Fifteenth Meeting of the

STANDING COMMITTEE ON TUNA AND BILLFISH

Honolulu, Hawai'i

22–27 July 2002

EXECUTIVE SUMMARY

The fifteenth meeting of the Standing Committee on Tuna and Billfish (SCTB 15) was held on 22–27 July 2002 in Honolulu, Hawai'i, at the invitation of the Chairman, and hosted by the Pelagic Fisheries Research Program of the University of Hawaii. SCTB 15 was attended by participants from Australia, Canada, Cook Islands, Federated States of Micronesia, Fiji, France, French Polynesia, Indonesia, Korea, Marshall Islands, New Caledonia, New Zealand, Niue, Northern Mariana Islands, Palau, Papua New Guinea, the Peoples Republic of China, Philippines, Samoa, Solomon Islands, Taiwan, United States of America, Vanuatu, Vietnam and Wallis and Futuna. Representatives from various regional and international organisations also attended the meeting. These included the Food and Agriculture Organisation (FAO) of the United Nations, Inter–American Tropical Tuna Commission (IATTC), the Indian Ocean Tuna Commission (IOTC), and the Forum Fisheries Agency (FFA).

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 2001 for the four main tuna species was 1,914,000 mt, the second highest annual catch on record after 1998 (2,039,000 mt). The 2001 WCPO catch of skipjack (1,206,000 mt) was slightly lower than in 2000 and well below the 1998 record catch (1,318,000 mt) and as usual dominated the total catch. The WCPO yellowfin catch (476,000 mt; 25%) was the highest since the record catch in 1998 (494,000 mt), and continues to comprise 35–40% of the global catch. The bigeye (115,000 mt; 6%) and albacore (117,000 mt; 6%) catches were similar to 2000 levels, but not as high as the record catches for these species taken during 1999 (116,000 mt and 148,000 mt, respectively).

Reports on relevant activities of other organisations were received from IATTC, FAO, and IOTC.

The Statistics Working Group reviewed the status of data collection, compilation and dissemination and the directives to the SWG that were made during SCTB14. These

concerned the compilation of data from Indonesia, the Philippines and Vietnam; methods to determine the extent of unreported catches in the WCPO, including trade statistics and catch certification schemes; discrepancies between bigeye species composition sampling by observers and port samplers for purse seiners; a workshop on standards for the design of national and regional observer programs; the targeting of albacore by longliners; the compilation of vessel and gear attributes; and increasing the observer coverage of most fleets. Directives to the SWG that were made during SCTB15 include several activities related to the development of standards for the design of national and regional observer programs; the evaluation of the reliability of port sampling data and observer data; the examination of discrepancies in the proportion of bigeye in 'yellowfin plus bigeye' determined from purse-seine port sampling data and observer data; the development of a project to sample the species composition and lengths of fish caught in the domestic fisheries of Indonesia; and the documentation of procedures that are used by Indonesia and the Philippines for collecting data and estimating annual catches.

The Methods Working Group conducted research during the inter-sessional period to evaluate the performance of several stock assessment models. The Oceanic Fisheries Programme operational model was used to generate "simulated data" for analysis by MULTIFAN-CL, SCALIA, ASCALA, ADAPT, and age-structured and Fox production models. MULTIFAN-CL and some of the other complex models appear to estimate ratios of certain population parameters with acceptable accuracy. Therefore, MWG participants were cautiously optimistic about the accuracy MULTIFAN-CL biological reference point estimates (e.g. B/B_{MSY} and F/F_{MSY}). During the inter-sessional period prior to SCTB 16, the MWG will continue the simulation work to evaluate model performance, focusing on the role of spatial structure and population movement in assessment results. Assessment models will also be tested with more realistic levels of variability in the simulated data. The MWG will conduct an in-depth review of the MULTIFAN-CL yellowfin assessment for presentation to SCTB 16.

A preparatory meeting of the Fishing Technology Working Group met prior to SCTB 15 where participants discussed 15 papers related to: fleet reports; technical reference papers; technical data collection; the economic condition of surface fisheries; advances in vessel efficiency; anchored and drifting FAD technology and bycatch; regional purse seine management initiatives, harvest capacity issues, regional bigeye tuna management issues and new entrants to the WCPO fishery. A detailed report of this meeting is appended to the SCTB 15 final report. During the plenary session of the FTWG, the report of the preparatory meeting was presented in addition to presentations on fishing strategies, vessel performance factors, current status and outlook for the US western Pacific purse seine fleet, and technical advances in regional purse seine and longline technology. Directives to the FTWG arising from discussion during SCTB 15 included work to: improve information useful to define and adjust for increasing efficiency in surface fisheries (particularly FAD-related issues); assist with observer training to recognize and document new fishing technologies; investigate the impact of new fishing technology on at-sea and port sampling programs; and assist efforts to improve catch and effort data describing mixed bigeye/yellowfin landings.

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

Several cross-cutting issues emerged from the Research Group discussions that SCTB wishes to highlight:

1. Stock assessments for skipjack, yellowfin and bigeye tunas continue to be hampered by the lack of adequate fisheries statistics (catch, effort, size and species composition) for some areas. In particular, data collection in the fisheries of Indonesia and Philippines needs to be strengthened.

2. There is a need for improved observer coverage in order to sample the proportion of bigeye and yellowfin in purse-seine catches, estimate catch rates for non-target species, and to collect size composition data.

3. The assessments for yellowfin and bigeye tuna indicate that both stocks are likely to be nearing full exploitation, in contrast to the skipjack and South Pacific albacore stocks, which appear capable of sustaining current levels of exploitation. The catches and fishing mortality of juvenile yellowfin and bigeye have increased greatly over the past decade, due primarily to increased catches in Indonesia, Philippines, and the international purse seine fishery. In respect of the purse seine fishery, the increased use of drifting FADs has increased juvenile mortality of both species. SCTB 15 therefore reiterated the recommendation of SCTB 14 that there be no further increase in fishing mortality in surface fisheries for these species in the WCPO.

4. The Research Groups identified various research and fishery monitoring activities that would lead to improved understanding of the stocks. Large-scale conventional tagging to provide better information on natural mortality, fishing mortality, movement and stock structure was seen as critical for all species. Also, archival and pop-up tagging of yellowfin, bigeye and albacore are needed to provide detailed information on vertical habitat utilization used in CPUE standardization studies. SCTB 15 therefore recommended that a small group be established to plan future tagging programs and consider funding alternatives.

The SCTB Chairman and Working Group and Research Group Co-ordinators for SCTB 15 were as follows:

SCTB Chairman :	Mr Bernard Thoulag
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 Chi-Lu Sun
Skipjack RG :	Dr Gary Sakagawa

Yellowfin RG :	Dr Robert Campbell
Billfish and Bycatch RG :	Mr Paul Dalzell

The Chair of SCTB was scheduled for rotation after the two-year term of Mr Bernard Thoulag of Federated States of Micronesia. The meeting endorsed the nomination of Dr Sung Kwon Soh (or his designate) of Korea for a new two-year term as SCTB chair.

The meeting considered the timing and venue of the 16th SCTB meeting. The meeting accepted an offer from Australia to host the meeting in Mooloolaba, Queensland in July 2003 (exact dates to be advised). The meeting closed on Saturday 27 July at 14:00 hrs.

ALBACORE RESEARCH GROUP – SUMMARY STATEMENT

The South Pacific albacore comprises a single stock. Catch in 2001 reached about 52,000 mt with a noticeable increase of fish caught by longliners from some Pacific Island countries (PICs). These vessels accounted for almost 50% of the total longline catch, which was estimated at 46,000 mt in 2001. Less than 15% of fish are taken east of 150° west, and most fishing occurs from 10ºS to 50°S.

The total catch last year was the highest since the peak recorded in 1989 when driftnet vessels fished in the region of the subtropical convergence zone (STCZ). The albacore surface fishery is now composed only of trollers with a fishing season spanning from November to April around the STCZ and in New Zealand coastal waters.

Albacore CPUE of Taiwanese longliners operating in the South Pacific showed a slight increase during the 1990s except at the lowest latitudes where a drop was recorded in the most recent years. This appears to be related to changes in the fishing practices of this fleet towards targeting of bigeye and yellowfin, particularly in the waters north of French Polynesia. Changes in fishing practices of PIC longliners may also explain some recent trends in the albacore CPUE recorded in the EEZs of these countries. Some of these vessels are now fitted to target different species with flexibility.

CPUE for the New Zealand troll fleet has been relatively stable during the 1990s, showing some convergence in recent years with that of the US troll fleet, which was previously higher and more variable.

The length frequency data collected from longline and troll fleets indicate a single multiple-age class mode throughout the year with some overlap in the size composition of fish taken by both fisheries from January to March.

From the most recent stock assessment carried out with the MULTIFAN-CL model, biomass levels appear to reflect the variation of recruitment: the current biomass is about 85% of the estimated equilibrium unexploited biomass.

The impact of the fisheries on total biomass is estimated to be low (reduction of less than 20% from the unexploited conditions). However, there is a need to improve the assessment with additional tagging data and more information on tag-reporting rates.

Better knowledge of the South Pacific albacore stock with respect to recruitment and biomass is expected from the use of a high resolution environmental and population dynamics simulation model originally developed for skipjack (SEPODYM model). With regard to albacore this model gives encouraging preliminary results but further refinement is required.

The MULTIFAN-CL model results indicate that current less than the MSY, aggregate fishing mortality is less than F_{MSY}, and the adult biomass is greater than B_{MSY}. The assessment could be improved by the following priority research and monitoring activities:

(i) Strengthen the monitoring of catch, effort and size composition of albacore caught by PIC longline fleets;

(ii) Obtain information on the fishing depth of longline gear targeting albacore;

(iii) Conduct conventional tagging to improve estimates of natural mortality, fishing mortality and movements, and archival tagging to obtain information on albacore vertical habitat utilization.

SKIPJACK RESEARCH GROUP – SUMMARY STATEMENT

Skipjack tuna are the most important tuna resource in the WCPO, in terms of its contribution by weight to the total catch. In the past decade, skipjack tuna catches have been approximately 1 million mt per year, contributing about 63% to the total tuna catch from the region. The 2001 catch was slightly more than 1.2 million mt, the second highest catch on record. The purse seine fishery accounted for most of this catch (69%) with 24% from the pole-and-line fishery.

The CPUEs for purse seine are variable with nominal CPUE for log and FAD sets showing an increasing trend (mainly due to increased efficiency of purse seiners), particularly in recent years. Nominal CPUEs for free-swimming school sets and for pole-and-line fisheries are essentially flat. A lack of trend was also seen in standardized pole-and-line CPUEs.

Skipjack tuna are concentrated in tropical waters but expand seasonally into subtropical waters to the north and south. Their fast growth, early maturity, high fecundity, year round spawning, relatively short life span, high and variable recruitment, and few ages classes on which the fishery depends makes this species unique among the main tuna species. Ongoing fishery oceanography and environmental studies continue to improve understanding of the factors influencing availability and productivity of skipjack tuna in the WCPO. They suggest a positive impact of El Nino on skipjack tuna recruitment, particularly when followed by a La Nina event. The cause for these recruitment differences appears to be changes in the area of the spawning habitat with temperature and in forage availability. Modeling results predict lower skipjack tuna recruitment over the next 2 years resulting from the 1998-2000 La Nina event. The biomass trend appears to be recruitment driven, with large variability and with the largest biomass levels

estimated to be for the model period 1998 to 2000. The model results suggest that the skipjack tuna population in the WCPO in recent years is at an all time high relative to the last 30 years.

Tag-based assessments from the early 1990s suggested low to moderate exploitation at catch levels slightly lower than those in recent years. Recent results from MULTIFAN-CL model analysis which incorporates tagging and other information, were consistent with earlier assessments but indicated that fishing mortality had continued to increase from the 1970s and falling to some extent in recent years, probably due to economic factors. While fishing mortality has increased, the impact of fishing on the stock is estimated to be relatively slight throughout the time period. The ratio of fishing mortality relative to F_{MSY} is small (<0.20) and fishing mortality over the past 30 years has been significantly less than natural mortality. Similarly, estimates of recent spawning stock biomass (SSB) are considerably higher than the estimated level producing MSY (SSB/ SSB_{MSY} > 5.0). The skipjack tuna stock appears to be healthy and capable of sustaining the current catch without adverse effect on stock condition.

Nevertheless, the Group noted that it does not appear that skipjack tuna move over great distances rapidly and hence, do not thoroughly mix over the entire region. Concentrated and sustained fishing effort in local areas, consequently, could result in local depletion. In such areas, further increase in fishing effort may not result in proportionate increase in catches, but instead result in decline in CPUE and even in average size of skipjack tuna taken. The experience in the Atlantic skipjack tuna fisheries where this has occurred was noted.

Future advances in the basic biology, data collection and stock assessment of skipjack tuna are required to substantiate the information required for the management of this economically and ecologically important species. Of particular importance is the need to estimate the magnitude and size composition of skipjack tuna caught in the domestic fisheries of the Philippines and Indonesia.

BIGEYE RESEARCH GROUP – SUMMARY STATEMENT

Bigeye tuna account for a relatively small proportion of the total tuna catch in the Pacific Ocean, but their economic value probably exceeds US$1 billion annually. The preliminary estimate of Pacific-wide catch of bigeye in 2001 is 191,503 mt, slightly down on the record catch of the previous year (212,749 mt). In the WCPO, the 2001 catch was an estimated 115,392 mt, unchanged from 2000. The longline catch in the WCPO in 2001 increased to a record level (71,643 mt) while the purse seine catch (24,133 mt) decreased by about 20% from the level observed in 2000. During the meeting, preliminary catch estimates were presented on a rapidly developing longline fishery based in Vietnam, for which the catch in 2001 may consist of up to 70% bigeye tuna. Catches by other gears (pole-and-line and various gears in Indonesia and Philippines) remained largely unchanged from the levels reported in recent years. In the EPO, bigeye catch in 2001 was an estimated 76,110 mt, down considerably from the 2000 catch of 97,402 mt. This decrease was due to a drop in the purse seine catch from the 2000 record level of 70,098

mt to 43,009 mt in 2001. The EPO longline catch of bigeye in 2001 was 33,101 mt, about a 20% increase over the previous year.

Considerable progress has been made in understanding bigeye tuna vertical habitat utilization and movements as the results of archival tagging experiments in various parts of the Pacific come to hand. Work being conducted in the Coral Sea, around Hawaii, and in the eastern tropical Pacific suggests that bigeye vertical distribution varies across the Pacific and is likely to be related to variation in several oceanographic variables. This information will be of considerable value in the estimation of effective longline effort for bigeye using habitat models. Movement data thus far collected from archival tags suggest a degree of regional fidelity, although longer term recaptures are required before strong inferences can be drawn regarding stock structure and mixing rates.

Several nominal and standardized CPUE time series were examined by the Group. The purse seine CPUE trends for the main fleets generally reflect the extent to which associated sets, especially on drifting FADs (which have produced higher juvenile bigeye catches in recent years), have occurred in the fishery. Nominal CPUE for Japanese longliners fishing in the tropical WCPO has been fairly stable over a long period of time. However, habitat-model standardized CPUE, which removes variability due to changes in targeting and some environmental variables, shows a declining trend.

Two stock assessment models were presented for WCPO bigeye, one using the MULTIFAN-CL method and the other using the A-SCALA method. While some of the details of the respective model results differed substantially because of different assumptions and data analysed (e.g. absolute biomass levels and biomass trends differ appreciably in the two analyses), both indicate that recent fishing mortality rates, particularly in the tropical region where most catch occurs, are near or above commonly used overfishing reference points. The MULTIFAN-CL analysis indicated somewhat lower impacts of fishing in the sub-tropical regions of the WCPO. On a WCPO-wide basis, the MULTIFAN-CL model estimated that fishing mortality rates and spawning biomass had not yet reached their respective MSY levels. The A-SCALA model suggested that current levels of fishing mortality are likely to be beyond the F_{MSY} reference point, although it was noted that some of the assumptions used in this analysis (particularly the assumption of constant catchability by the purse seine fishery) are probably unrealistic. However, both analyses agree that further increases in fishing mortality rates are unlikely to result in significant increases in long-term average yield with the current pattern of age-specific exploitation. Moreover, it is clear that the high juvenile fishing mortality generated by the fisheries in the Philippines and Indonesia, and by purse seine FAD and log sets in the WCPO, are limiting potential yields from the fishery and are likely impacting longline fishery performance in the tropical region.

The Group recognised that: (1) the fishing mortality rates on adults are low and without a trend; (2) there are continuing uncertainties inherent in the assessments and, in particular, uncertainties associated with estimates of the juvenile bigeye catch; and (3) there is concern regarding increasing catches, indications that current yields appear to be sustained only by recent periods of above average recruitment, and that fishing mortality rates on juveniles are high (relative to natural mortality) and increasing. For these

reasons, the Group reiterated its recommendation that there be no further increase in the fishing mortality rate on juvenile bigeye tuna in the WCPO.

The Group noted that the following research and fishery monitoring activities should lead to improved stock assessment for bigeye tuna in the WCPO:

(i) Improved catch, effort and size composition data from the Indonesian and Philippines fisheries, and from the rapidly developing Vietnamese fishery;

(ii) Improved estimates of bigeye catch from the WCPO purse seine fishery;

(iii) Continued acquisition of data on bigeye tuna habitat (through archival and pop-up satellite archival tagging), and the incorporation of these data into habitat models to provide estimates of effective longline effort;

(iv) Additional conventional tagging of bigeye to provide additional information on fishing and natural mortality, movements and other parameters.

YELLOWFIN RESEARCH GROUP – SUMMARY STATEMENT

Catches of yellowfin tuna represent the second largest component (21-28% 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.

The catch of yellowfin tuna in the WCPO first exceeded 200,000 mt in 1980. With the expansion of the purse seine fishery during the 1980s catches doubled to reach around 414,000 mt by 1992. Since that time yellowfin catches in the WCPO have varied between 326,000 and 494,000 mt, with the catches during the last five years being at historical high levels, averaging 464,000 mt. The catch during 2001 is currently estimated to be 475,000 mt, the second highest recorded. Purse seine vessels harvested the majority of the yellowfin catch (45% by weight) during 2001, while longline and pole-and-line fisheries caught 17% and 3% respectively and various other gears accounted for 34 % (mostly eastern Indonesia and the Philippines).

Nominal catch rates of yellowfin for purse seine fleets are characterised by strong interannual variability believed to be associated with variation in environmental conditions associated with the El Nino Southern Oscillation cycle. Catch rates for most fleets indicate no clear trend over the available time series of data, despite the increased efficiencies associated with the use of drifting FADs. Nominal catch rates of yellowfin for the Japanese distant water longline fleet display a steady decline during the 1980s, increased during the mid-1990s, dropped sharply to a historical low during 1999 before recovering somewhat during 2000. However, after accounting for the increased targeting on bigeye tunas since the mid-1970s, standardised catch rates for this fleet in most regions of the WCPO display large interannual variability, no overall long term trend, but somewhat higher values between the mid-1970s through to the late 1990s.

New research on the displacement patterns of tagged yellowfin, together with the results of research on juvenile recruitment patterns, indicate the possibility that short to medium (less than 1000 km) distance movements may be more characteristic of overall yellowfin movements patterns than long-distance migrations and large scale mixing. While further work with archival tags is required to increase our understanding of movement patterns, the higher degree of regionalisation of yellowfin populations implied by these results increase the risk of localised depletions where catch levels are too high relative to local immigration rates of yellowfin.

New research on the trophic ecology of yellowfin associated with natural and man-made aggregation sites is also improving our understanding of the ecological consequences of the increased used of FADs. However, further work is required to understand habitat preferences, trophic dynamics and the influences of recent increases in fishing efficiencies (eg. the increased used of drifting FADs) to help improve the standardisation of catch rates.

Tag-based assessments from the early 1990s found exploitation levels of yellowfin tuna to be low to moderate at catch levels at that time, about 20-25 percent below those in recent years. However, more recent assessments of the yellowfin stock in the WCPO using the MULTIFAN-CL model indicate that fishing mortality has increased significantly since this time, largely as a result of catchability increases in the purse seine fisheries. The results from the latest assessment reaffirm these earlier findings as well as the result from last year's assessment that indicated recent recruitment may have declined significantly. The reasons for this decline remains uncertain though does not appear to be related to a decline in spawning biomass due to fishing. It is possible that a shift to a lower productivity regime characterised by lower average recruitment has occurred.

The recent declines in recruitment have produced a significant decline of around one-third in overall stock biomass since 1997. Biomass levels in 2000 and 2001 are estimated to be the lowest since the mid-1970s. The decline in biomass is most evident in the main catch regions of the western equatorial Pacific where current biomass is estimated to have declined by over 50 percent since the mid-1990s. For the WCPO in total, the current biomass is estimated to be around 35% less than that which would have occurred in the absence of fishing.

Attempts to estimate an MSY for yellowfin continue to be hampered by uncertainty in the stock-recruitment relationship and the age-specific exploitation patterns as well as other uncertainties in the stock assessment models. The possibility of two different productivity regimes also complicates the situation, as estimation of the MSY level and associated spawning biomass ratio (the ratio of spawning biomass to that for the unfished stock) are dependent on overall stock productivity. Nevertheless, the assessment reviewed by SCTB 15 reaffirms the result of the previous assessment that the yellowfin stock in the WCPO is presently not being overfished (ie. $F/F_{MSY} < 1$) nor is it in an overfished state ($SSB/SSB_{MSY} > 1$). However, the current trends in both ratios are towards their respective reference points, and if a shift to a lower productivity regime has occurred, it is believed that present catches may not be sustainable.

There is increasing evidence that the north Pacific Ocean is undergoing an environmental regime change and this is likely to have an effect on the productivity and distribution of tunas in the Pacific Ocean. The results of recent assessments of yellowfin tuna in the WCPO suggest that the stock may be responding to this regime change with lower recruitment now than before. The results, however, have elements of uncertainty because of assumptions used in the assessment models and incomplete fisheries information available for the analyses. Furthermore, due to the short time-series on which they are based, estimates of recruitment and cohort strength in the most recent years are the most poorly determined. As a result, further years data will be needed to confirm the present results, especially in terms of future stock productivity. Nonetheless, if the stock is entering a regime of low recruitment, the current catch of 475,000 t is significantly higher than the estimated MSY for a low recruitment regime (~290,000 t) and is not sustainable. In such an event fishing mortality would need to be reduced, especially on juvenile yellowfin in the equatorial regions where the stock is believed to be close to if not already fully exploited. If, however, recent estimates of low recruitment is normal variability of a high-recruitment regime, the current catch is estimated to be close to the estimated MSY for a high recruitment regime and appears to be sustainable.

While recognizing continuing uncertainties associated with the present stock assessment, the Group 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 fishing mortality is recommended.

Furthermore, the Group believes that this uncertainty and its impact on stock status advice highlights the need for the following immediate actions:

(i) The condition of the yellowfin stock should be closely monitored over the next few years;

(ii) Fishery data collections should be significantly improved, particularly for the fisheries that catch a significant amount of yellowfin tuna;

(iii) Options for fishery management actions required for maintaining a healthy stock in a low recruitment regime should be evaluated in order to be prepared should further analyses validate that the future is a low-recruitment regime;

(iv) A greater understanding of changes in catchabilities is required in order to develop improved indices of stock abundance based on CPUE;

(v) Further development of stock assessment models, particularly MULTIFAN-CL should be undertaken;

(vi) The development of alternative recruitment indices, other than those provided by MULTIFAN-CL, should be developed; and

(vii) Studies on the multi-species influences of the assessment should be carried out.

(viii) The Group also saw the need for additional large-scale and archival tagging to help validate the recent level of fishing mortality estimated from the assessment models and provide additional information on yellowfin movement, natural mortality and exploitation rates to support future stock assessment analyses.

BILLFISH AND BYCATCH RESEARCH GROUP – SUMMARY STATEMENT

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 Program (OFP) generates an annual estimate of commercial billfish catches, but currently not on recreational billfish catches. A system for reporting of catches by recreational fishing clubs in the WCPO was established by the OFP, but ensuring that such data are collected and provided to the OFP requires considerable work, and it has not been possible to adequately cover this activity (for most countries) over the past year.

During the 15th SCTB, the BBRG dealt with turtle bycatch in WCPO pelagic fisheries, and other species bycatch in WCPO pelagic fisheries.

The BBRG heard about the progress of a project to assess the global ecological impacts of longline fisheries on sea turtles, seabirds, and sharks. The principal items in the first year of this study were the declining population trends of Atlantic sharks, mapping ocean features and bycatch, and estimates of total black footed albatross longline-related mortality in North Pacific. Work was currently underway on determining longline-related sea turtle mortality in the Pacific. The goal of the study was to generate bounded estimates and determine relative threat of fisheries versus other sources of mortality. The discussions on this study noted difficulty on obtaining the data needed to accomplish the study objectives, changes in the operational characteristics of longline fisheries over time, and the documentation of other sources of turtle mortality so as to place longline related impacts in the correct context.

The results of a review by OFP of turtle bycatch in longline fisheries in the tropical WCPO from observer data were presented. There was little information on the nature of fishery interactions with longliners, e.g. tangling or hooking. Depth was a major factor in interactions, with shallow set longlines set at night catching an order of magnitude more turtles than deep sets made in the day. Olive Ridley and green turtles were the most frequently encountered turtles. An annual total of about 2000 turtle interactions with longlines within the tropical WCPO were estimated from observer data.. The review listed recommendations on a variety of improvements including fishery observer coverage, species identification, collection of turtle biometrics, interaction descriptions, crew education and awareness.

The BBRG heard about progress of research to reduce longline-turtle interactions in the Hawaii-based swordfish fishery. Data from the first phase of experimental fishing for swordfish, which may catch fewer turtles, have been completed and the results were

currently being analyzed. The start of the second phase of this project to test direct mitigation measures such as blue dyed bait and distance of hooks from the float was uncertain due to a legal challenge to the fishing experiment by several conservation advocacy organizations. Research on the behavior and physiology of turtles using captive animals was ongoing. Results to date indicate that captive turtles are attracted to red-dyed bait, and not to blue bait. Also, turtle vision may be less acute under low light conditions than the fish targeted by longlining, and this may assist in the design of light sticks, that would attract fish but not turtles.

BBRG heard how at-sea observer programs can help turtle research by collecting information on the pelagic life phase of sea turtles. This includes tag deployment, collection of biological data and specimens for genetic research. Recent research on the use of pop-up satellite archival tagging (PSAT) of sea turtles was discussed to determine post hooking survivorship of sea turtles. PSATs record hourly depth, temperature, and a daily geolocation. The state-of-the-art tag provides somewhat questionable geolocation data, and is also difficult to attach to sea turtles, but the one redeeming quality of the PSAT is its ability to provide data even in the event of a mortality. PSATs have been deployed on hard shell turtles and tests were currently underway with a new method for attachment of PSATs to leatherback turtles. Results of tagging of turtles with ARGOS tags was reviewed and showed the how turtles use oceanic features such as fronts and eddies. Data collected on diving behavior showed the percentage of time turtles spend at various depth ranges.

The preliminary results of recent tagging of oceanic sharks were reviewed by the BBRG. This project was attaching PSATs to blue and other oceanic sharks and collecting blood samples to determine key biochemical indicators for hooked and released sharks. The PSATs also record the time spent at different depths by oceanic sharks. This work was being augmented with data from longline fishing using time-depth recorders to look at the depth and time of day sharks were taken on longlines.

An update was given on ongoing research on the biology of opah (moonfish) and monchong (pomfrets). This project was collecting basic biological information and life history data for the opah and two monchong species. Updates were also given on the MULTIFAN-CL stock assessments of North Pacific swordfish and Pacific blue marlin. Problems associated with data inputs for both assessments were noted and discussed.

A report was given on a recently initiated food web study on the tuna ecosystem of the Western and Central Pacific Ocean. The objective of this study is to understand pelagic predator-prey relationships and to provide a model to assess the environmental and fishing impact on the ecosystem and tuna stocks. Diet and trophic level of the different components of the ecosystem were established by examining stomach contents and by analyzing the isotopic composition of muscle samples. Data from this study will be used in bio-dynamic ecosystem models.

Sequential changes in swordfish catch rates off eastern Australia were reviewed by the BBRG. As fishing effort had increased, fishing spread further offshore to maintain high catch rates. Similar scenarios were noted for many longline fisheries, where catch rates were initially high then dropped off markedly. The East Coast Australia fishery has been

studied from its inception and provides an opportunity to investigate this phenomenon. Several hypotheses were being explored, including the concept of resident sub-populations around seamounts, environmental changes and changes in the longline fleet composition over time. The BBRG was presented with the initial results of an age and growth study for juvenile swordfish in Taiwan using otolith microstructure. If the micro-increments observed in the sagittal otoliths were laid down on a daily basis, then juvenile swordfish reached a size of about 94 cm in their first year. Estimates of spawning dates, based on the otolith analysis, ranged from February to October.

The BBRG made the following recommendations:

(i) A strong focus should continue to be maintained on monitoring regional billfish catches, both in commercial pelagic fisheries and from recreational fisheries;

(ii) Efforts 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;

(iii) 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. There are many protected-species issues emerging in the U.S. that can have a great impact on tuna fisheries, e.g., the recent Pacific longline and gillnet moratorium petition designed to protect leatherback turtles. The BBRG also notes that changes to existing fishery management statutes may be used to influence seafood exporters to the US to conform with various bycatch mitigation measures.

(iv) The BBRG recommends that a watching brief be maintained on other bycatch issues as they arise, e.g. future developments under the FAO IPOA on seabird-fishery interactions. Two meetings of note are the Second International Fishers Forum (Nov 2002) and International Marine Turtle Technical Workshop (February 2003), which are both focused on turtle-longline mitigation.