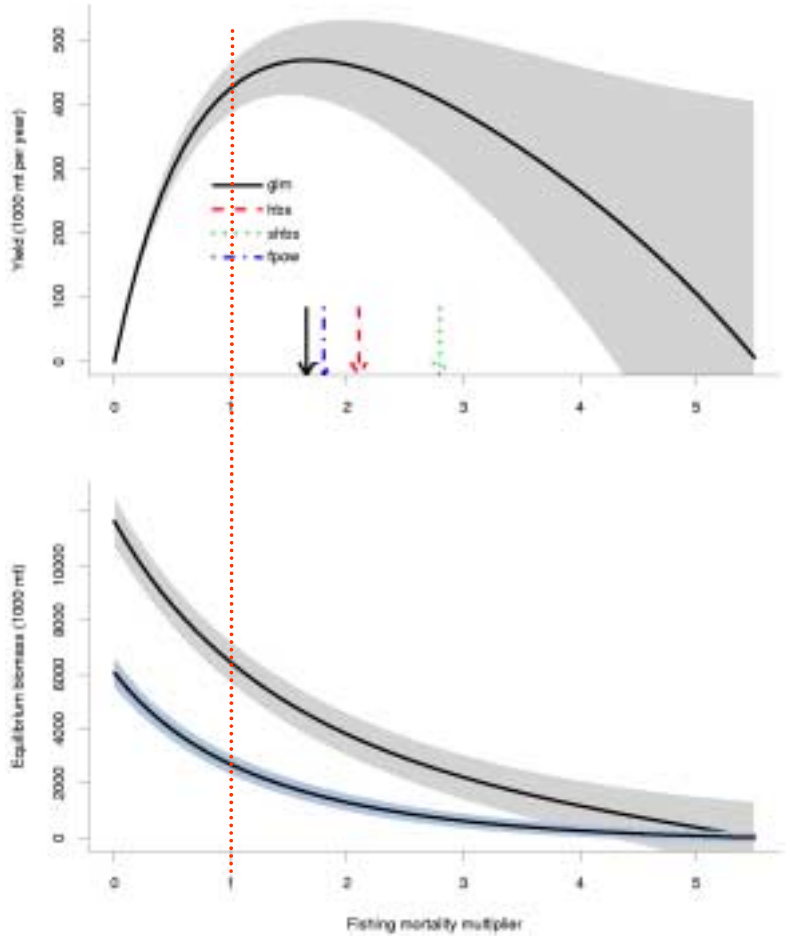


Figure 14. Yield, equilibrium biomass and equilibrium spawning biomass as a function of fishing mortality multiplier.



BIGEYE RESEARCH GROUP – SUMMARY STATEMENT

Key attributes

Bigeye tuna are a relatively slow growing species 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. They have a wide distribution between 40°N and 40°S (Figure 15) and vertically between surface and 500 m deep (occasionally to 1000 m) due to their tolerance of low oxygen levels and low temperatures. These and other characteristics make them less resilient to exploitation than skipjack and yellowfin tunas. There is no clear evidence of plural stocks in the Pacific and geographical distribution is known to be continuous throughout the Ocean. On this basis, and considering the existence of two major surface fishing areas in the western and central Pacific and eastern Pacific, stock assessment has been carried out on two different stock hypotheses, i. e., two-stock hypothesis (western and central Pacific and eastern Pacific) and a Pacific-wide stock hypothesis allowing the extent of basin-scale mixing to be estimated. 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.

Recent developments in the fishery

The number of purse seine vessels has exceeded 200 since the early 1990s. In more recent years, there has been an increase in the number of vessels flagged by the Pacific Island countries while the number of purse seiners in other nationalities has reduced slightly. There had been an increase in purse seine catches of juvenile bigeye tuna associated with the increased use of the drifting FADs during the late 1990s. However, recent catches have fallen to some extent mostly due to a reduced use of drifting FADs since 1999.

Overall longline fleet size has been stable. The number of foreign vessels based in Pacific Island countries fell during the past 6 years, while the number of Pacific Island domestic vessels has increased since the early 1990s. The distant-water longline fleet has decreased to some extent, since some country reduced its distant-water longline vessels. The catch composition in the longline fishery has changed from BET-25%, YFT-55%, ALB-20% in 1980 to BET-30%, YFT-35%, ALB-35% in 2002, suggesting increased targeting of bigeye as well as albacore.

Trends in Catch and effort

The total bigeye tuna catch in the WCPO was 108,000 MT in 2002, similar to 2001 and representing 62% of the total Pacific catch in the same year. Available statistics (Figure 16) indicate that 60% of the WCPO catch was taken by longline, and most of the remainder by purse seine (21%) and by the domestic fisheries of Indonesia and Philippines and others (18%). 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 2002, estimated through the statistical analysis of sampling data, continued to reduce since the 1999 record high of 34,568 mt due to a decreased use of drifting FADs. There is also considerable uncertainty in the estimation of the Indonesian and Philippines catches due to the lack of (or limitations in) systematic sampling programs. Nominal (unadjusted) CPUE for WCPO bigeye tuna derived from longline data indicated a sharp decline during the early stages of the fishery but has been fairly stable over recent years.

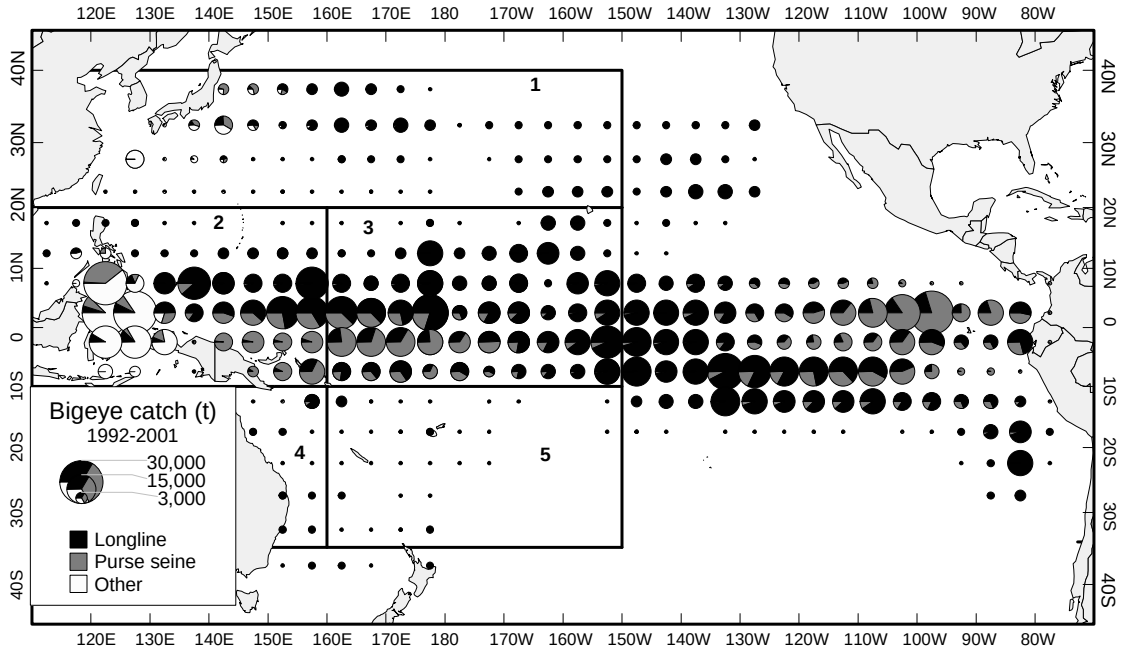


Figure 15. Distribution of bigeye tuna catch, 1992–2001. The spatial stratification used in the WCPO MULTIFAN-CL model is shown.

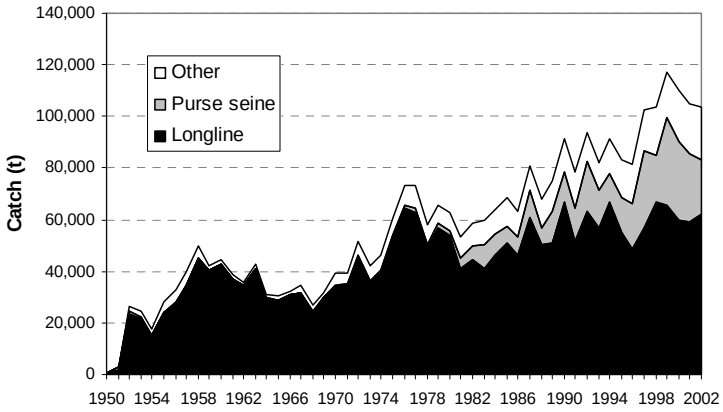


Figure 16. WCPO bigeye tuna catch, by gear.

Stock assessment

The stock assessment was conducted using the statistical model 'MULTIFAN–CL' applied to data for the WCPO as has been done in recent years. However, there are a number of differences in methods and data used in the 2003 analysis from the previous ones. Most important of these are the extension of the data to 1950 including the additional longline catch and effort data, disaggregation of size data into length and weight, definition of separate longline fisheries for the fleet of Taiwan and fleet of Mainland of China in the tropical regions, application of different methods in standardizing longline effort, the incorporation of equilibrium yield projections and the computation of a wide range of reference points useful for management purposes.

This year's assessment results were qualitatively different from last year's, although the trend of biomass was similar for the comparative period analyzed last year. The largest difference, that was

common in all runs made this year, was a sharp increase in recruitment from 1990. This appears to be directly related to increasing catches of small fish over the same period. It is not clear that the model, as formulated for bigeye, can distinguish changes in catchability from changes in recruitment. Consequently, this model behavior raises questions regarding low recruitment estimates in the early years when catches were also low. The summary results of this year's analysis were given below, however, the Group considers these results should be viewed with caution because of this problem. The Group decided not to select a single model to estimate standardized effort for the longline fisheries. This is because the present application of habitat models relies on the assumption of a spatially and temporally invariant habitat preference. There is some evidence that this assumption may not hold, and further work on habitat-based standardizations is required. Therefore, the Group decided to continue to consider a range of standardization methods until this issue is resolved. Also, the Group considered that it is not appropriate to quote the absolute numbers of population estimates, and that qualitative statements on stock status and relative bench marks should be provided.

Abundance indices

The abundance indices are generally similar to each other except for areas 4 and 5 (see Figure 15 for area stratification used in the Multifan-CL application). The trends for the first 10 years are somewhat different in areas 2 and 3. All of these indicated decreasing trends but areas 2 and 5 indicated an increase and later decline between 1970 and 2000.

Fishing mortality

There has been a consistent increase in fishing mortality (F) on juvenile and on adult age classes since the beginning of the fishery (Figure 17). The adult F increased very quickly from the beginning of the fishery and has been higher than juvenile F by 25-50% up until 1990. F for adult bigeye peaked in the mid 1990s. Juvenile F continued to increase and is at a similar level to the adult F in the most recent years. The impact of the fisheries on the stock is much higher in the tropical regions than in the sub-tropical regions, consistent with the distribution of the catch.

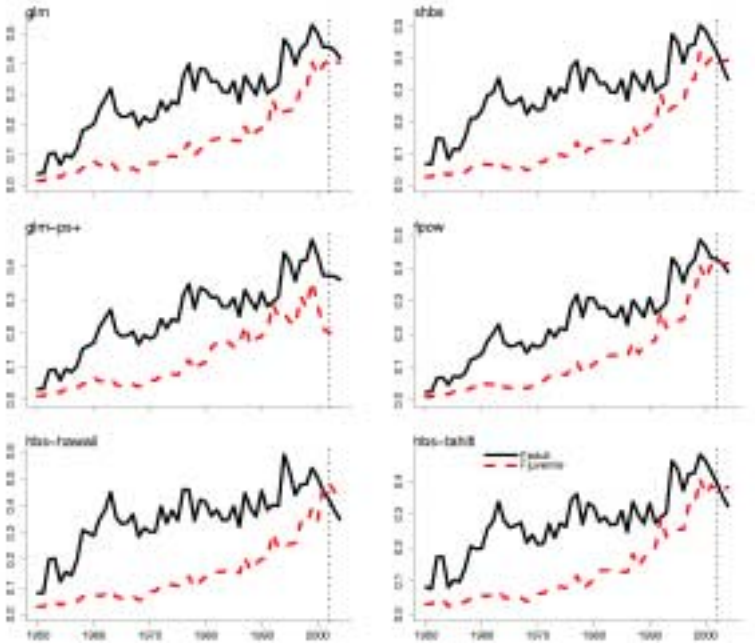


Figure 17. Estimated annual average juvenile and adult fishing mortality for the WCPO obtained from the separate analyses using different standardised effort for the LL1–LL5 longline fisheries.

Biomass

Total estimated biomass of bigeye tuna in the WCPO indicated a decline during the 1950s and 1960s of about 30 % (Figure 18). Thereafter it has been fairly stable. This trend can be seen in all areas except area 5. In areas 2 and 3, where the stock was heavily exploited during the beginning of the fishery, biomass recovered during the 1970s and 1980s before entering a sharp decline in the 1990s (Figure 19).

Figure 18. Estimated annual average total biomass (million t) for the WCPO obtained from the separate analyses using different standardised effort for the LL1–LL5 longline fisheries. The vertical dotted line indicates the point at which population projections are made with assumed levels of effort.

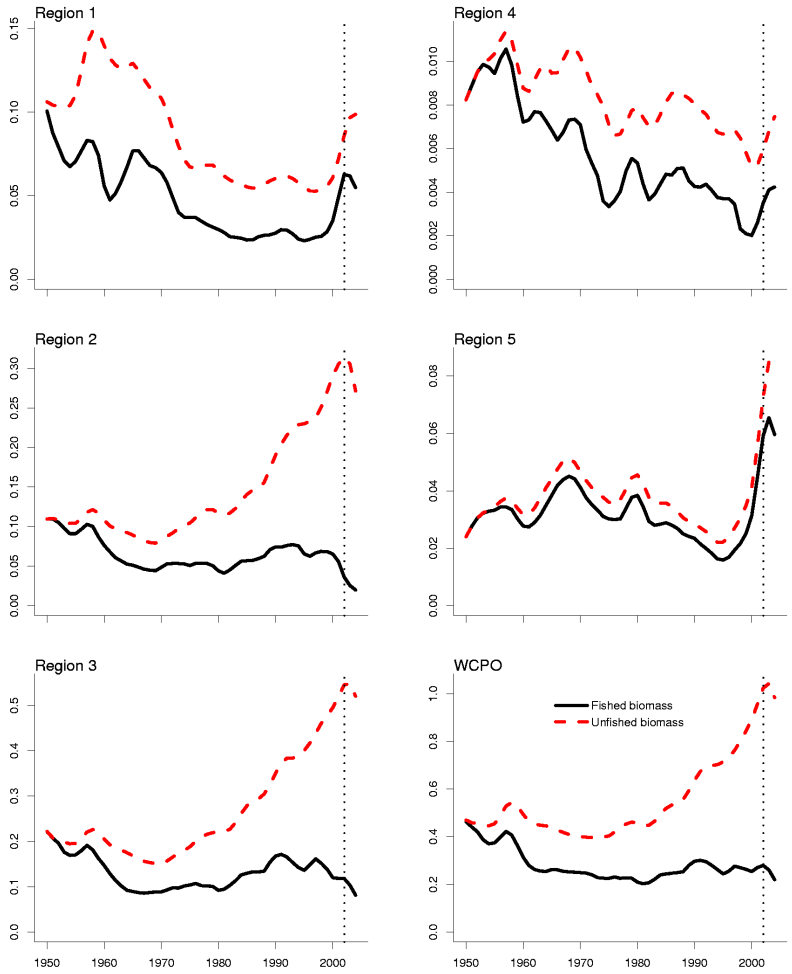


Figure 19. Comparison of the estimated biomass trajectories (lower heavy lines) with biomass trajectories that would have occurred in the absence of fishing (upper thin lines) for the GLM-based model for each region and for the WCPO. Y-axis units are million t.

Recruitment

Generally, estimated recruitment (Figure 20) indicated some fluctuation but with an increasing trend since the early 1980s and reached the highest level in 1999, which is about 2.5–3 times higher than in 1980. However, as noted above, this pattern may be an artifact related to surface fishery development and/or the lack of early size data. This issue requires further investigation.

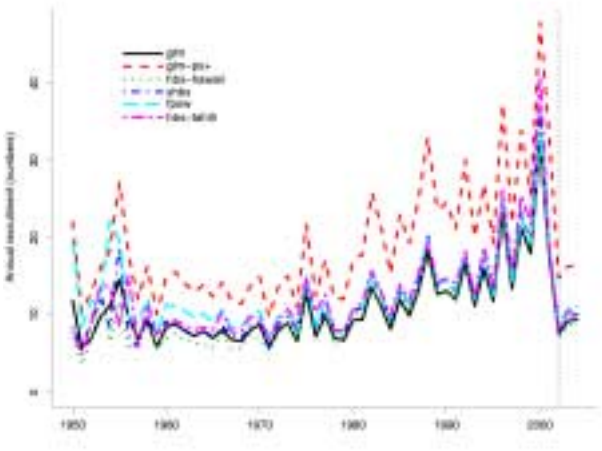


Figure 20. Estimated annual recruitment for the WCPO obtained from the separate analyses using different standardised effort for the LL1 –LL5 longline fisheries. The vertical dotted line indicates the point at which population projections are made with assumed levels of effort.

Stock status

The bigeye assessment results of this year are both uncertain and for key management benchmarks, inconsistent with the bigeye assessment presented at SCTB 15 (Table 2). In particular, the SCTB 15 assessment concluded that overfishing was not occurring ($F_{current}<F_{msy}$), while this year's assessment concluded that overfishing is occurring ($F_{current}>F_{msy}$). Given that it is unlikely that the true status of the bigeye stock has changed so dramatically, as indicated by changes in the parameters in Table 2 since last year, the Group cannot discount last year's assessment. Consequently, caution should be exercised in using the bigeye assessment results for management purposes until such time that these issues can be resolved.

The current stock status was assessed by the yield curve (Figure 21) and a range of reference points. The analyses indicated that the current F is larger than FMSY. However, the current biomass remains higher than BMSY. In other words, overfishing is occurring, but the stock is not yet overfished because of the recent above-average recruitment.

Overall, the longline fishery has had the largest impact on the stock, and later development of the purse seine fishery and increases in the Philippines and Indonesian catch have also had high impact on the stock. In this regard, the assessment results are consistent with those from a Pacific-wide assessment as well as the current status of the stock in the eastern Pacific. The current level of exploitation appears not to be sustainable in the long term, unless the high recent recruitment is continued in the future.

Therefore, the Group believes that there should be no further increase in the fishing mortality rate for bigeye tuna, until the results is further confirmed.

The Group noted, however, while recognizing the current uncertainty in the stock assessments, all the stock assessment results conducted this year were more pessimistic than the last year's. If further assessments confirm the concern derived from this year's results, the managers should consider practical management action to prevent further decline of stock.

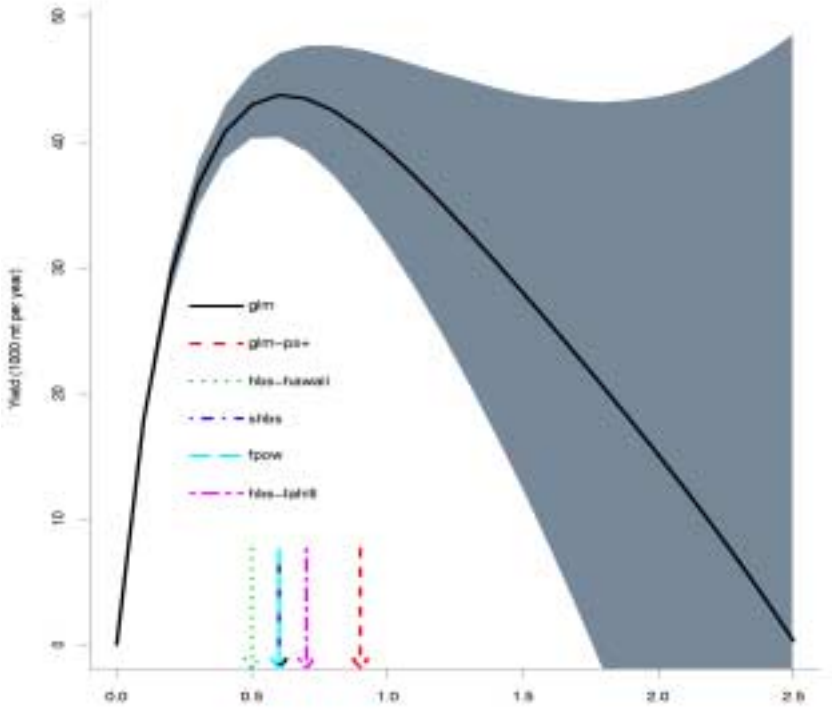


Figure 21. Yield curves estimated for four different levels of recruitment for the WCPO. Recruitments are averages for 1950-2002(SRR), 1952-1980, 1981-2001, 1990-2001.

Table 2. Estimates of performance measures based on the 2002 and 2003 stock assessments.

Management Quantity	2003 Assessment	2002 Assessment
MSY	40,000~80,000 MT	90,000 MT
Y_{Fcurr} / MSY	1.98~2.85	1.2
B_{curr} / $B_{curr,F=0}$	0.27 ~ 0.34	0.6
F_{curr} / F_{msy}	1.11~2.00	0.3
B_{curr} / B_{msy}	1.35~1.76	3.0

ALBACORE RESEARCH GROUP – SUMMARY STATEMENT

Key attributes

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 tropical and sub-tropical waters between about 10°S and 25°S during the austral summer, with juveniles recruiting to surface fisheries in New Zealand coastal waters and in the vicinity of the sub-tropical convergence zone (STCZ – about 40°S) in the central Pacific about two years later, at a size of 45–50 cm in fork length. From this region, albacore appear to gradually disperse to the north, but may 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 of fish reaching an age of 10 years or more.

Recent developments in the fishery

Catch in 2002 reached 51,000 mt, which is the second highest in the post-drift net period (Figure 22). Since drift netting ceased in 1992, catches have predominantly come from troll fleets of New Zealand and the US south of 30°S, and by longliners which fish mainly between 10°S and 50°S (Figure 23).

Catches from the Pacific Island Country (PIC) longline fleets have increased in recent years. In 2002 these fleets accounted for 50% of the total longline catch. The Taiwanese fleet, which has traditionally targeted albacore and has accounted for the majority of the historical longline catch, recently moved some of its activities to target seasonally northern albacore or bigeye in the equatorial waters of the WCPO. The catch of albacore by this fleet has therefore fallen in recent years.

Trends

Catch and effort

CPUE has been fairly stable in the central zone (10°–30°S), where catch rates from the PIC fleets have tended to converge in recent years. The current CPUE in several PIC longline fleets is significantly less than the levels attained in the early years of these fisheries. In some cases, high CPUE has been maintained by expanding the area of fishing to the extremes of the EEZs and beyond. There has been a gradual decline in the catch rates in a number of fisheries. This decline has been gradual in some fisheries and stronger in other areas, particularly Samoa and American Samoa. However, the CPUE for the Samoan and American Samoan fleets remains higher than other fleets despite these declines. Some degree of convergence in CPUE is also noted for the New Zealand and the US troll fleets, although CPUE for the US vessels has generally been higher and more variable.

Sizes of fish

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 24). Troll catches are of smaller albacore, typically

50–85 cm in length. Size composition varies from year to year, but no trends are evident over the past five years.

Recruitment

Recent application of a high resolution environmental and population dynamics simulation model (SEPODYM) to South Pacific albacore has provided some preliminary results on the possible mechanisms for recruitment variability. Recruitment as estimated by MULTIFAN-CL (see stock status below) appears to be negatively correlated with El Nino events, which may explain low recruitment rates in the 1980s and 90s (Figure 25).

Biomass

Biomass levels have largely reflected the variation in estimated recruitment, peaking in the late 1950s and late 1970's (Figure 26). Current biomass is estimated to be about half of the maximum estimated levels and about 60 % of the estimated biomass in the early 1950s. Biomass is concentrated in the area south of 10°S.

Fishing mortality

Fishing mortality is higher for adult albacore than for juveniles, reflecting the predominantly longline exploitation (Figure 27). 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.

Stock status

The current stock assessment was conducted with MULTIFAN–CL. The fishery for albacore is unique in that it has exhibited no significant trend in catches over the period of 1960 – 1995. Due to the problems faced by all assessments conducted with limited data on stocks, which have been apparently exploited at only low exploitation rates over the period of the fishery, the results obtained provide little information on the biomass of the stock. Improved results from this model would be expected if there were better return rates of tags placed on albacore. An analysis based on a Schaefer production model provided an estimate of MSY, but the Group considered that this methodology requires further review before it can be used to provide advice on stock status.

The assessment gave similar results to last year's assessment, with a low impact of fishing on biomass, and indicated that the current biomass is at about 60% of unfished levels. It is therefore unlikely that the stock is being overfished or is in an overfished state.

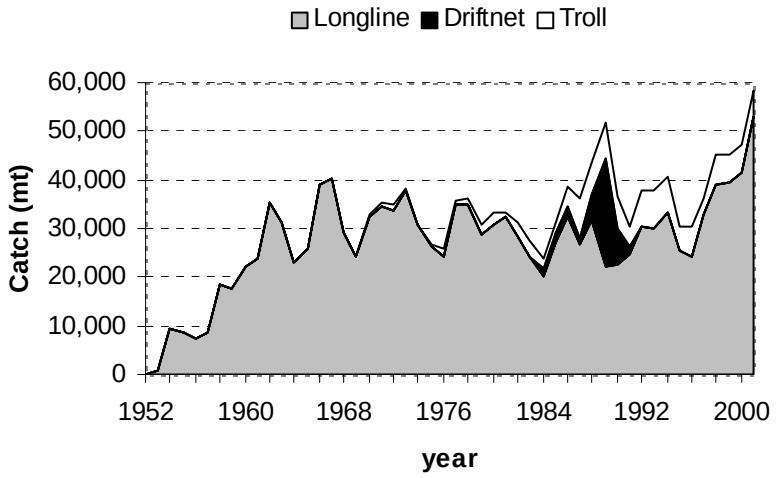


Figure 22. South Pacific albacore catch by gear type.

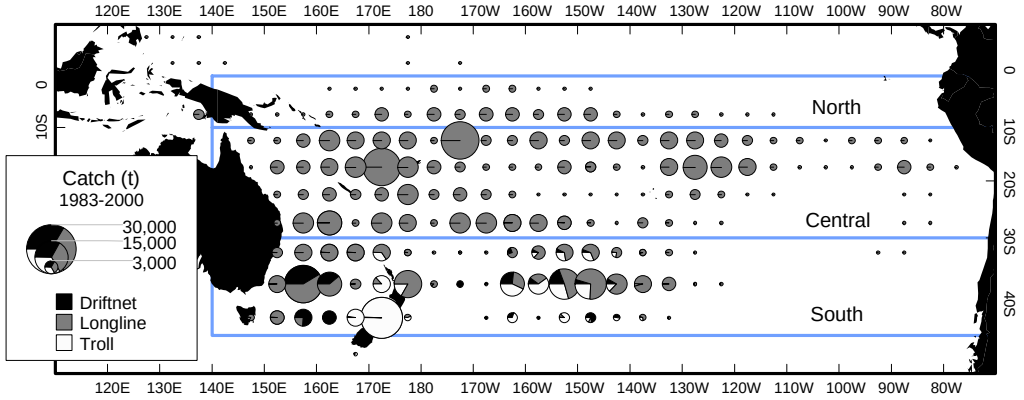


Figure 23. Albacore catch distribution (1983-2000) by fleet. The spatial distribution used in the MULTIFAN-CL model is shown.

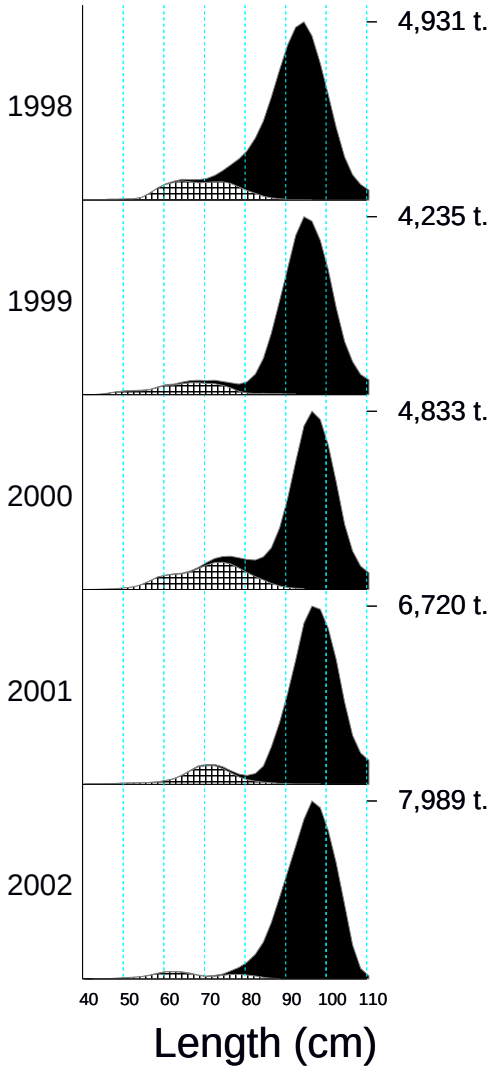


Figure 24. Annual albacore tuna catch-at-size in the south Pacific, 1998–2002. Longline = black; troll = hatched. The y-axis scale is in weight - the figures on the right indicate the catch weight in a 2-cm size class.

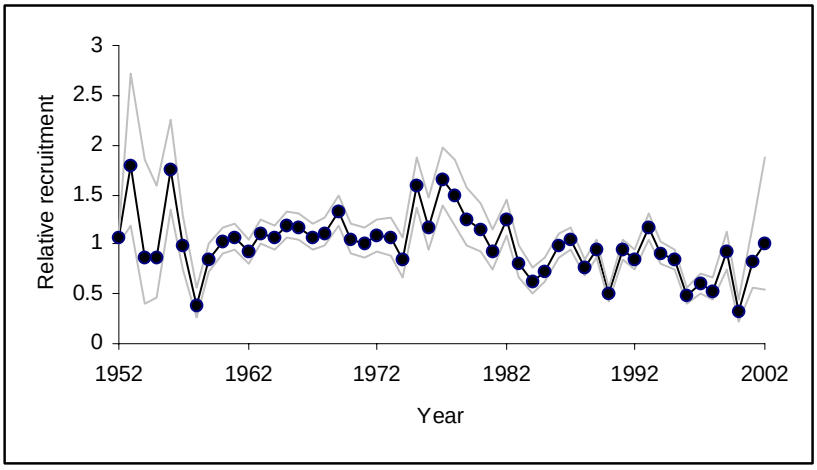
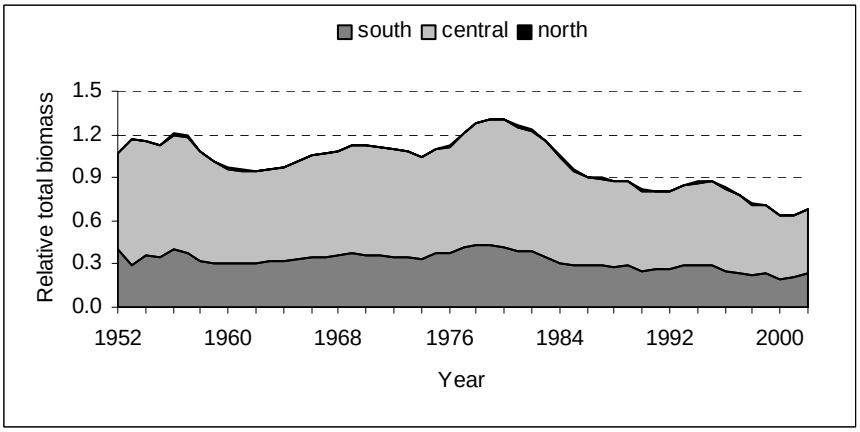


Figure 25. Estimated annual recruitment, with 95% confidence intervals, scaled to the average of the points estimates.



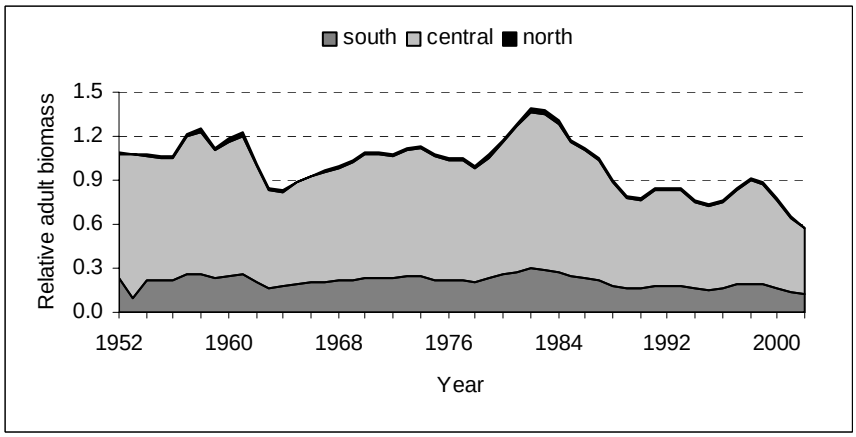


Figure 26. Estimates of relative total and adult biomass, by region.

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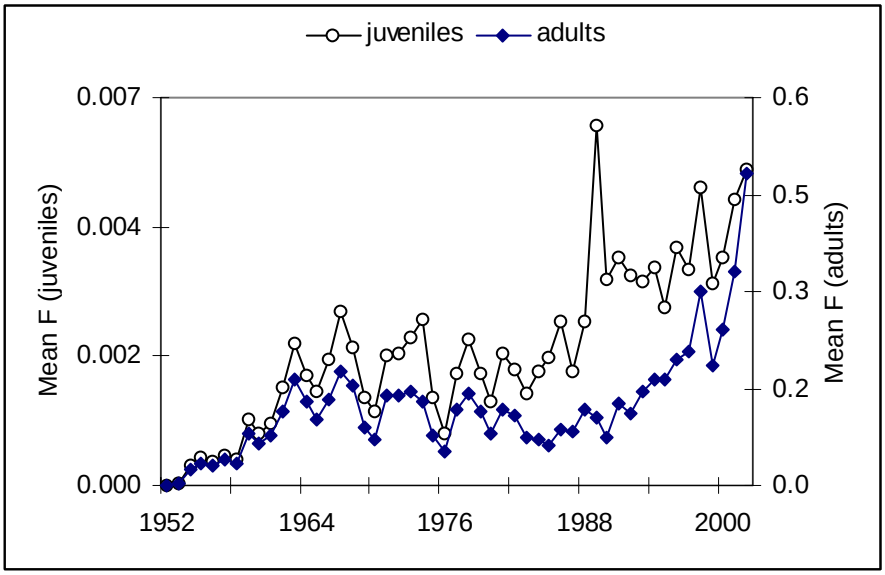

Figure 27. Estimated average annual fishing mortality rates for juveniles (ages 1-5) and adult (ages 6-12) albacore in the South Pacific.

BILLFISH AND BYCATCH RESEARCH GROUP – SUMMARY STATEMENT

During SCTB 16, the BBRG dealt with billfish catches and catches of other species, with focus on mahimahi and wahoo.

BILLFISH

The Billfish and Bycatch Research Group has a more varied perspective than the single species research groups. Issues include non-targeted catches in pelagic fisheries, protected species interactions and the catch of billfish by commercial and recreational fisheries. SPC's Oceanic Fisheries Programme (OFP) generates annual estimates of commercial billfish catches, but currently not on recreational billfish catches. A system for reporting catches by recreational fishing clubs in the WCPO was established by the OFP. Ensuring that such data are collected and provided to the OFP, however, requires considerable work, and it has not been possible to adequately cover this activity (for most countries) over the past year.

There were several papers and presentations on the biology and management of swordfish fisheries. Research by CSIRO has been focused on developing an operational model for swordfish management in the Australian East Coast longline fishery. It is thought that the swordfish stock is currently not overfished but a better understanding of the sustainable harvest is required. In the absence of a swordfish stock assessment the operational model provides a framework for the evaluation of alternative harvest strategies.

Other studies by CSIRO have included investigation of declines in the catch per unit of effort (CPUE) of swordfish in the Australian East Coast longline fishery, and age and growth studies for swordfish caught by this fishery. The CPUE study, using generalized linear models, investigated a number of different hypotheses for the decline in CPUE, including competition between vessels, fishing down of seamounts, and changes in fishing practices and/or fleet structure. The analyses supported the notion that there has been a sequential spatial depletion of the swordfish resource off the central east coast of Australia. However, the changes in observed CPUEs do not appear to be supported by the hypothesis that these changes have been due to changes in fishing strategies adopted by fishers or oceanographic conditions on the fishing grounds.

The ageing study validated annulus formation indirectly in the second anal fin spines of swordfish from eastern Australia. Growth curves fitted to age-at-length data fell within the range of studies conducted elsewhere. A validation study of age-at-length for swordfish is still required. A study of factors affecting swordfish catch in New Zealand's longline fishery was also presented. Targeting of swordfish in this fishery is prohibited but swordfish are caught and retained by vessels targeting bigeye tuna. Various factors such as fleet type, area, season, operational characteristics and environmental effects were found to have an influence on swordfish CPUE. However, the number of light sticks was found to have the greatest effect, and could increase swordfish CPUE four-fold. A collaborative project to develop an age and sex structured population assessment model for North Pacific swordfish was presented to the BBRG. The model will address uncertainties in the current North Pacific swordfish stock assessment resulting from swordfish sexual size dimorphism, where females grow faster and larger than males.

Three presentations were made on marlin catches. The first from Australian Bureau of Rural Sciences concerned interactions between longline and charter sportsfishing vessels taking striped marlin off the southeast coast of Australia. The study concluded that both that the catch rates in both fisheries are likely to be predominantly reliant on the underlying abundance or availability of striped marlin. Some evidence for commercial targeting of this species was presented and a possible link to reduced charter fishery catch was discussed. The second was a study by the Japanese National Research Institute of Far Seas Fisheries (NRIFSF) of the vertical distribution of blue marlin CPUE in the Atlantic. The study showed that the vertical CPUE trends with respect to depth and temperature relative to the surface are not always consistent with the vertical distribution of blue marlin. The final presentation referred to an information paper on the ongoing tagging of recreationally caught billfish and gamefish.

SHARKS AND OTHER SPECIES.

There were two presentations on sharks. The first concerned a directed shark longline fishery in Papua New Guinea given by the PNG National Fisheries Authority. This fishery has grown in importance in PNG and comprises 9 freezer equipped longliners which annually land about 1,500 mt of dressed shark, most of which is exported along with the fins. Half of the catch comprises silky shark, and the fishery is managed under a shark longline management plan approved in 2002. NRIFSF presented information on Japanese purse seine and pole and line tuna fisheries that make use of seasonal migrating whale sharks associated with schools of skipjack tuna. Fishing around whale sharks peaks between July and August and is concentrated in an area to the east of Japan.

A regional overview of mahimahi catches in various pelagic fisheries in the western and central Pacific was presented jointly by the Oceanic Fisheries Programme (OFP) and the Western Pacific Fisheries Council. The overview also included depth descriptions of CPUEs and mean lengths of mahimahi and wahoo in pelagic longline and troll fisheries in the US Flag Pacific Islands. A summary was made of the results of a dietary study of mahimahi, wahoo and lancetfish by the OFP. The results showed that mahimahi consumed primarily epipelagic fishes, while wahoo consumes a mix of epipelagic and mesopelagic fish and mollusks. The main dietary items for lancetfish included a pelagic gastropod, epipelagic and mesopelagic fish and mollusks. Lancet fish were also noted to demonstrate a high degree of cannibalism.

OFP also presented a preliminary ECOPATH model of the western Pacific warm pool ecosystem. A simulation run was shown where the current level of fishing effort was doubled for 25 years and resulted in declines of the biomass of sharks, billfish, yellowfin and piscivorous fish, but an increase in the biomass of small scombrids. Little confidence could be placed in these results at present, but they demonstrated the type of simulations that can be conducted with the model. The limitations and weaknesses of the current model were discussed, as was its potential application for generating reference points for ecosystem-based fishery management.

Two studies of longline fishery bycatch were presented by the Australian Fisheries Management Authority (AFMA) and Japan's NRIFSF. The AFMA study evaluated the Bycatch reporting rates from logbooks versus those from observers. Non-commercial species and regulatory discards such as blue and black marlin appear not to be fully recorded in logbooks. Similarly, bycatch of seabirds and turtles appear to be under-reported, although for turtles, this conclusion may be confounded by the rarity of interactions. Observer coverage has been set at about 5%, a level sufficient to provide an accurate estimate of catch of most target and bycatch species.

NRIFSF presented a synopsis of its activities concerning shark, seabird and turtle bycatch. The main objectives for sharks include improving data collection, stock assessment and effective utilization. NRIFSF is continuing an ongoing program of mitigation research to reduce interactions between seabirds and pelagic longline vessels. Apart from tori poles, other methods being tested include blue dyed bait and weighted hooks. Results to date have been used to require longline vessels fishing within 20 miles of Torishima Island, the main breeding site of the endangered short-tail albatross, to use two seabird mitigation measures. NRIFSF also has an ongoing research program for longline-turtle mitigation, including the use of circle hooks, and modification of bait and depth of set. Turtle conservation measures also include nesting beach protection and management in Japan for loggerheads, and in Irian Jaya for leatherbacks.

The OFP made a brief presentation concerning the development of an individual-based model for North Pacific loggerhead turtles. The model will be adapted from an existing model developed for skipjack. The model will be used to simulate oceanic foraging and consequent interactions with fisheries.

The BBRG made the following recommendations (edited from SCTB 15 report)

1. A strong focus should continue to be maintained on monitoring regional billfish catches, both in commercial pelagic fisheries and from recreational fisheries

2. The BBRG notes the importance of observer programs in obtaining accurate estimates of bycatch. As such efforts should be made to improve observer coverage in WCPO pelagic fisheries in order to obtain more reliable statistics on bycatch, and to permit risk analysis on bycatch species. Prior to implementation, the objectives for an observer program and the process by which these objectives can be met should be clearly identified. The risk assessment currently being conducted to set objectives for an observer program for the Australian East Coast swordfish fishery may be a useful paradigm for this process;

3. Participants should strengthen data collection on turtle interactions in pelagic fisheries in order to refine estimates of the interaction problem, due to concerns regarding the population status of Pacific turtles. The BBRG also recommends closer collaboration and liaison by participants with the appropriate government and regional agencies to ensure that turtle nesting sites are inventoried, and non-fishery related impacts on turtle populations are clearly identified and addressed, to place fishery impacts to turtle populations in context. Some of this broader analysis may be done by other organizations, but SCTB should remain informed of the issues and be able to evaluate information and analyses as they are used to set management policy.

4. The BBRG recommends that a watching brief be maintained on other bycatch issues as they arise, e.g., future developments under the FAO IPOAs on seabird-fishery interactions, and on shark fisheries.

5. The BBRG recommends that additional research be conducted on stock structure and stock boundaries of species of interest to the BBRG.

6. The BBRG, noting the review of logsheet programs and biological data programs by the Statistics Working Group, recommends that data collection programs be modified to better report bycatch species.

FISHING TECHNOLOGY WORKING GROUP – SUMMARY STATEMENT

The work of the Fishing Technology Working Group was presented and discussed during a preparatory meeting and during the SCTB 16 plenary session. Brief summaries emphasizing new developments by national and distant water representatives were provided, emphasizing new developments in regional fisheries, expansion / contraction of fishing effort, port sampling and observer programs and developments in shore-side processing facilities. A common theme throughout the major purse seine fleets was a continued and self-enforced reduction in FAD associated sets due to the tendency of these sets to produce smaller, lower value catch compared to unassociated schools. Industry efforts to reduce overall effort and catch by self-enforced, extended port calls and efforts to control IUU fishing were also noted.

A review of the Palau Arrangement was provided to the Group, detailing numbers of agreed and reported purse seine vessels that may operate within the region in categories of multilateral, bilateral foreign, domestic locally based, new bilateral and special arrangements. The "New Bilateral" category allows access to vessels from China and the EU while "Special Arrangements" were established to accommodate additional purse seine vessels from the EU, China and the Philippines. As of April 2003, 194 vessels had been licensed and were operating in the region.

The Palau Arrangement effort cap of 205 vessels was established in 1992 as a per vessel limitation on total purse seine effort in the WCPO. While efforts to precisely quantify increases in vessel efficiency have not yet been realized, it is widely recognized that effective fishing effort in purse seine fisheries has been increasing steadily.

In this regard, the work of the FTWG was recognized as essential, and that work toward quantifying increases in effective fishing effort in both longline and purse seine fisheries should be a priority task. The group presented work toward identifying key components of increasing efficiency in fleets and the development of historical timelines of the introduction of key gear and targeting practices by regional purse seine fleets. Work along these lines will continue with cooperation from regional and DWFN agencies.

Additional presentations and inter-sessional work concentrated on training materials for regional and national port sampling and observer programs to better define advances in fishing power and the accurate reporting of species specific catch and effort. The Group presented work to document and characterize the historical development and current status of the latest technology available to regional purse seine vessels, and this work will be expanded to include longline gear and fleets. Improved reporting of bigeye landings, especially from mixed catches by purse seine fleets was recognized as a broad, cross-cutting measure of high priority to the region. The Group supported these efforts with the development of an identification key for purse seine caught bigeye and yellowfin for training purposes.

Due to the ecological and resource implications of FAD utilization, the Group monitors recent developments in both large-scale anchored FAD arrays and the use of drifting FADs by regional purse seine fleets. The large numbers of anchored FADs supporting purse seine operations in PNG as well as means to monitor and regulate these FADs were presented and discussed.

The application of innovative technology and fishing methods to reduce bycatch is a specific FTWG task. The Group presented information on proposed and ongoing efforts to reduce purse seine bycatch

of undersize tuna and associated finfish bycatch as well as gear related to bycatch reduction and improved targeting in longline fisheries.

Several critical issues that may be directly addressed by the Terms of Reference of the FTWG arose during SCTB 16, such as estimating effective effort for catch rate standardization, potential gear related methods to reduce juvenile bigeye mortality and technology issues related to estimating harvesting capacity in regional fisheries. The FTWG will actively pursue these priority activities and related studies inter-sessionally, with results presented to SCTB 17.

METHODS WORKING GROUP – SUMMARY STATEMENT

The Methods Working Group (MWG) had two major tasks for SCTB 16. The first task was to carefully scrutinize the MULTIFAN-CL assessments of yellowfin and bigeye tunas. Lack of reliable fisheries data, in particular size-frequency and fishing effort from Indonesia and the Philippines is a continuing concern in both assessments. The influence of different methods of effort standardization emerged an additional source of uncertainty in all stock assessments, especially for yellowfin and bigeye. The influence of recent high catches of juvenile bigeye in the purse seine fishery on high estimates of recruitment is a major uncertainty in the bigeye assessment. The second major task before the MWG was a comparison of the performance of different stock assessment methods against "data" from an operational model with known properties. Seven stock assessment methods were tested against forty different realizations of five different fishery scenarios of increasing complexity. Time did not allow completion of this task, effectively an analysis of 1,400 different stock assessments, but preliminary results indicated that the performance of the stock assessment methods varied widely. The MWG also compiled a list of general criteria or principles to assist fishery managers in selecting a stock assessment method. Finally, the MWG prepared a table illustrating the general effects of alternative fishery management actions both on stocks and on the industry under different stock conditions.