Commission for the Conservation and Management of Highly Migratory Fish Stocks in the Western and Central Pacific Ocean

Scientific Committee
Third Regular Session

Honolulu, HI, USA
13–24 August 2007

SUMMARY REPORT

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Scientific Committee
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EXECUTIVE SUMMARY

OPENING OF THE MEETING

1. The Chair, Dae-Yeon Moon (Korea) opened the Third Regular Session of the Scientific Committee (SC3), which took place in Honolulu, Hawaii, USA from 13−24 August 2007. The Chair welcomed participants to the meeting.

2. The matters considered by the Scientific Committee (SC) and its six Specialist Working Groups (SWGs) — Biology (BI), Ecosystem and Bycatch (EB), Fishing Technology (FT), Methods (ME), Statistics (ST), and Stock Assessment (SA) — included:

1) a review of fisheries in the western and central Pacific Ocean (WCPO) and the eastern Pacific Ocean (EPO);
2) a review of yellowfin tuna stocks in the Convention area as well as northern area stocks, including albacore, Pacific bluefin, striped marlin and swordfish with a focus on requests for advice and recommendations arising from the Third Regular Session of the Commission in Apia, Samoa in December 2006;
3) a review of the report requested by the Second Regular Session of the Scientific Committee (SC2) on alternative stock status reference points;
4) bycatch mitigation issues associated with seabirds, sea turtles, sharks, juvenile bigeye and yellowfin tunas, and ecological risk assessment;
5) issues associated with the Regional Observer Programme (ROP), data confidentiality and dissemination, Indonesia and Philippines Data Collection Project, and WCPFC Tagging Project;
6) cooperation with other relevant organizations;
7) special requirements of small island developing states and territories;
8) future work programme for the Scientific Committee; and
9) administrative matters associated with the functioning of the SC.

Election of Vice-Chair

3. Keith Bigelow (USA) was confirmed as the Vice-Chair of the SC until the conclusion of the Sixth Regular Session of the Commission in December 2009.

OVERVIEW OF WESTERN AND CENTRAL PACIFIC OCEAN FISHERIES

4. The provisional total Convention Area tuna catch for 2006 was estimated at 2,189,985 mt (Fig. 1), the second highest annual catch recorded, and only slightly less than the record in 2005 (2,204,335 mt). During 2006, the purse-seine fishery accounted for an estimated 1,573,447 mt (72% of the total catch – only 12,000 mt less than the record catch of 2005), with the pole-and-

line fishery taking an estimated 211,829 mt (10%), the longline fishery an estimated 229,323 mt (10%), and the remainder (8%) taken by troll gear and a variety of artisanal gear, mostly in eastern Indonesia and the Philippines.

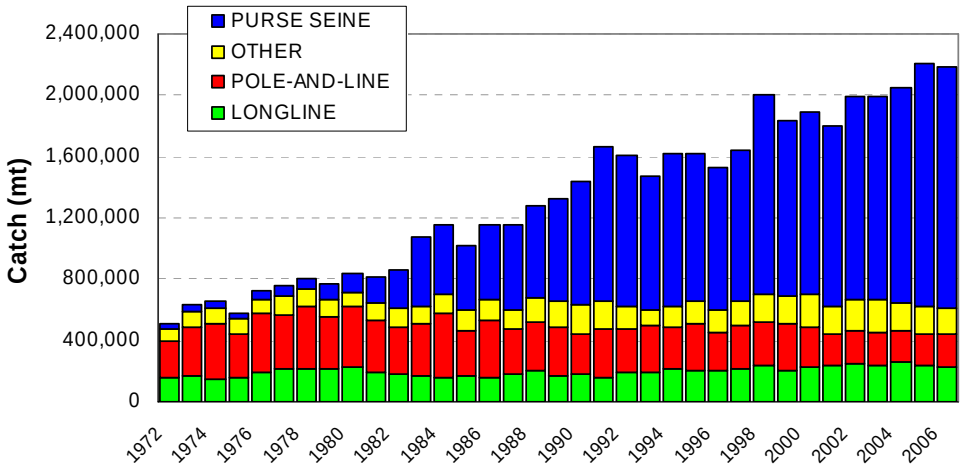

Figure 1. Catch (mt) of albacore, bigeye, skipjack and yellowfin in the Convention Area, by longline, pole-and-line, purse seine and other gear types.

5. The provisional Convention Area tuna catch (2,189,985 mt) for 2006 represented 78% of the total Pacific Ocean catch of 2,800,740 mt and 51% of the global tuna catch (the provisional estimate for 2006 is just over 4.3 million mt).

6. The 2006 Convention Area catch of skipjack (1,537,524 mt – 70% of the total catch) was the highest ever, continuing the trend of consecutive record catches since 2002 (Fig. 2). The Convention Area yellowfin catch for 2006 (426,726 mt – 19%) was about 5% lower than in 2005, but still around the average catch level for the period since 2000. The Convention Area bigeye catch for 2006 (125,874 mt – 6%) was also lower than in 2005, but slightly higher than the average catch level for the period since 2000. Recent Convention Area albacore catches (98,626 mt [4%] in 2005 and 99,861 mt in 2006 [5%]) have been the lowest for nearly 10 years, mainly due to low catches in the North Pacific.

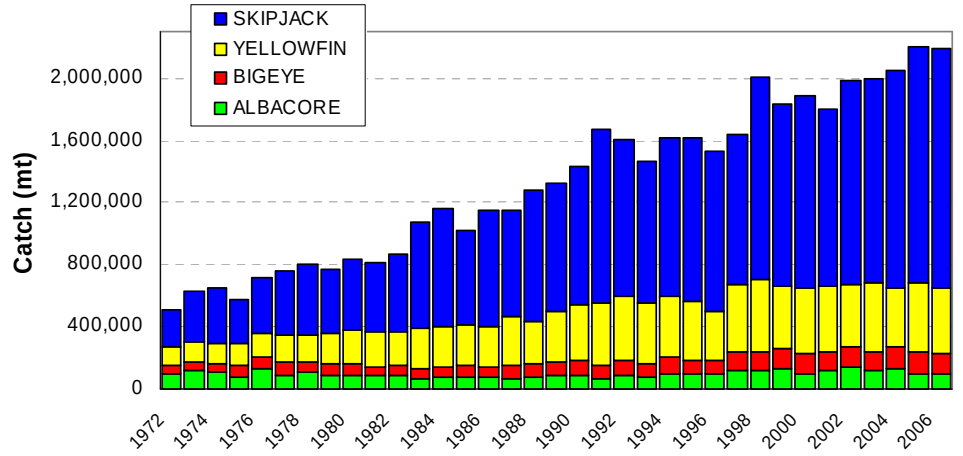

Figure 2. Catch (mt) of albacore, bigeye, skipjack and yellowfin in the Convention Area.

STOCK STATUS AND MANAGEMENT ADVICE AND IMPLICATIONS

WCPO bigeye tuna

7. No stock assessment was undertaken for bigeye tuna in 2007. The latest stock assessment for bigeye tuna is presented in SC2-SA-WP-2. Thus, the stock status description and management recommendations from SC2 are still current.

WCPO yellowfin tuna

Status and trends

8. The 2007 stock assessment conclusions differ slightly from the 2006 assessment, particularly in relation to the ratio of the current estimate of fishing mortality compared with the fishing mortality at maximum sustainable yield (F/F_{MSY}), with the threshold in the 2007 assessment being slightly more optimistic than that in the 2006 assessment. While the point estimate of F/F_{MSY} remains slightly less than 1.0 (0.95), the probability distribution associated with the fishing mortality-based reference point indicates that there is almost an equal probability that the value of F/F_{MSY} is less than or greater than the reference point. Therefore, the possibility of overfishing is still relatively high (47%). The reference points that predict the status of the stock under equilibrium conditions are B/B_{MSY} (1.10) and SB/SB_{MSY} (1.12), which indicate that the long-term average biomass would remain slightly above the level capable of producing MSY at 2002–2005 average fishing mortality. Overall, current biomass exceeds the estimated biomass at MSY (B/B_{MSY} >1.0) indicating that the yellowfin stock in the WCPO is not in an overfished state, although there is a small probability (6.2%) that it is in an overfished state (Figs. 3−4). The change in the estimated MSY in 2007 from that in 2006 may reflect changes in the data structure, fishery designations and levels of uncertainty in the assessment, especially in estimating absolute values, and the change in the scenarios modeled between years.

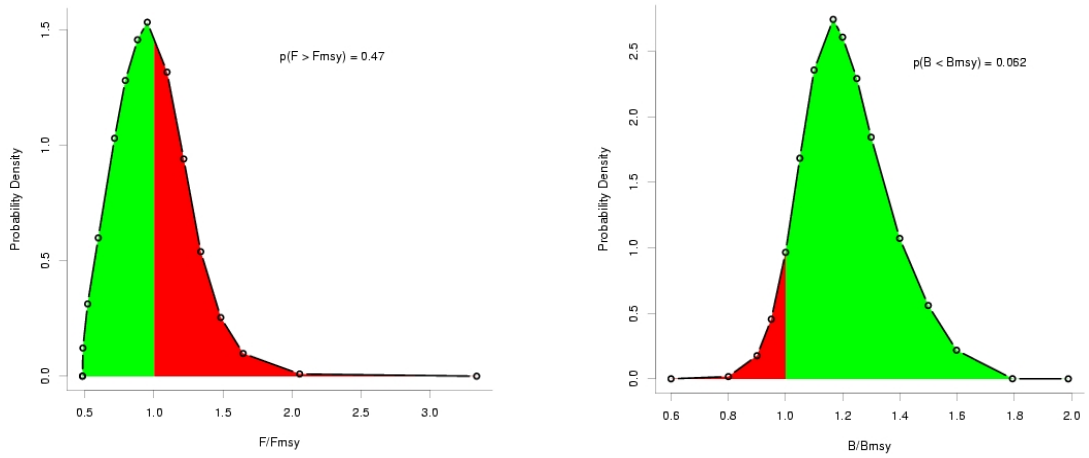

Figure 3. Probability of overfishing occurring (F/F_{MSY} >1, left panel) and the stock being overfished (B/B_{MSY} <1, right panel) for yellowfin tuna in the WCPO.

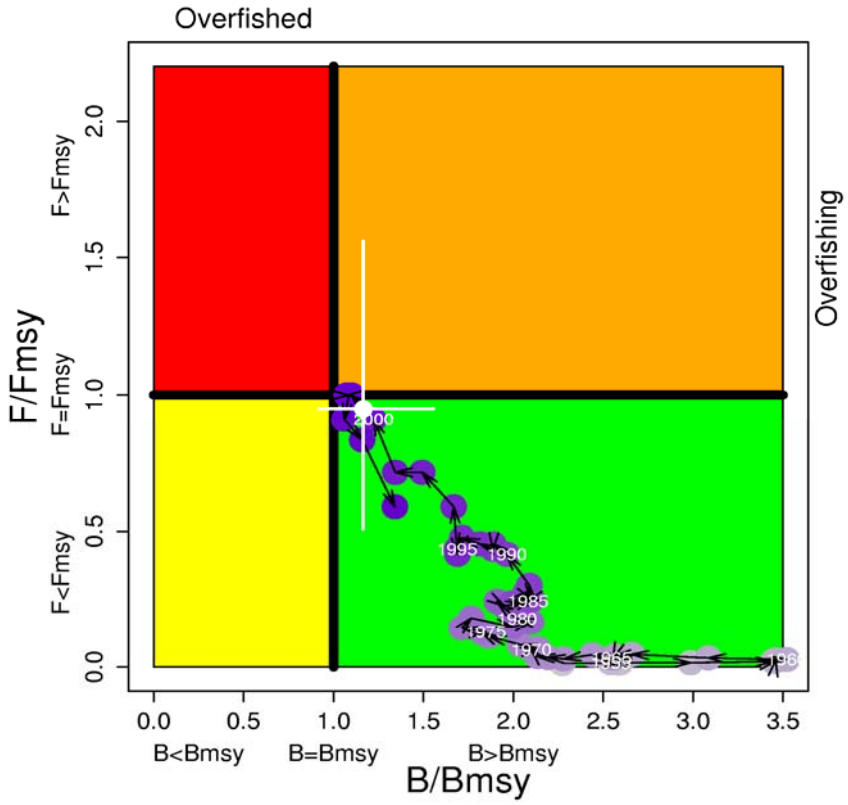

Figure 4. Temporal trend in annual stock status, relative to B_{MSY} (x-axis) and F_{MSY} (y-axis) reference points, for the model period (1952–2006). The color of the points is graduated from mauve (1952) to dark purple (2006) and the points are labeled at five-year intervals. The white point represents the reference points computed for the "current" period (2002–2005) and the white lines represent the associated 95% confidence intervals. (The color figure is attached at the end of the report.)

9. The attribution of depletion to various fisheries or groups of fisheries indicates that the Indonesian and Philippines domestic fisheries have the greatest impact, particularly in their home Region (3) and are contributing significantly to the impact in adjacent assessment Regions 1, 4 and 5 through fish movement. The purse-seine fishery also has a high impact in Regions 3 and 4 and accounts for a significant component (~40%) of the recent (2002−2005) impacts in all other Regions, except Region 6. It is notable that the composite longline fishery is responsible for biomass depletion of about 10% in the WCPO during recent years and generally catches larger, older size classes, while purse-seine fisheries are responsible for a larger percentage of the impacts and generally the catch is smaller and younger fish.

Management advice and implications

10. The point estimate of the $F_{current}/F_{MSY}$ ratio (0.95) in the 2007 assessment was lower than the point estimate (1.11) in the 2006 assessment, where the "current" period is 2002–2005 for yellowfin stock assessment. This change is largely due to the new configuration of the fisheries, their updated size data, and the modeling improvements. However, the possibility of overfishing is still relatively high (47%).

11. The WCPO yellowfin tuna fishery can be considered to be fully exploited. Both the 2006 and 2007 assessments indicate that there is a high probability that overfishing is occurring (73% for the base case 2006 assessment and 47% for the base case 2007 assessment). In order to reduce the likelihood of overfishing, and if the Commission wishes to maintain average biomass at levels greater than 5% above B_{MSY}, reductions in the fishing mortality rate would be required (Fig. 5). The various levels of fishing mortality reduction required to maintain the biomass at specified levels above B_{MSY} (relative to the average levels for 2002–2005) are given in Figure 5.

12. Stock projections for 2007–2011, which attempt to simulate the conservation and management measures adopted at WCPFC2 and WCPFC3, indicate that the point estimate of B/B_{MSY} remains above 1.0 throughout the projection period. However, the increasing uncertainty in future projections is likely to result in an increased probability of the biomass declining below B_{MSY} by the end of the projection period.

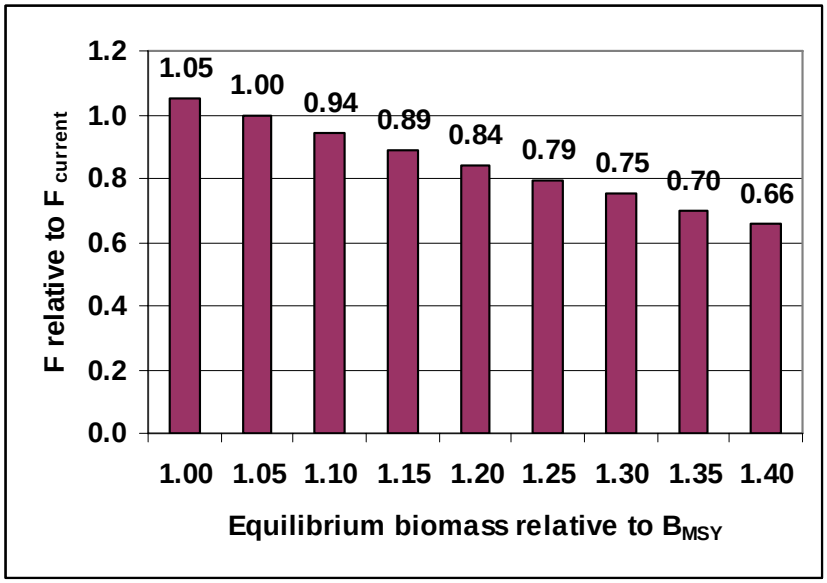

Figure 5. Estimates of the equilibrium level of fishing mortality (relative to current levels) required to sustain biomass at the indicated levels (relative to B_{MSY}).

WCPO skipjack tuna

13. No new assessment for skipjack was conducted in 2007. Thus, the stock status description and management recommendations from the First Regular Session of the Scientific Committee (SC1) are still current.

South Pacific albacore

14. No stock assessment was undertaken for South Pacific albacore in 2007. Thus, the stock status description and management recommendations from SC2 are still current.

Southwestern Pacific swordfish

15. No stock assessment was undertaken for southwest Pacific swordfish in 2007. Thus, the stock status description and management recommendations from SC2 are still current.

Southwestern Pacific striped marlin

16. No stock assessment was undertaken for southwestern Pacific striped marlin. Thus, the stock status description and management recommendations from SC2 are still current.

Northern stocks

17. The International Scientific Committee (ISC) Chair reported on the recent work and findings of the ISC. Progress for the year included organizing and completing eight working group workshops, completing two full stock assessments (albacore and striped marlin) and one updated stock assessment (Pacific bluefin tuna), and reviewing plans for full stock assessments for Pacific bluefin tuna and swordfish by 2010.

North Pacific albacore

18. A North Pacific albacore stock assessment conducted in 2006 indicated that spawning stock biomass (SSB) increased from 2002 (73,500 mt) to 2006 (153,300 mt) and is projected to increase to 165,800 mt in 2007. The increase is attributable to strong year classes in 2001 and 2003. Projections (2007−2020), using an average productivity of 27.75 million fish and F equal to 0.75, indicate that the SSB will reach equilibrium by 2015 at 92,600 mt.

19. The conservation advice provided by the ISC for North Pacific albacore is as follows: "Due to updating, and improvements and refinements in data and models used in the 2006 stock assessment, it is now recognized that $F_{current}$ (0.75) is high relative to most of the F reference points. On the other hand, the same analysis indicates that the current estimate of the SSB is the second highest in history but that keeping the current F would gradually reduce the SSB to the long-term average by the mid 2010s. Therefore, the recommendation of not increasing F from current level ($F_{current}$ =0.75) is still valid. However, with the projection based on the continued current high F the fishing mortality rate will have to be reduced."

Pacific bluefin tuna

20. The total catch of Pacific bluefin (PBF) tuna showed considerable fluctuation in the past between 8,500 mt in 1990 and 38,000 mt in 1956. Recent catches are relatively higher, and the average for the past five years was 22,300 mt. During the same period, Japan's catch accounted for 40–60% of the total catch, followed by Mexico and Korea. The last assessment conducted in January 2006, indicated unresolved inconsistencies between the observed and predicted abundance indices as well as uncertainties observed in the growth of older fish. Because of these problems, the ISC instructed the Pacific Bluefin Working Group (PBFWG) to re-assess the PBF stock in 2008 and in the meantime maintained its previous recommendation that "bluefin tuna fishing mortality should not be increased above recent levels as a precautionary measure."

Other stocks: North Pacific striped marlin

21. According to an ISC striped marlin stock assessment conducted in 2007, spawning biomass has declined from around 40,000 mt in the early 1970s to about 5,000 mt in the early

2000s. Spawning biomass in 2003 was estimated to be 14−15% of the 1970 level, depending on the model scenario used. Recruitment estimates have also exhibited a long-term decline since the 1970s. Stock projections from 2004 through 2009 indicate that both spawning biomass and landings will continue to decline if the current fishing mortality rate is maintained.

22. The ISC advised that the fishing mortality rate of striped marlin should be reduced from the current level (2003 or before), taking into consideration various factors associated with this species and its fishery. Until appropriate measures in this regard are taken, the fishing mortality rate should not be increased.

Management advice and implications

23. The SC acknowledged, with appreciation, the work of the ISC and did not modify its management recommendations.

Inclusion of North Pacific striped marlin as a northern stock

24. As requested by WCPFC3, the SC discussed the standard for designating a given stock as a northern stock, acknowledging that under the provisions of the Convention, the stock must lie mostly north of 20ºN. The information provided in SC3-GN-WP-3 was limited to catch information, and because the ISC's recent stock assessment did not address the spatial distribution of biomass, the SC could not determine whether the stock biomass lies mostly north of 20ºN. Given the lack of pertinent information, the SC did not recommend that striped marlin in the North Pacific be considered a northern stock. The Chair of the ISC noted that the ISC is likely to review further information when it meets next year and will provide any relevant information to the next session of the SC.

Review of reference points

25. As requested by WCPFC3, the SC reviewed the report on alternative stock status reference points requested by SC2 and made the following recommendations and statements in relation to reference points:

1) A future work programme should begin to guide the WCPFC on appropriate reference points and the implementation of the precautionary approach in the management of the western and central Pacific fisheries.
2) The primary component of a future work programme should be the specification of limit and target reference points for target stocks, with agreed decision rules (i.e. management strategies) and, if feasible, the development of a simulation environment for their evaluation by management strategy evaluation (MSE).
3) The work programme should facilitate the participation of all members, cooperating non-members and participating territories (CCMs) including developing states and territories.
4) Because it will take at least three−five years to develop decision rules that have been adequately evaluated using the MSE approach, and because decisions on the management of the fisheries are likely to be required during this period, the Commission should develop and adopt interim decision rules and reference points for management action, based on the provisions of the Convention including its incorporation of Annex II of the UN Fish Stock Agreement.
5) The science provider should examine the sensitivity of the management advice, arrived at using the current combination of reference points and assessment methods, to the uncertainties in the assessment inputs and the underlying model uncertainty.

This would provide the SC and the Commission with a more comprehensive understanding of the full range of uncertainty in the current estimates of stock status and sustainability of the current levels of fishing, as well as a more informed basis for constructing the operating model that will be required in the MSE context.

6) There is a critical need to ensure that the fishery data collection, monitoring (i.e. the use of observers) and verification, which are integral parts of the precautionary approach, are central to any work plan. In addition, it is essential that the basic information requirements for providing meaningful management advice are addressed through research and fishery independent data (e.g. tagging).

26. As a means of progressing a future working programme, the SC made the following recommendations to the Commission:

1) A scoping paper and draft work plan should be developed over the next year to inform both the SC and the Commission on the potential costs, benefits and difficulties of alternative approaches for identification of appropriate reference points (e.g. MSE) within the WCPO.
2) The scoping paper should include technical and organizational issues, and any associated difficulties related to undertaking an MSE in the WCPO, and should also include identifying the use of interim management strategies (including reference points and decision rules) while a full MSE is underway. The external consultancy report (SC3-ME-WP-3) and the report of the SC3 informal small group on biological reference points (SC3-ISG-WP-5) should serve as a foundation for developing the scoping paper and draft work plan.
3) A presentation of SC3-ME-WP-3 should be made to the upcoming Commission meeting to inform the Commission about the use of reference points (and approaches to evaluating them) in the management of highly migratory fish stocks in the WCPO.

BYCATCH MITIGATION

Seabirds

27. The SC reviewed the available scientific information and decided that at this time there was no need to amend the suite of mitigation measures, or to make changes to the area of application listed in CMM-2006-02.

28. With regard to the technical specifications for mitigation measures, differing views were expressed by SC members on some specifications and complete agreement could not be reached. There was vigorous debate as to whether the technical specifications should include operational considerations such as weather and oceanic conditions. No agreement was reached by the SC on this matter, and it was referred to the Technical and Compliance Committee (TCC) for further consideration.

29. An unambiguous list of specifications could not be adopted by consensus. However, a list with areas of non-agreement clearly indicated was adopted. The SC noted it would review this issue at its next meeting and reminded CCMs, as they implement CMM-2006-02 next year, to provide information to the Commission on the specifications of the mitigation measures that they will require their vessels to employ, as well as any data resulting from research undertaken to further develop and refine measures to mitigate seabird bycatch as required by the CMM.

30. The SC considered the requirement of CMM-2006-02 for estimating seabird interactions and bycatch in the Convention Area. The SC noted that this was a complex task, requiring representative observer coverage, fine-scale distribution of seabird populations, and frequency and interactions between seabirds and fisheries. The SC reaffirmed that seabird mortality estimates would need to be addressed through the 2008−2010 work programme. The Secretariat is requested to obtain the available estimates of seabird population sizes and trends for the next meeting of the SC. The Secretariat is also requested to include a summary of seabird catch reporting in its coverage of data gaps. Several CCMs reminded the SC that current observer coverage is less than 1% in the longline fisheries and that this seriously compromises the ability to assess wider ecosystem impacts.

Sharks

Fin–weight ratios

31. The SC generally considered that the average 5% fin-to-carcass ratio was reasonable, given the variations in species composition, size and processing methods.

Identification of key shark species for annual reporting to the Commission

32. The SC recommends that observer programmes should collect information on the catch of all shark species, both retained and discarded, to the lowest possible taxonomic level. This information should be provided in the annual reporting to the Commission.

33. The SC was not in a position to define what constitutes a "key" shark species. CCMs shall provide details of the shark species that are caught to assist in the identification of key shark species at next year's SC. Future consideration should include information on the known distribution of those species (e.g. tropical or temperate, coastal or pelagic).

Juvenile bigeye and yellowfin tuna

34. The SC adopted the following recommendations.

Research and analyses

1) An analysis to determine the size of yellowfin tuna that should be considered in discussions about reducing fishing mortality of small tuna on floating objects (STFO), incorporating such parameters as stock condition, recruitment indices, yield-per-recruit, and economic considerations.
2) A comparative study on relative rates of STFO and floating-object associated fauna between:
    a) floating objects in the eastern vs. western regions of the WCPO;
    b) drifting FADs vs. anchored FADs (especially bigeye); and
    c) relative rates of STFO taken in archipelagic areas close to large island environments vs. catch rates offshore or in high seas areas.
3) A detailed analysis of skipjack, yellowfin and bigeye catch on floating object sets by time of day.
4) An examination of vessel specific bigeye quotas with vessel owners as a means to reduce bigeye catch and improve targeting by purse-seine fisheries.

Industry-associated research

1) A survey of purse-seine operators to determine their accuracy in estimating set size, species composition and fish size prior to setting.
2) Design acoustic studies onboard commercial purse-seine vessels engaged in commercial fishing operations to document the accuracy of set size, species composition and fish size prior to setting. (Note: this would test the feasibility of vessel or fleet-specific STFO quotas as a management option).
3) The use of net depth recorders or other depth recording devices in conjunction with ADCP or Doppler current meters and set details to characterize actual pursing depth of WCPO purse-seine gear in different areas and conditions.
4) Closer collaboration and communication between the SC and the tuna industry to seek new ideas and workable solutions to reduce the take of STFO, particularly on drifting and anchored FADs (Note: designed personal interviews and surveys as conducted by Moreno et al. (2007)[1] should be conducted in the WCPO).

Turtles

35. The SC provided advice on effective strategies to reduce sea turtle interactions (Table 1). Column A in the table contains the articles that vessels should carry in order to safely release hooked sea turtles. Consensus was reached that these tools would be effective in all longline fisheries, if used according to guidelines. Column B contains sea turtle bycatch mitigation measures that have been shown to reduce the capture or injury of turtles, while maintaining target species catch based on research conducted around the world.

Ecological risk assessment

36. The meeting recalled that SC2 had endorsed ecological risk assessment (ERA) in general and productivity-susceptibility analysis (PSA) in particular, as an appropriate way to assist the Commission in prioritizing species for management action or further research. The SC endorsed the substance of the ERA research plan developed during a pre-SC3 workshop organized by the Secretariat of the Pacific Community's Oceanic Fisheries Programme (SPC-OFP) and that it is incorporated in the draft SC work programme for 2008–2010.

[1] See FT-WP-5: G. Moreno, L. Dagorn, G. Sancho, and D. Itano. in press. Fish behaviour from fishermen knowledge: the case study of tropical tuna around drifting fish aggregating devices (DFADs). (summary of Canadian Journal of Fisheries and Aquatic Sciences).

Table 1. Effective strategies to reduce sea turtle interactions in fisheries. (Discussion was not completed on the items in Column B due to reservations by Japan and will continue at further meetings of the WCPFC and its committees.)

A: All longline fisheries	B: Optional methods for longline fishing
• Carry and use dipnets (where appropriate), line cutters and dehookers to handle and release sea turtles using guidelines to be established by WCPFC	For shallow-set fisheries (majority of hooks <100 m) targeting swordfish, with possible bycatch of loggerhead or leatherback turtles: • Use large circle hooks* • Use fish bait as a replacement for traditional use of squid bait For other fishery sectors than that described above (if applicable): • Replace non-circle hooks with circle hooks* that are at least as wide (minimum width) as those replaced • Replace non-circle hooks with hooks* (any style) that are at least 20% wider (minimum width) • Use only fish for bait • Eliminate the shallowest-set hooks (i.e. <100 m) in deep-set fishing • Replace the shallowest set hooks (i.e. <100m) with circle hooks*
* For all methods, hooks should not have points offset any greater than 10^{o}. Review has shown that greater offsets can have negative effects in increasing the frequency of deep hooking as opposed to mouth hooking.	

DATA AND INFORMATION

Regional Observer Programme

Recommendations — Scientific priorities and objectives of the Regional Observer Programme

37. Observer objectives and priorities for longline and purse-seine fisheries given in last year's WCPFC-SC2 Summary Report were used as a starting point for formulating a more generic set of scientific priorities and objectives for the ROP, given now in Attachment K of the this report.

38. There are six scientific objectives that should be considered in the development of the ROP, all of which are high priority. The scientific priorities and objectives for the ROP should be given by the text contained in Appendix II of Attachment K.

Recommendations — Minimum fields of scientific data to be collected by the ROP

39. There were a wide range of opinions held on the minimum fields of scientific data to be collected by the ROP. A combination of SC3-GN-WP-6 (data standards for the ROP) and SC3-DP-4 (comments on alternative data standards proposed by China, Chinese Taipei, Japan and Korea) was accepted as a basis for moving forward.

40. It was recommended that the text contained in Appendix III of Attachment K be used as the starting point for future discussions on the minimum fields of scientific data to be collected by the ROP.

41. The SC noted that:

- The list of data fields contained in Appendix III of Attachment K is provisional and requires more consideration and refinement (by other subsidiary bodies of the Commission and subsequent sessions of the ST-SWG);
- Many delegations expressed a strong desire for further opportunities to add items to, or subtract items from, this list;
- The SC only considered scientific needs for the fields of data to be collected by the ROP;
- At the ST-SWG, a consensus agreement was reached on slightly over 100 fields of data (those not square bracketed in Appendix III) that should be collected by the ROP, but consensus was not reached with regard to other fields;
- In some instances, the discussion of fields of data was made more complicated by the lack of shared understanding regarding the meaning and purpose of each proposed field.

Recommendations — Improve the documentation of the meaning of each proposed field of data

42. Two items should be added to the SC's work programme, these being the draft list of:

- minimum data fields for the ROP (contained in Appendix III of Attachment K) be annotated with explanations of what each field is and why it is needed;
- minimum data fields for the ROP be annotated with detail describing the format (units of measure, codes etc) to be used when collecting each field (completing the work that was started in SC3-GN-WP-6).

Data confidentiality, security, and disseminations

Procedures for the access to and dissemination of data compiled by the Commission

43. The SC forwards suggestions made by the ST-SWG (in SC3-ST-IP-9) so that they might be considered by TCC3 and the Commission.

Information Security Policy

44. The SC recommended that:

- the Secretariat proceed immediately with the implementation of the Information Security Policy;
- if CCMs wish to provide written comments on the Information Security Policy they should do so before 16 November 2007 (and preferably before TCC3).

Indonesia and Philippines Data Collections Project (IPDCP) update and review

45. The SC noted the report of the 4th Steering Committee for the IPDCP, and encouraged additional funding support for the activities that have been initiated and continue to be supported under the IPDCP.

Tagging initiatives

46. The SC noted the excellent achievements of the Phase 1 component of the Regional Tuna Tagging Project in Papua New Guinea. The SC recommended that:

- the Commission endorse the Phase II extension of the tagging project as a Commission-sponsored research project;
- a steering committee be established to plan the Phase II component of the project; and
- a voluntary fund be established by the Commission to encourage CCMs to provide the necessary funding for the project.

Other matters

Data gaps

47. The SC recommended that:

- the Commission should note that data gaps (including late and/or absent data) are impacting on the ability to provide the best available scientific advice, particularly for the assessment of stocks;
- the Secretariat deploys on the WCPFC website (within the next 12 months) a prototype computer program that allows data gaps to be easily identified;
- a study be undertaken to identify the causes of data gaps. This study should be from a holistic perspective, paying particular attention to those instances where data were not collected.

Procedures for the provision of data to the Commission

48. The ST-SWG recommended that the scientific data to be provided to the Commission be that data documented in Appendix IV of Attachment K.

49. The SC noted the need for further consideration (at the Commission level) of the wording related to the provision of data on fishing activities outside the Convention Area.

COOPERATION WITH OTHER ORGANIZATIONS

50. The WCPFC Executive Director briefed the SC on relations with WCPFC and other organizations, such as the: Secretariat of the Pacific Community (SPC), Commission for the Conservation of Southern Bluefin Tuna (CCSBT), International Scientific Committee (ISC), Inter-American Tropical Tuna Commission (IATTC), International Commission for the Conservation of Atlantic Tunas (ICCAT), Agreement for the Conservation of Albatross and Petrels (ACAP), Pacific Regional Environment Programme (SPREP), Commission for the Conservation of Antarctic Marine Living Resource (CCAMLR), and the Indian Ocean Tuna Commission (IOTC). The SC was invited to provide written comments on the draft memorandum of understanding (MOUs) to the Secretariat by 20 September 2007 so that those comments could be taken into account when the TCC reviews the draft at its Third Regular Session, 27 September–2 October 2007.

CONSIDERATION OF THE SPECIAL REQUIREMENTS OF DEVELOPING STATES AND PARTICIPATING TERRITORIES

51. The SC recommended the continuation of stock assessment workshops for small island developing states and territories similar to the workshop programme conducted by the SPC-OFP.

FUTURE WORK PROGRAMME

Strategic Research Plan 2007–2011 for the SC

52. The SC deferred for consideration the Strategic Research Plan 2007−2011 for consideration at SC4.

2008 Work programme and budget, and 2009−2010 provisional work programme and indicative budget

53. The SC recommended to the Commission the work programme and provisional budget for 2008–2010, as outlined in Attachment O. The SC also recommended that during 2008, the Commission provide funding support from its core budget to several high priority research projects as indicated in Table 2.

54. The SC recommended that the WCPFC Secretariat, together with the Chair, Vice-Chair and SWG conveners, and in consultation with CCMs and the Commission's Science Service Provider, draft guidelines outlining the process for formulating the work programme and budget of the SC to ensure that the process is efficient, transparent and facilitates broad participation in the scientific work programme. These guidelines are to be presented to SC4 for review, adoption and implementation.

ADMINISTRATIVE MATTERS

Rules of Procedure

55. The SC recommended that the WCPFC Executive Director consult with CCMs regarding the issue of Rules of Procedure for subsidiary bodies and, taking into account the comments tabled at, or provided during, the SC on the draft Rules of Procedure recommended by SC2, and any comments provided by NC3 and TCC3, provide to WCPFC4 options for advancing this issue.

Independent review of the science structure and functions of the Commission

56. The SC made recommendations on the proposed review's scope, steering committee, terms of reference for the steering committee, reviewer attributes, dissemination of expressions of interest, budget and indicative schedule. These are appended as Attachment P of this report report.

Review of Part 1 of the Annual Report to the Commission

57. The SC agreed to continue its consideration of this issue at SC4 and the Commission will continue to use the current format approved by WCPFC2.

Next meeting

58. The SC accepted Papua New Guinea's offer to host SC4 at Port Moresby from 11–22 August 2008.

OTHER MATTERS

Priorities for stock assessment for 2008

59. The SC recommended that the following species be fully assessed in 2008, subject to the completeness of SPC-OFP's data holdings:

1) WCPO bigeye (with consideration given to a Pacific-wide bigeye stock assessment with IATTC);
2) South Pacific albacore;
3) WCPO skipjack (2008/2009).

Table 2. Selected items from the SC work programme for 2008–2010 and (indicative) budget that require funding from the Commission's core budget (USD)

Strategic Research Activity or Project with priority identified at SC3 (Attachment O)	2008		2009		2010	
	Core	Other	Core	Other	Core	Other
1. Collection, compilation and verification of data from the fishery						
Project 14. (Priority = High) Indonesia and Philippines Data Collection Project (IPDCP)	**115,000**		**115,000**		**115,000**	
Indonesia • An outline of a full project proposal for the IPDCP 2008-2010 in Indonesia was reviewed by the Steering Committee on the IPDCP and briefed at the SC3. USD61,000 is proposed for each year for 2008-2010 to be funded from the General Account Fund. • A preliminary research was commenced in June 2007 with a support of USD 30,000 from the Commission. Its progress report was provided at the 4th Steering Committee. Philippines • The Philippines has successfully finished two-year IPDCP in the country. It focused on the establishment of data collection system. The Commission considered the importance of the continuity of data collection in Philippines and supported Philippines basic funds to run the established system. A proposal and budget level for this continuity was submitted to the Steering Committee on IPDCP and the estimated budget agreed for each year of the period 2008-2010 was USD54,000.							
Project 16. (Priority = Medium) Publication and distribution of Commission's training and educational materials.	**7,500**		**7,500**		**7,500**	
• SWG conveners may recommend items to be published and distributed for the Commission's work. For example, during 2007 additional guides were developed by the FT-SWG on longline and purse seine bycatch species. Funding support to provide colour reprints of these guides as well as tuna guides in languages deemed useful for Commission objectives. • Includes development of training materials and the production of material to facilitate the identification of target and non-target species by fishermen, observers, and port samplers with the objective of improving data quality.						

2. Monitoring and Assessment of Stocks						
2a. Stock assessment and modeling						
Project 26. (Priority = High) - NEW **Revised Stock assessment on southern swordfish**	**7,500**	**110,000**				

- CMM 2006-03 states that "The Commission will review this measure in 2008 on the basis of advice from the scientific committee following their consideration of an updated swordfish stock assessment…" and so this became a SA-SWG priority.
- This species is not one of the principal target species assessed by the SPC-OFP but is an important target species for a number of CCMs. Australian and New Zealand scientists are proposing to undertake this work but are seeking some funds from the Commission as the research is directly addressing a request from the Commission and will have broader regional benefits. Funding from the Commission would also help secure funds from funding sources from Australia and New Zealand.

2b. Biological Studies						
Project 35. (Priority = High) **Refinement of bigeye parameters Pacific-wide: A comprehensive review and study of bigeye tuna reproductive biology.**	**15,000**		**30,000**	**170,000**	**30,000**	**170,000**

Objectives

- To obtain accurate scientific information on maturity, spawning locations, sex ratios, and fecundity for inclusion in stock assessments of bigeye (including yellowfin and albacore) tuna in the Pacific Ocean.

Items to be considered as a joint research between IATTC and WCPFC

- Based on tagging studies to date, the movements of bigeye are geographically restricted. The limited amount of mixing across the Pacific Ocean can create differences in life history characteristics as a function of differences in oceanography and genetic structure. Therefore, obtaining size and age based estimates of bigeye reproductive characteristics from spatial strata across the Pacific Ocean would be useful for inclusion in bigeye stock assessments, since current estimates are based on inadequate spatial strata and limited sample sizes to have much confidence for inclusion in Pacific-wide assessments.

Funding

- The level of required budget may depend on the scope and duration of such biological researches in a joint proposal. The anticipated duration for bigeye biological study is 3 years with a rough amount of USD 400,000.

- Budget can be shared with IATTC, a preliminary study for feasibility in 2008 (USD 15,000) and two-year project $200,000 each year for 2009 and 2010. Any specific research and analysis requested by the Commission will be supported by the Commission's core budget.
- In addition, obtaining adequate numbers of bigeye samples may require a collaborative sampling effort by scientists from China, Japan, Korea, and Taiwan from their nation's commercial and research long-line vessels.

Notes

- It is important to address some of the outstanding issues related to the biological parameters for bigeye, but we also need to ensure work is done on other species for which much less data are available. Hopefully, the priority species will identify themselves through the Ecological Risk Assessment process. In the WCPO, we have a range of similar or even more critical issues related to yellowfin and albacore tuna.
- Though this is a high priority project, there appears to be no expectations of SPC-OFP support here.

Project 39. (Priority = High) - NEW Regional study of the stock structure and life-history characteristics of South Pacific albacore.	**25,000**	**190,000**	**25,000**	**190,000**	**25,000**	**190,000**

- This project was identified as a BI-SWG priority and a proposal to undertake this work is being developed by Australia and conjunction with New Zealand, SPC-OFP and other CCMs (e.g. New Caledonia, French Polynesia, FFA countries). It may directly addresses stock assessment needs for one of the principal target species in the WCPO and will be of direct benefits to a range of CCMs.
- Funding from the Commission would also help secure funds from funding sources from Australia and New Zealand. A better description of the work and justification for the funding requested from WCPFC will be available during the WCPFC4, if necessary.

3. Monitoring and assessment of the ecosystem						
Project 42. (Priority = High) Pacific-wide tagging project	**10,000**		**10,000**	**2,500,000**	**10,000**	**2,500,000**

Objectives: The main objectives of these tuna tagging experiments are to obtain information on movement, stock structure, growth, mortality, behaviour, habitat utilization, and vulnerability for use in stock assessments for yellowfin, bigeye and skipjack tuna.

Progress of Pacific-wide tagging project (Joint tagging between IATTC and WCPFC)

- Phase-1 tagging project was done in PNG waters. A Phase-2 tagging project was proposed at SC3.
- IATTC are holding a tagging workshop in October 2007.

Level of budget and funding

- Funding is a limiting factor for Pacific Ocean tuna tagging experiments and should be sought from a broad range of sources, including member and non-member countries with substantial financial interests in these fisheries, GEF, and non-governmental organizations, particularly foundations interested in supporting scientifically based tuna conservation efforts.
- The budget required for a 2 year pan-Pacific tagging project would need at least USD 9 million to do a wide coverage project in the WCPFC-CA alone. Approximately USD 2.4 million has been identified through SPC projects. To provide some additional perspective, the IOTC tagging project over 3 years in a much smaller area than the Pacific (or even the WCPFC-CA) cost USD 19 million.
- The core budget will be used for the coordination of the project, including having a workshop, consultancy, and travel fee for the participation of experts.

Sub-projects included

- Undertake a preliminary analysis of the vertical distribution of skipjack, yellowfin and bigeye tuna associated with fish aggregation devices, as indicated by acoustic tagging data. Scientists from other CCMs will participate in this project and related data analysis.
- Ongoing and newly funded research with sonic and archival tags in Hawaii, PNG and other areas.

Project 43. (Priority = High) **Ecological Risk Analysis, including PSA.**	**130,000**		**130,000**		**130,000**	

- On-going ERA Work Programme was presented to SC3 and the substance of the ERA Research Plan was endorsed as a three-year project by the SC3.
- Annual budget includes USD30,000/year for identifying areas of spatial and temporal overlap of seabird and sea turtle interactions with tuna fisheries and estimating seabird mortality as requested from CMM-2006-02.
- More details on the project and priority of this project relative to other projects will be provided at WCPFC4, if necessary.

Project 56. (Priority = Medium) - NEW **Utilize underwater videos and other tools to characterize species, size composition and spatial distribution of tunas aggregating around floating objects.**	**5,000**					

• Utilize underwater videos and other tools to characterize species, size composition and spatial distribution of tunas aggregating around floating objects as a FT-SWG Priority • The unit used in the EPO by IATTC cost approximately $3000. On advice from IATTC, it will likely be necessary that gear be suitable to depths of at least 100 m due to deeper thermocline and mixed layer depth in the WCPO. This will require greater pressure ratings and length of cables.						
4. Evaluation of management options						
Project 57. (Priority = High) - NEW Development of Scoping Paper, and draft Work Plan, on the potential costs, benefits and difficulties of alternative approaches for identification of appropriate reference points and implementation of an MSE within the WCPO.	**10,000**		**10,000**		**10,000**	
• Development of Scoping Paper, and draft Work Plan, on the potential costs, benefits and difficulties of alternative approaches for identification of appropriate reference points and implementation of an MSE within the WCPO • This project was a ME-SWG Priority and recommended by the SC3 to be undertaken in 2008. • Research will be continued to further develop and refine the Commission's management tool. A workshop will be considered and CCMs may be able to fund travel for their respective scientists to participate in this process.						
Project 60. Unallocated budget			**60,500**		**66,550[a]**	
• This contingency fund is prepared for any scientific research, analysis or project as requested by the Commission. Based on the amount of USD 55,000 for 2008, 10% of annual inflation rate was applied for 2009 and 2010.						
SUB-TOTAL (NON SPC-OFP SERVICES)	**325,000**	**300,000**	**388,000**	**2,860,000**	**394,050**	**2,860,000**
TOTAL SPC-OFP	**713,104**		**N/A**		**N/A**	
SUB-TOTAL (SPC-OFP SERVICES minus SPC-OFP subsidy)	**325,000**		**357,500**		**393,250[a]**	
GRAND TOTAL minus SPC-OFP subsidy	**650,000[b]**	**300,000**	**745,500**	**2,860,000**	**787,300**	**2,860,000**

[a] An annual increase of 10% was applied.
[b] An increase of USD15,000 from the indicative budget of USD625,000

Commission for the Conservation and Management of Highly Migratory Fish Stocks in the Western and Central Pacific Ocean

Scientific Committee
Third Regular Session

Honolulu, HI, USA
13-24 August 2007

SUMMARY REPORT

AGENDA ITEM 1 — OPENING OF MEETING

1. The Chair, Dae-Yeon Moon (Korea) opened the Third Regular Session of the Scientific Committee (SC3), which took place in Honolulu, Hawaii, USA from 13–24 August 2007. The Chair welcomed participants to the meeting.

2. The matters considered by the Scientific Committee (SC) and its six Specialist Working Groups–SWGs (Biology – BI, Ecosystem and Bycatch – EB, Fishing Technology – FT, Methods – ME, Statistics – ST, and Stock Assessment –SA) included:

1) a review of the fisheries in the western and central Pacific Ocean (WCPO) and the eastern Pacific Ocean (EPO);
2) a review of yellowfin tuna stocks in the Convention area as well as northern area stocks, including albacore, Pacific bluefin, striped marlin and swordfish with a focus on requests for advice and recommendations arising from the Third Regular Session of the Commission in Apia, Samoa in December 2006;
3) a review of the report requested by the Second Regular Session of the Scientific Committee (SC2) on alternative stock status reference points;
4) bycatch mitigation issues associated with seabirds, sea turtles, sharks, juvenile bigeye and yellowfin tunas, and ecological risk assessment;
5) issues associated with the Regional Observer Programme (ROP), data confidentiality and dissemination, Indonesia and Philippines Data Collection Project, and WCPFC Tagging Project.;
6) cooperation with other relevant organizations;
7) the special requirements of small island developing states and territories;
8) the future work programme for the Scientific Committee; and
9) administrative matters associated with the functioning of the SC.

3. The following countries attended the session as members of the Commission and as participating territories: Australia, Canada, China, Cook Islands, European Community, Federated States of Micronesia, Fiji, French Polynesia, Guam, Japan, Kiribati, Korea, Marshall Islands, Nauru, New Caledonia, New Zealand, Niue, Palau, Papua New Guinea, Philippines, Samoa, Chinese Taipei, Tokelau, Tonga, Tuvalu, United States of America (USA), Vanuatu, and Wallis and Futuna. Solomon Islands was unable to attend.

4. Indonesia attended as a cooperating non-member. The Pacific Islands Forum Fisheries Agency (FFA), Secretariat of the Pacific Community (SPC), Agreement for the Conservation of Albatross and Petrels (ACAP), International Scientific Committee for Tuna and Tuna-like

Species in the North Pacific Ocean (ISC), Birdlife International, The Marine Conservancy, and World Wildlife Fund (WWF) attended as Observers.

5. A list of participants is appended as Attachment A.

1.1 Welcoming address

6. Samuel Pooley, Director of the Pacific Islands Fisheries Science Center, gave a welcoming address (Attachment B).

7. Andrew Wright, Executive Director of the Western and Central Pacific Fisheries Commission (WCPFC), provided the meeting with an opening statement (Attachment C) in which he outlined many of the issues facing the SC, focusing particularly on the need to deal with data gaps. He expressed appreciation to the many people involved in preparation and support of this meeting, including staff of the Secretariat of the Pacific Community's Oceanic Fisheries Programme (SPC-OFP), the National Oceanic and Atmospheric Administration (NOAA) Pacific Islands Region Office and Science Center, the Western Pacific Regional Fishery Management Council (WPRFMC), and the WCPFC secretariat.

1.2 Election of Vice-Chair

8. Keith Bigelow (USA) was confirmed as the Vice-Chair of the SC until the conclusion of the Sixth Regular Session of the Commission in December 2009.

1.3 Adoption of agenda

9. The agenda, with minor amendments, was adopted by the SC (Attachment D).

1.4 Meeting arrangements

10. The SC adopted a work schedule to support discussions in the SWGs during the first week of the meeting, while the second week was reserved for plenary discussions. In addition, informal small groups (ISGs) were selected to progress issues associated with procedural items on the agenda outside of session.

1.5 Reporting arrangements

11. The Chair noted that each SWG would produce both a full SWG report, to be annexed to the SC Summary Report, and a summary SWG report, for inclusion within the main text of the SC Summary Report.

12. The Chair noted that the SC Summary Report would be accompanied by an Executive summary that would serve as the basis of the presentation to the Fourth Regular Session of the Commission.

13. A list of abbreviations and acronyms used in this report and a list of documents for the SC are included as Attachment E.

1.6 Intercessional activities of the SC

14. The Chair made a brief report on the intercessional activities of the SC.

AGENDA ITEM 2 — REVIEWS OF FISHERIES

2.1 Overview of the western and central Pacific Ocean (WCPO) fisheries

15. Peter Williams and Chris Reid co-presented an "Overview of Tuna Fisheries in the Western and Central Pacific Ocean, Including Economic Conditions – 2006" (SC3-GN-WP-1). The presentation is summarized here in two parts, a general overview and an overview of the economic condition of the fishery.

General overview

16. The provisional total Convention Area tuna catch for 2006 was estimated at 2,189,985 mt (Fig. 1), the second highest annual catch recorded, and only slightly less than the record in 2005 (2,204,335 mt). During 2006, the purse-seine fishery accounted for an estimated 1,573,447 mt (72% of the total catch – only 12,000 mt less than the record catch of 2005), with the pole-and-line fishery taking an estimated 211,829 mt (10%), the longline fishery an estimated 229,323 mt (10%), and the remainder (8%) taken by troll gear and a variety of artisanal gears, mostly in eastern Indonesia and the Philippines.

17. The provisional Convention Area tuna catch (2,189,985 mt) for 2006 represented 78% of the total Pacific Ocean catch of 2,800,740 mt and 51% of the global tuna catch (the provisional estimate for 2006 is just over 4.3 million mt).

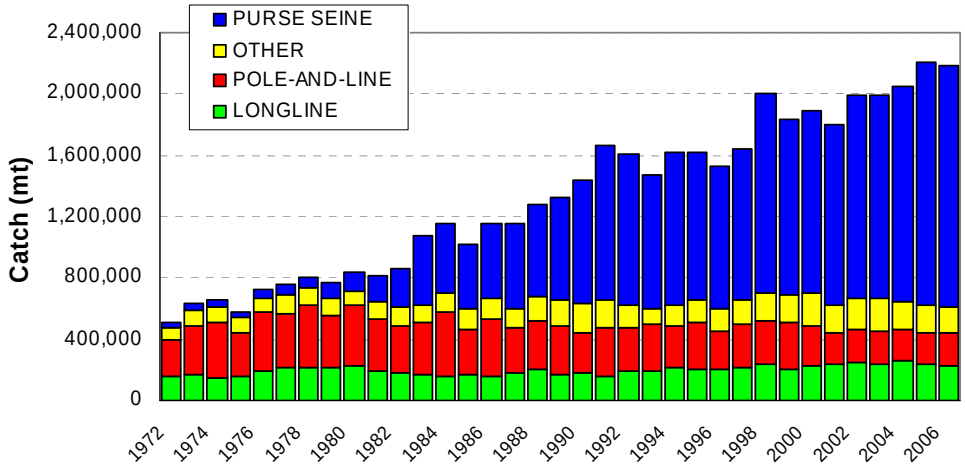

Figure 1. Catch (mt) of albacore, bigeye, skipjack and yellowfin in the Convention Area, by longline, pole-and-line, purse seine and other gear types.

18. The 2006 Convention Area catch of skipjack (1,537,524 mt – 70% of the total catch) was the highest ever, continuing the trend of consecutive record catches since 2002 (Fig. 2). The Convention Area yellowfin catch for 2006 (426,726 mt – 19%) was about 5% lower than in 2005, but still around the average catch level for the period since 2000. The Convention Area bigeye catch for 2006 (125,874 mt – 6%) was also lower than in 2005, but slightly higher than the average catch level for the period since 2000. Recent Convention Area albacore catches (98,626 mt [4%] in 2005 and 99,861 mt in 2006 [5%]) have been the lowest for nearly ten years, mainly due to low catches in the North Pacific.

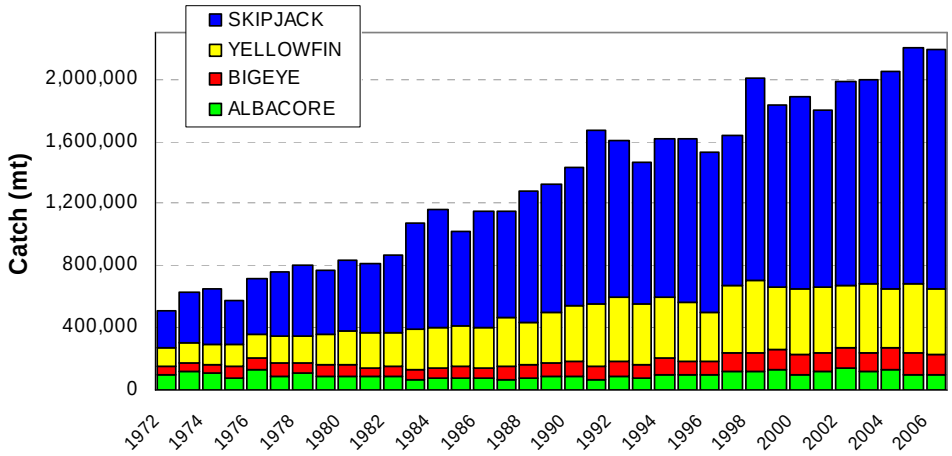

Figure 2. Catch (mt) of albacore, bigeye, skipjack and yellowfin in the Convention Area.

19. The provisional 2006 purse-seine catch of 1,573,447 mt was the second highest on record but only 12,000 mt less than the record in 2005 (1,586,064 mt). The 2006 purse-seine catch was dominated by a record catch of skipjack tuna (1,305,405 mt – 83% of the total catch), but experienced a drop in yellowfin tuna catch (243,620 mt – 15%) compared with the relatively high level taken during 2005 (258,273 mt). The estimated purse-seine bigeye catch for 2006 (24,180 mt – 2%) was slightly less than the average for years since 2000. The total estimated purse-seine effort for 2006 was lower than the previous two years, even though the 2006 catch level is on par with 2005, with very good catch rates were experienced during 2006.

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

21. The provisional Convention Area longline catch (229,323 mt) for 2006 was the lowest since 2000 and around 10% lower than the highest on record which was attained in 2004 (261,038 mt). The Convention Area albacore longline catch (78,921 mt – 34%) for 2006 was similar to the (high) catch levels experienced in recent years. The provisional bigeye catch (75,496 mt – 33%) for 2006 was the lowest for five years, and the yellowfin catch (70,021 mt – 31%), the lowest for seven years.

Discussion

22. Subsequent discussion included suggestions for improving future presentations of the review of fisheries by combining log and fish aggregation devices (FADs) set type data, and presenting vessels size/capacity data to assist understanding of increases in fleet capacity. It was noted that the latter endeavor would be hindered by a lack of vessel size data from some vessels. Discussion around increased skipjack catch per unit of effort (CPUE) was unable to determine if this was due to increased availability, increased fishing method efficiency or other factors at this point in time.

Economic condition of the fishery

PURSE-SEINE FISHERY

23. It was noted that skipjack prices were relatively flat and stable throughout the first three quarters of 2006 before embarking on an upward trend that has continued through to the present (July 2007). In 2006, Bangkok benchmark skipjack prices (4–7.5 lbs, cost and freight–c&f) traded in a range of USD800–1,000/mt, and over the first half of in 2007 skipjack prices rose dramatically from just over USD1,000/mt in January to around USD1,400/mt by mid-July. It was also noted that Bangkok yellowfin prices (20 lbs and up, c&f) over 2006 ranged from a low USD1,180–1,200/mt in early January to a high of USD1,600–1,650/mt from mid-September to early November and that Bangkok yellowfin prices have been trending upward for much of the period since 2000 when prices averaged around USD950/mt for the year. In 2006, prices averaged around USD1,500/mt and continued to increase in 2007 with the latest reports (mid-July) indicating prices at USD1,850–1,900/mt.

24. The estimated delivered value of the purse-seine tuna catch in the WCPFC area for 2006 is USD1,583 million the highest level since at least 1995. This represents an increase of USD82 million or 5% on the estimated delivered value of the catch in 2005 that was driven by a USD89 million (8%) increase in delivered value of the skipjack catch with the value of the yellowfin catch steady at USD341 million.

LONGLINE FISHERY

25. It was noted that Japanese market prices for longline caught yellowfin and skipjack have been reasonably steady since 2002–2003, with some signs in recent times that Japanese market conditions were improving with prices in most markets rising in 2006. US prices for fresh imports of yellowfin continued to rise in 2006, with bigeye prices declining marginally.

26. It was noted that Bangkok albacore market price (10 kg and up, c&f) continued to increase in the first half of 2006 peaking at USD2900–2950/mt before embarking on a downward trend through to July 2007 when they stood at USD1750/mt.

27. The estimated delivered value of the longline tuna catch in the WCPFC area for 2006 is USD1.112 billion. This represents a marginal increase of USD5 million on the estimated value of the catch in 2005 with a USD25 million (14%) increase in value of the albacore catch being offset by a USD17 million (3%) and a USD4 million (1%) decline in the value of the bigeye and yellowfin catch, respectively.

Discussion

28. With respect to fishery economics, it would appear that the fall in albacore tuna prices in 2006 was primarily the result of oversupply versus demand, which resulted from a record catch in the South Pacific, although other factors may also operating. Bigeye tuna prices may effectively be capped as a result of being the secondary "sashimi" of choice relative to farmed and wild bluefin tuna. Bigeye prices would increase only if bluefin prices increased to such an extent that some buyers could no longer afford bluefin, at which point "substitution" would become more prevalent. There was some additional discussion about whether it is possible to undertake analyses relating catch volumes to prices, so as to assist in managing the fishery in a manner that maximizes its value. However, while such analyses are possible, their interpretation is complicated by the many factors that can affect price, aside from catch volume.

2.2 Overview of the eastern Pacific Ocean (EPO) fisheries

29. Mark Maunder presented a Review of the "Eastern Pacific Ocean Fishery for the 2006 Fishing Year" (SC3-GN-WP-2).

30. The fishing capacity of the purse-seine fleet fishing in the EPO has increased steadily over the last 10 years. The longline effort rapidly increased in the early 2000s, but has subsequently declined. Total catches increased starting in 1995, peaked in 2003, and then declined.

31. Yellowfin tuna catches increased substantially in the mid-1980s due to a regime shift in productivity. They have remained stable since, except for a peak in the early 2000s followed by a decline. Catches in 2006 and the first half of 2007 have been low. The distribution of catch across the gear types has remained fairly constant since the start of the assessment in 1975. Presently, there are few large fish in the catches and catches are concentrated in the coastal areas. The changes in catch are reflected in the recruitment and abundance estimated by the assessment model. Both exploitation and environmental variation have greatly impacted the population. The yellowfin tuna population in the EPO may be overfished and may be experiencing overfishing. The status is estimated to be worse if a stock recruitment relationship is used. A moderate increase in yield could be gained if larger fish were caught.

32. Bigeye tuna catches have increased since the mid-1990s due to an expansion in the purse-seine fishery on floating objects. During this period, catches by the longline fleet generally decreased. There are few large fish in the current purse-seine catches and the spatial distribution is extended farther to the west. The longline catch is distributed across the entire Pacific Ocean. Tagging has shown long distance movement between the EPO and WCPO, but movement is generally limited. Recruitment of bigeye tuna increased in the late 1990s, declined, then increased again recently. Both fishing and the environment have impacted the population. Since about 1995 the purse-seine fishery on floating objects has had an increasing impact on the population and currently has the largest impact. The bigeye tuna population in the EPO may be overfished and is experiencing overfishing. The status is estimated to be worse if a stock recruitment relationship is used. A substantial increase in yield could be gained if larger fish were caught.

33. Skipjack catches have been increasing since the late 1990s when the purse-seine fishery on floating objects started expanding. The spatial distribution of current purse-seine catches has extended farther to the west. An assessment for skipjack tuna in the EPO has not been conducted for several years due to the large uncertainty in the assessments.

34. Subsequent discussion focused on the results from the yellowfin and bigeye tuna stock assessments undertaken in the EPO. The shift in distribution of fishing effort and of bigeye tuna catches towards the western section of the EPO fishery was most probably due to low catches in the eastern section. It was also noted that EPO vessels are fishing west of 150ºW. Concern was expressed over the very low recent catches of adult yellowfin on dolphin sets and the possible implications of this for current and future stock condition. Recent estimates of biomass were clarified to be based on highly uncertain (and high) recent recruitment estimates and therefore were themselves considered to contain high uncertainty. It was also noted that the comparison of stock assessment results between EPO and WCPO in the past have shown similar findings.

35. With respect to measures currently proposed in the EPO, there were three described for the yellowfin tuna stock, these being measures based around either extended closures, total quota

setting, or incremental in-season quota setting (although the methodology/capacity to apply this in-season has not been developed). For the bigeye tuna stock, measures revolving around equatorial spatial closures and vessel quota setting have been proposed, in conjunction with the possibility of having a FAD use "register" to monitor FAD fishing capacity/effort. It was also noted that the estimation of recruitment in future assessment models may be assisted by environmental indicator based models of recruitment such as those being investigated/developed in the WCPO (e.g. for yellowfin tuna).

2.3 Fishery reports from members, participating territories and cooperating non-members (CCMs)

Australia

36. Domestic longline activity off eastern Australia declined in 2006, with the number of active vessels falling from 100 (2005) to fewer than 50 vessels (2006). Longline fishing effort also declined, from 12.5 million hooks in 2003 to 8.8 million hooks in 2006. Few purse seiners, troll and pole-and-line vessels operated off southern New South Wales in 2006. The domestic longline yellowfin tuna catch in 2006 was 1,829 mt, which was a substantial decline from the 2003 peak catch of about 3000 mt. The 2006 catch of bigeye tuna (498 mt) was also less than the peak catch (1,050 mt) reported in 2001; and the 441 mt of striped marlin was down from the 2003 level (634 mt). The 2006 broadbill swordfish catch (1,132 mt) was the lowest since 2001 (1,396 mt). There is renewed interest in albacore tuna, with increased landings (2,591 mt) primarily for the canning market.

37. The proportion of swordfish taken from outside the Australian Fishing Zone continues to decrease with the decline of the fleet and increased fuel costs. The proportion taken from outside the zone decreased from 12% of the total weight in 2005 to 10% in 2006. Smaller proportions of the striped marlin, bigeye tuna and yellowfin tuna are taken outside the AFZ because those species are also the target of smaller longliners operating closer to ports.

Canada

38. Max Stocker presented a summary of catch, effort and catch per unit of effort (CPUE) data for the Canadian albacore troll fishery in the WCPFC Convention Area (SC3-AR-WP-3). The Canadian fishery for albacore tuna (*Thunnus alalunga*) is a troll fishery that uses tuna jigs. The total Pacific albacore tuna catch from 2002–2006 by the Canadian albacore troll fishery ranged from 83 mt in 2005 to 453 mt in 2003. The preliminary catch estimate for 2006 is 135 mt — an increase of 63% over the 2005 catch of 83 mt. Fishing vessel days (v-d) ranged from 105 v-d in 2006 to 408 in 2002. CPUE ranged from a low of 494 kg/v-d in 2005 to a high of 1,286 kg/v-d in 2006. Catch follows a decreasing trend from 2003–2006. Similarly, CPUE follows a decreasing trend from 2003–2005 then trends upward in 2006.

39. In terms of research activities, a project to document the existing relational database for the Canadian Pacific albacore catch and effort data has been completed. A technical report has been published (http://www.dfo-mpo.gc.ca/Library/327827.pdf). Canada participated in and chaired the ISC Albacore Working Group (ISC-ALBWG) stock assessment workshop held at the National Research Institute of Far Seas Fisheries (NRIFS) in Shimizu, Japan, 28 November—5 December 2006. Participants from Japan, United States, and Canada conducted a full assessment of the north Pacific albacore stock with data up to 2005.

China

40. There were two types of tuna fisheries in the WCPFC waters in 2006: longline (LL) and purse seine (PS). The total number of LL vessels in 2006 was 157, which included 100 ice fresh tuna longline vessels (IFLL) and 50 deep frozen tuna longline vessels (DFLL). The IFLL vessels mainly operate in the exclusive economic zone (EEZ) of Pacific Island countries, targeting bigeye and albacore. The major fishing grounds were distributed among the EEZs of the Federated States of Micronesia, Marshall Islands and Fiji. Most of the DFLL vessels targeted bigeye tuna in the high seas and the EEZs of Pacific Island countries. The size of LL vessels ranged from 67 gross registered tons (GRT) to 742 GRT. The number of PS vessels in 2006 increased to 9.

41. The total catch of tuna and tuna-like species by Chinese LL and PS vessels was 78,877 mt in 2006, the majority of which comprised albacore (7,191 mt), bigeye (9,790 mt), yellowfin (8,965 mt), and skipjack (47,776 mt).

42. The catch by the Chinese LL fishery and PS fishery was 26,133 mt and 52,744 mt, respectively. The 2006 catch by IFLL and DFLL vessels was 13,157 mt and 12,976 mt, respectively. The catch composition by IFLL is mainly albacore (44%, 5,826 mt), bigeye (16%, 2,076 mt) and yellowfin (16%, 2,135 mt) and other (18%, 2,385 mt). The catch composition by DFLL is mainly albacore (11%, 1,365 mt), bigeye (59%, 7,714 mt) and yellowfin (14%, 1,862 mt) and swordfish (8%, 1,024 mt). The catch composition by PS is skipjack (91%, 47,776 mt) and yellowfin (9%, 4,968 mt).

43. Bigeye and yellowfin tunas caught by longline vessels operating in Pacific Island countries and high seas areas were exported to Japan's sashimi market. The albacore catch was landed at Fiji for canning. Catch by the PS fishery was mostly transshipped to Thailand for canning.

Cook Islands

44. The Cook Islands had 30 active longline vessels operating within the WCPF Convention Area during 2006, with the majority of them operating within the Cook Islands EEZ. Total annual catch estimates for 2006, when compared with 2005, had decreased along with fishing effort. Albacore remained the dominant catch species accounting for 74% of total catch, which was little over 3,000 mt.

45. Efforts are being made to improve monitoring and data collection with the addition of full-time port samplers to the programme, and the recruitment of observers from other Pacific Island nations.

European Community

46. The European purse-seine fleet (EC-SPAIN) has been operating in the WCPO since 1999, taking sporadic catches. This fleet consists of five large tuna purse-seine vessels with a hold volume of 11,997 m^3 (ranging from 1,881–3,161 m^3). Preliminary data for 2006 suggest total nominal catches — made by three purse-seine vessels — of 10,862 mt (yellowfin 1,980 mt; bigeye 688 mt; skipjack 8,194 mt) in areas of the WCPFC. There is 100% coverage of onboard observers, in keeping with the Agreement on the International Dolphin Conservation Program (AIDCP) managed by the IATTC.

47. The Spanish surface longline fleet started fishing in WCPFC waters in 2004. Delays in the collection of 2006 surface longline fishery data (due to the great distance between the fishery and Spain) makes it difficult to process the data on time, and so these data are not yet available. Eight Spanish flag longline vessels targeting swordfish were fishing during 2005. These vessels are typically 10.8 m in length, 291.8 GRT, and have 861.8 hp engines. The catch composition of the main species held onboard, in tons of round weight, taken by all eight vessels were: swordfish 1,226 mt, blue shark 1,299 mt, shortfin mako 303 mt, billfish 67 mt, and tuna (various species) 44 mt. Data on fin body weight ratios of shark species and other biological parameters were recorded. Opportunistic tagging and release activities were also carried out. Specific observations for evaluating the incidental bycatch of turtles were incorporated in the protocols of scientific observers.

Federated States of Micronesia

48. The number of vessels licensed annually to fish within the EEZs of 14 Pacific Island countries, ranges between 340 and 400 vessels over the last decade. Japanese fishing vessels have been the most numerous among the fleets operating. Japan employs all three gear types, including the only pole-and-line vessels within the fishery. For this period (2006), the total number of vessels licensed is 318, which is down from 330 vessels in 2005 and 399 vessels in 2004.

49. The majority of the vessels licensed by the National Oceanic Research Management Authority (NORMA) to fish in FSM's EEZ are foreign vessels. The license revenue from these vessels represents a significant percentage of the government's overall revenue. Catch and effort has fluctuated with total catches of target tuna species ranging from about 75,000 mt to over 200,000 mt during the last decade.

50. The total 2006 FSM longline catch for all species in the WCPFC Convention Area was reported to be 482 mt, which represented an increase of approximately 10% above the 2004 catch. The breakdown of the total 2006 catch is bigeye 172 mt (~35%), yellowfin 270 mt (~56%), and 40 mt (9.3%) of other species.

51. The total 2006 catch by the tuna fishery in FSM's EEZ (by logsheets) is estimated to be 129,577 mt. The three gear types comprise the total tuna catch in the following order: purse seine 122,214; longline 6,004 mt; and pole-and-line 1,359 mt. The total EEZ catch has increased 12% over last year's total EEZ catch from all fleets within both the purse-seine and longline fisheries. A total of 140 vessels of 10 different flags fished in FSM's waters during 2006. A record of over 122,000 mt of the three main tuna species (skipjack >83%, yellowfin ~14%, and bigeye <2%) were harvested by purse seine vessels within FSM's waters.

52. FSM's EEZ catch (122,214 mt) for the purse-seine fishery by nine fleets consists primarily of skipjack (93%), yellowfin (6.4%) and bigeye (0.5%). Effort (by days fishing) within the EEZ was reported to be 3,442. Most effort was by Japanese, Korean and Taiwanese purse-seine fleets operating within the EEZ during this period. The Japanese purse-seine fleet remained dominant over other fleets, with most effort for this period, as it has been over the last decade.

Fiji

53. Ever since its introduction in the early 1980s, longlining has been the predominant tuna fishing method. In 2006, Fiji had 80 domestic longline vessels operating in and around its waters, catching a total of 20,707 mt of tuna and non-target species. Over the last five years, the annual

catches of tuna and non-target species ranged from a low of 12,314 mt in 2003 to 22,287 mt in 2004.

54. The majority of the catch was within Fijian waters, with some activity on the high seas and in neighbouring EEZs, where several vessels are licensed to fish. Records show that the catch from the Fijian fleet in waters outside Fiji's EEZ has increased considerably during the years 2001–2004, from 10% to 55%. Contrasting patterns were observed in 2005 and 2006 where the catch from the domestic fleet from waters outside Fiji's EEZ was reduced to 30%–40%.

55. Trends in nominal CPUE for the longline fleet showed a steady increase of 1.03 per 100 hooks in 2003 to 1.93 per 100 hooks in 2006 for albacore. A peak in yellowfin CPUE for 2004 may be due to there being more yellowfin available compared to previous years; otherwise, yellowfin CPUE appeared relatively stable over the time series. Bigeye CPUE appears to have remained consistent at and around 0.2 per 100 hooks.

French Polynesia

56. The tuna fishery is a major component of French Polynesia's economy. The overall nominal catches for the professional tuna fisheries in 2006 is estimated to be around 8,000 mt, in which 65% were caught by longliners; albacore accounted for 38%, yellowfin tuna for 15%, skipjack 14% and big eye tuna 6%. The longline fleet is mostly based in Tahiti and usually exploits half to two-thirds of the EEZ, although the core fishing ground remains historically in the northern part of the EEZ (10°–20°S/140°–150°W). In 2006, the longline yield was lower than yields obtained around 2002, mainly due to poor albacore catches. At the end of the year, an experimental fishing trip was conducted with six professional longliners in the southern part of French Polynesia's EEZ. Albacore catch rates were very low, whereas swordfish catch rates were good.

Japan

57. An activity report of Japanese fisheries (including longline, pole-and-line, purse seine and miscellaneous fisheries) operating within the Convention Area was presented. In 2005, 1,233 Japanese longline vessels were operating in the WCPFA — 58 vessels (4%) less than in 2004; 423 pole-and-line vessels were in operation in 2005 — 36 vessels (9%) less than in 2004; and 35 purse-seine vessels (over 200 GRT) were operating in the Convention Area's equatorial waters in 2005, which was equivalent to the number in 2004. In 2005, the number of 50–200 GRT purse-seine vessels catching tunas north of 20°N was 87 in 2005 — 4 vessels less than in 2004. The total the Convention Area tuna catch (Pacific bluefin, albacore, bigeye, yellowfin and skipjack) by the Japanese fishery in 2005 was 498,000 mt, corresponding to 110% of 454,000 mt from the 2004 catch. In 2005, the tuna catch by the purse-seine fishery was 266,000 mt (54% of the overall total tuna catch); 153,000 mt (31%) by the pole-and-line fishery; 64,090 mt (13%) by the longline fishery; and the remaining (3%) by other gear types.

58. Japan conducted several research activities relating to tuna in the Convention Area in 2006 and early 2007, including a tagging study for tropical tunas and sharks, cruise survey to study the movement and migration patterns of bigeye and blue marlin, a mid-water trawling survey to learn about the distribution of juvenile skipjack, as a bycatch species related research, experiments with circle hooks with the aim of reducing hooking mortality of sea turtles, experiments on the side-setting method, and a sea turtle nesting survey.

Kiribati

59. Kiribati's EEZ supports large tuna catches by foreign vessels fishing under access agreements and multilateral arrangements with the USA. Artisanal tuna catches are vital to food security on most islands. Domestic industry development has been constrained by logistical problems such as operational and transportation costs. Kiribati had only one locally flagged purse-seine vessel in operation. The F/V *KAO 1* operates under a joint venture arrangement by Otoshiro Fishing Company, Japan and the Government of Kiribati. Small-scale longlining is encouraged and being tried at Kiritimati.

60. The largest catch for the F/V *KAO 1* was in 2002 with over 5,500 mt. The catch declined in 2003 and 2004 to around 4,000 mt. The catch increased again in 2005 to about 6,000 mt and then declined to 4,660 mt in 2006. Skipjack dominated the catch in 2006 accounting for about 72% of the total catch. Yellowfin and bigeye were also in the catch but represented a smaller percentage, accounting for 24% and 3%, respectively.

61. The number of longliners is declining, from 240 in 2002, to 166 in 2005, and to 129 in 2006. In 2006 the number of purse-seine vessels was 110. Taiwan, Japan and Korea dominated purse-seine and longline activities in Kiribati waters in 2006.

62. The highest purse-seine catch was in 2002 at over 294,000 mt. There was a decrease in the total catch from 185,535 mt in 2005 to 133,092 mt in 2006. Skipjack remains the dominant catch species. In 2006, Korean vessels dominated the purse-seine fishery, followed by Taiwan, New Zealand, FSM and Japan. The longline catch increased from 6,476.4 mt in 2005 to 8,837 mt in 2006. Bigeye and yellowfin dominated the catch.

Korea

63. Over 90% of Korea’s total Pacific Ocean tuna catches are taken from the Convention Area. Catcheswithin the Convention Area have fluctuated from 216,000 mt to 276,000 mt and averaged 246,000 mt. Annual purse-seine catches during the last five years ranged from 180,000 mt to 250,000 mt, averaging 208,000 mt. Skipjack and yellowfin tuna comprised 83.2% and 16.6% of this catch, respectively. The Korean longline fishery targets bigeye and yellowfin tuna, with minor catches of albacore, which comprise 80–88% of the total catch. Billfish and other fish species are incidentally caught in this fishery. Annual longline catches ranged from 27,000 mt to 54,000 mt during the past five years. The number of longliners and purse seiners fishing in 2006 was 130 and 28, respectively, which represents a decrease of 23 longliners compared with the previous year. Korean tuna fisheries depend on overseas markets, with a large portion of the catch exported to Japan and other international markets. About 28,000–50,000 mt of longline-caught tuna and 60,000–137,000 mt of purse seine-caught tuna have been exported annually.

64. Korea's Ministry of Maritime Affairs and Fisheries (MOMAF) initiated the development of an observer programme for distant-water fisheries, including tuna fisheries, in 2002. In 2006, a nine observer trips were conducted to monitor Korean tuna longline and purse-seine fisheries, of which two cruises were carried out in the Pacific Ocean. Monthly biological sampling for purse-seine catches has been carried out at a domestic landing site once a month since 1993, to obtain size data and information on the reproductive biology of yellowfin and skipjack tuna. A total of 1,476 skipjack and 203 yellowfin tuna were sampled for morphometric measurements and gonad somatic index (GSI) during 2006.

65. Since concerns regarding sea turtle bycatch in longline fisheries have been raised in various international meetings, the Korean government has funded an experiment to investigate whether circle hooks can solve this international problem of sea turtle mortality. The second experiment was carried out by the National Fisheries Research and Development Institute (NFRDI) scientists aboard a commercial Korean longliner operating in the eastern Pacific during September–October 2006. This experimental survey will be repeated with various types of circle hooks during the period August–September 2007. To solve practical problems that fishermen usually encounter when they record bycatch species, NFRDI issued the second edition of "Fishes of the Pacific Ocean" in 2006.

Marshall Islands

66. The tuna fishery in the Republic of the Marshall Islands (RMI) continues to be dominated by the purse-seine fishery, predominately distant-water fleets, whose catch comprises mostly skipjack tuna. Currently, there are five RMI-flagged purse-seine vessels fishing both within RMI's EEZ and throughout the Convention Area. The remainder of the fleets licensed to fish in the RMI's EEZ consists of distant-water longliners, domestically based foreign longliners, and Japanese pole-and-line vessels. The overall number of vessels operating in the Marshall Islands has declined from 283 vessels in 2005 to 228 vessels in 2006.

67. With the exception of the domestically based foreign longline fleet, whose catch remained relatively stable, there was significant reduction in the overall catch by all fleets in RMI's EEZ in 2006: 12,919 mt in 2006 compared with 20,488 mt in 2005. Similarly, the catch by the RMI purse-seine fleet experienced a decrease of ~27% throughout the Convention Area, 56,164 mt in 2005 and 41,164 mt in 2006.

68. The Marshall Islands Observer and Port Sampling Programmes strive to maintain effective monitoring programmes and have undergone significant improvements over the past few years. Domestically based foreign longline and domestic purse-seine vessels continue to dominate observer coverage due to the convenience for placements. While acknowledging the need for further expansion of the programmes, the RMI looks forward to collaborating with the Commission in the establishment of the Regional Observer Programme.

Nauru

69. The tuna fisheries in Nauru form a key component to the economic development of Nauru with access fees from foreign fishing licenses contributing a significant component of the national GDP. Ffisheries development is characterized by a predominant reliance on access fees from all the major purse-seine fleets operating in the WCPO, and little onshore development, although the latter is an issue that is assuming higher priority with the planned restructuring of the Nauru Fisheries Trading Corporation.

70. Nauru's EEZ continues to provide a rich ground for purse-seine fleets of the Fishing Partner members of the WCPFC, with initial catch data for 2006 indicating a relatively high level of catch.

New Caledonia

71. For more than 20 years, tuna fishing in New Caledonia has been done by longliners only, with no licenses having been issued to foreign vessels since early 2001.

72. In 2006, 24 domestic vessels were licensed to fish in the EEZ compared with 27 in 2005, and 29 in 2004 and 2003. In terms of the number of boats active, only 21 longliners fished last year, which is less than in 2005 (23 active vessels then).

73. Despite better CPUE data, the annual catch has shown a similar decreasing trend to that of fishing effort, from 2,620 mt in 2004 down to 2,110 mt in 2006. Albacore remains the main species caught accounting for about two-thirds of the overall catch. Over the last 10 years bigeye has become a bycatch species of the domestic fishery with only 35 mt unloaded in 2006.

74. Seasonality continues to affect the catch of the New Caledonian fleet. However, patterns during last year were somewhat different from the previous two years, especially with regard to albacore, with drops in catch during the transitional seasons having been less important than in 2004 and 2005.

75. Port sampling and observer activities under a new EC-funded project due to start in 2008 will continue to add scientific data to the logsheets currently collected on a regular basis. It should be noted that in 2006, the incidental catch of a turtle (juvenile green turtle) was reported by the observer programme, which is the first such occurrence since the start of the programme in early 2002.

76. Over the last few years several initiatives, both on the scientific and technical aspects of the tuna fishery, have been implemented on a local scale so as to contribute to regional efforts to improve and spread knowledge about the spatial distribution of target tuna species and the links to environmental signals.

New Zealand

77. The number of longline vessels operating in New Zealand has declined from 151 vessels in 2002 to 56 in 2006. The New Zealand tuna fleet consists of around 200 domestically owned and operated vessels (mostly between 15 m and 25 m in length). New Zealand has four New Zealand flagged Class-6 purse seiners fishing offshore. These have fished in the EEZs of Pacific Island states and in high seas areas of the equatorial WCPO since 2000. These vessels also fish domestically along with six smaller capacity domestic-based purse seiners. The number of purse seiners has been stable at around 10 vessels.

78. Since 2002, skipjack (16,790 mt), of which nearly all was taken by purse seine, has comprised the greatest part of the catch of all tuna species, both within and beyond New Zealand fisheries waters. Beyond New Zealand fisheries waters, yellowfin (1,282 mt) makes up most of the balance. Yellowfin are rarely part of the purse-seine catch within New Zealand fisheries waters due to the domestic purse-seine fishery focusing almost exclusively on free schools of skipjack. The second most important component of New Zealand's domestic fisheries are albacore (2,540 mt), which are taken mostly by troll gear but also by longline. The domestic longline fleet mostly targets bigeye and southern bluefin tunas, and more recently swordfish, but the greatest part of the catch consists of albacore. Over 200 mt of striped marlin are caught annually by the recreational fleet, with well over half of the fish tagged and released. Blue shark is the most common bycatch species in the longline fishery followed by Ray's bream. The recent large reductions in longline effort have resulted in reductions in landings of major bycatch species. New Zealand longline vessels fishing south of 30ºS are required to use tori lines to reduce seabird catches during the setting process. In addition, longline vessels fishing for tuna or swordfish in New Zealand fishery waters may only set their lines at night and must use tori lines while setting. Because the purse-seine fishery is based on free schools of skipjack, bycatch is

minimal (e.g. 2.5 mt out of 410 mt). No interactions with non-fish bycatch (e.g. seabirds, turtles, and marine mammals) were observed. Most tuna caught in New Zealand's waters are exported and the destination of exports varies depending on the species.

79. New Zealand has a Scientific Observer Programme (SOP) and two active port sampling programmes. In the 2005-2006 fishing season, 17.4% of the longline effort was observed, in 2006 3.4% of the New Zealand purse-seine effort was observed. A considerable amount of research is directed at tunas and tuna-related species in New Zealand. Both fishing permit holders (fishers) and fish receivers are required to furnish returns to the Ministry of Fisheries. New Zealand has four data collection systems in place to collect catch and effort data. New Zealand also has a system for collecting information on non-fish bycatch from fishers.

Niue

80. Niue has a small EEZ (~450,000 km^2) and is one of the smallest members of the WCPFC. Niue has a newly developed fishing fleet consisting of foreign fishing vessels licensed to fish in its waters (EEZ). The fishery follow 3 components which all are targeting the same species given the nature of the land formation, Niue does not pertain fringing reefs or lagoons so access to highly migratory species is easy for all fishers which are all sought out by both canoe fishers to the industrial longliners making management and data collection a tougher task. Niue now has a fish factory that holds 6,000 mt and is employing locals as factory workers; the factory will be employing more local workers with the intention of moving them into managerial positions. Moves to strengthen the national legislation, which will incorporate the measures adopted by the Commission, have begun and will ensure that data collection is credible and is carried out in a manner that will provide good results for stock assessment purposes.

Palau

81. Palau's EEZ is relatively small (629,000 km^2) and borders those of Indonesia to the south, the Philippines to the west, and FSM,to the east, with high seas areas to the north and southeast (the Palau–FSM–PNG corridor). The tuna fishery primarily involves the activities of foreign longline fleets (Chinese and Taiwanese) that are locally based with the exception of the Japanese fleet (longliners, purse seiners and pole-and-liners), which operate from its home port, all under access agreements. The number of foreign vessels fishing in Palau's waters has been increasing over the years, and mainly consists of vessels from Taiwan, Japan and China. This increase in vessel numbers also contributes to an increase in catch. Although yellowfin has been the predominant catch, bigeye catches for 2005 and 2006 for some fleets has increased, probably in relation to changes in fishing methods and species targeted.

82. Palau's close link to international tuna markets means that all fresh chilled sashimi-grade tuna can be air-freighted within 48 hours to Japan, the US mainland and Chinese Taipei. Bycatch, including billfish, are stored and later exported by commercial carriers to canneries in the Philippines, Chinese Taipei and Singapore. Seven fishing companies have valid access agreements with the Republic of Palau to fish in Palau's waters. Three of these are locally based foreign fishing companies that are currently in operation, one company that is in the process of building and investing in a fishing port, and the remainder are local and have yet to begin fishing operations.

Papua New Guinea

83. Papua New Guinea's EEZ is 2.4 million km^2 and is one of the largest and more productive in the WCPO, producing on average 20% of the WCPO's purse-seine catch (300,000 mt annual average in the past five years). Catches have been increasing and the current 2006 catch is, for the first time, over 400,000 mt. Tuna is the largest of Papua New Guinea's (PNG's) fisheries and represents a balance of both domestic industry development and foreign distant-water fishing nation (DWFN) access arrangements. In 2006, 186 purse-seine vessels fished in PNG's waters under various arrangements including the bilateral access, the multi-lateral access with the USA, the FSM arrangements, and those PNG-flagged and PNG-sponsored under the FSM arrangement. Also licensed were 66 longline and handline vessels, of which only 45 were active. Longline and handline fisheries are domestic and no foreign vessels fish under this category. The operation of the tuna fishery has been guided by the PNG National Tuna Fishery Management Plan since 1999. The Plan establishes an overall management structure and an application framework for all tuna fisheries by gear, including license limits and TACs. The purse-seine fishery further operates within guidelines of several important regional and sub-regional arrangements such the Parties to the Nauru Agreement (PNA), the Palau Arrangement, and the FSM Arrangement (FSMA), and now the WCPFC, to which the PNG tuna fishery is subjected to adhere to its requirements. The longline fishery includes nine vessels that target sharks and operate under a Shark Fishery Management Plan.

84. PNG has one of the largest and most active observer programmes in the region. It has a current strength of 97 observers, covering all fisheries including 100% coverage on all purse-seine vessels that fish on FADs in PNG's waters, especially PNG's archipelagic waters. PNG is taking proactive steps to address issues on the catch of small tunas on FADs, and in this regard has just completed a tuna tagging project with its partners the Secretariat of the Pacific Community (SPC) and the University of Hawaii, and funding agencies that include the Government of PNG, the Global Environment Fund (GEF), the government of Australia and New Zealand, and others. The broad objective of the project was to tag tuna to obtain a better understanding of their movements and behavior, especially around FADs. PNG is again collaborating with SPC and the Institute of Research for Development (IRD) based in Noumea, New Caledonia to carry out a study on seamounts, which will begin in May 2008. One of the objectives will be to understand the role of seamounts in tuna production.

85. Finally, onshore investment in tuna processing for export is actively encouraged in PNG. Foreign and domestic access by purse-seine vessels is increasing linked to commitment to onshore investment, especially in the form of tuna processing.

Philippines

86. The Philippines is among the top fish producing countries in the world. Over 1.5 million people depend on the fishing industry for their livelihood. The Philippine fishing sector consists of municipal and commercial components, with the former involving vessels less than 3 GRT in size, and under the jurisdiction of local government units (LGUs). Larger commercial vessels (>3 GRT) are required to fish outside municipal waters, 15 km beyond the shoreline, and are required to obtain a commercial fishing vessel license (CFVL) at the Bureau of Fisheries and Aquatic Resources. Republic Act 9379 (or the Handline Fishing Law) will formally give a separate category for handline vessels, which are targeting large pelagic fish.

87. Although provisional, the 2006 estimated tuna catch by species is as follows: skipjack – 164,326 mt; yellowfin – 113,397 mt; and bigeye – 29,471 mt. Estimates of annual bigeye and

yellowfin catches for the past years have been reported as a combined catch (yellowfin/bigeye tuna) but for 2005, the Bureau of Agricultural Statistics (BAS) began separating the catches of these two tuna species with assistance from the WCPFC. However, there is still a need to improve the identification of these two species to accurately reflect the actual catch of yellowfin and bigeye. It should also be noted that past statistics (before 2003) were under reported because the degree of cooperation from the private sector was not ideal, due to their lack of appreciation of the need for fisheries data in fisheries management. The recent cooperation of the fishing sector strengthened the data collection system, thus resulting in improved catch level estimates by the BAS. The recent increase in catch was in fact not the result of increased fishing effort, but was instead due to the cooperation of the fishing sector realizing the importance of accurate catch data for fisheries management.

88. The ongoing research activities of the National Stock Assessment Program (NSAP) and the WCPFC supported project — the Indonesia and Philippines Data Collection Project (IPDCP) — has ensured continuous coverage of key tuna landing centers, which collect data on species composition, length–frequency, and vessel catch and effort. The UNEP-GEF project, "Reversing Environmental Degradation Trends in South China Sea and Gulf of Thailand", initiates the establishment of fish refugia as a management tool in identified sites in the South China Sea to address the issue of growth overfishing and recruitment overfishing. This scheme will also be implemented in the Moro Gulf to mitigate the impact of growth overfishing in the tuna fisheries.

Samoa

89. Samoa's domestic tuna longline fishing fleet targets albacore and other tunas year round in Samoa's EEZ. The fleet consists of vessels ranging from 9 m to over 20 m in length. There were about 17 vessels engaged in longline fishing in 2004 and this increased to 54 in 2006. This is mostly attributed to the increasing number of alia boats in the fleet. An improvement in longline catches was noted in 2006 after a dramatic decline from 5,091.6 mt in 2002 to 2,845.9 mt in 2003. Albacore tuna is the main component of the catch and this species made up over 77% of the total longline catch from 2002 to 2006. Yellowfin and bigeye tuna constitute around 14.8% of the total catch as bycatch species. It is apparent from data collected that seasonal variation in albacore catches occurs in Samoa's EEZ. Annual estimates in longline catch rates indicate a general declining trend since the fishery came into existence, although catch rates have increased in 2005 and 2006.

90. A review of the current fisheries legislation has been initiated to ensure that Samoa's legal obligation under various regional and international arrangements are met.

91. Port sampling has continued to provide core data for estimates of Samoa's longline catch. Considering recent development in tuna fisheries data collection, the possibility of adopting the SPC-designed TUFMAN system is being investigated for compatibility with current local data collection methods.

Chinese Taipei

92. The three major tuna fisheries operating within the Convention Area are large tuna longline (LTLL), distant-water purse seine (DWPS), and small tuna longline (STLL). The total number of LTLL vessels in the Convention Area was 133 in 2005 but declined to 117 in 2006. Albacore, bigeye and yellowfin comprise the major catches of LTLL in the Convention Area. The albacore catch by the LTLL fishery in the South Pacific Ocean declined from 9,468 mt in 2005 to 6,365 mt in 2006, while the northern Pacific albacore catch was 3,848 mt in 2006. The bigeye

tuna catch in the WCPFC Convention Area declined from 10,083 mt in 2005 to 7,841 mt in 2006. The yellowfin tuna catch in this area declined from 5,755 mt in 2005 to 3,583 mt in 2006.

93. The total number of DWPS vessels in the Convention Area was 34 in 2006. The most dominant species from this fishery were skipjack, accounting for about 88% of the total catch, followed by yellowfin tuna 11%, and bigeye tuna 1%. In 2006, catches of skipjack, yellowfin and bigeye tunas were 189,392 mt, 19,793 mt and 987 mt, respectively.

94. The total number of STLL vessels in WCPFC Convention Area was 1,490 in 2006. The dominant species caught included yellowfin, bigeye and swordfish. The 2005 catches were yellowfin tuna 13,816 mt, bigeye tuna 5,415 mt, and swordfish 3,523 mt. Preliminary estimates for 2006 catches are yellowfin 15,071 mt, bigeye 6,454 mt, and swordfish 4,908 mt.

Tokelau

95. Tokelau is still developing its tuna management capacities. It currently has two staff members committed full time to commercial fisheries management. The tuna research and statistics needs are largely being met by SPC-OFP.

96. Offshore fishing over the past five years has been undertaken by foreign fishing purse-seine vessels of DWFNs and neighboring Pacific Island states, although the licensing of longline vessels began in 2007. A Forum Fisheries Agency (FFA) Vessel Monitoring System (VMS) was installed in 2004 which means that licensed foreign fishing vessels can now be monitored while within Tokelau waters.

97. The establishment of an Observer Programme has been proposed in the new drafted Fisheries Rules and its implementation is expected when the Rules are endorsed. The lack of infrastructure that allows transshipment to be carried out in Tokelau is a contributing factor to there being no port sampling coverage to date.

Tonga

98. The operation of Tonga's tuna longline fleet continued in 2006 in a similar manner as it did in 2005, but with fewer fishing vessels than those reported to the SC2. As in 2005, Tonga continued to operate its tuna fishery with a domestic longline fleet only, which mainly operated within Tonga’s EEZ.

99. The tuna fishery catch rate (CPUE), and total catch in quantity and value for 2006 continued to improve from 2004 and 2005 levels, but were still much lower than the highest catch level reached in 2001 (nearly 2000 mt). Albacore tuna continued to comprise the highest percentage of tuna composition in the total catch during 2006, with increasing percentages of bigeye and yellowfin tunas. Tuna catch compositions indicate that most longline vessels and the structure of the fleet are targeting bigeye and yellowfin tunas for the fresh fish market with a high proportion of albacore tuna.

100. SPC-OFP continued to provide Tonga Fisheries with relevant information about tuna stocks in Tongan waters relative to the WCPO stock as a whole. The total tuna catch by the Tongan fleet in 2006 still remains insignificant to have any major impact on the whole stock in the region and WCPO. Despite the ample room for improvement and development of tuna fleet in Tonga, high fuel costs have restricted fishing vessel operations mainly to areas near the main fishing port, Nuku’alofa.

101. Tonga Fisheries continue to improve tuna data collection (established few years ago) with assistance from SPC and FFA, and recently by the Commission. This includes increasing port sampling and observer coverage on domestic vessels using regional observer programme with same standard data collection and compulsory domestic VMS programme. At the same time, measures and resolutions of the Commission are being implemented and monitored by Tonga Fisheries.

Tuvalu

102. Exploitation of tuna resources by locals is relatively low and insignificant in terms of total harvest due to specific characteristics of the local fleet (refer to the Tuvalu Annual Report 2005). Nonetheless, data collection from such exploitation is ongoing and will remain a challenge to the fisheries department.

103. In 2006, 70 foreign fishing vessels were reported as having been actively fishing in Tuvaluan waters. The fleet comprises vessels from seven different countries, with the purse-seine fleet being the most dominant with 45 vessels (60%). The longline fleet (21 vessels) accounts for 30% of the entire fishing fleet, while the pole-and-line fleet has six vessels representing 10% of the total fleet. The size of the overall fleet has dropped by 37% from that observed in 2005.

104. The total catch for 2006 could not be accurately determined because catch data from pole-and-line vessels were not available at the time of writing. The combined purse-seine and longline catch was 14,141.33 mt. Of this, the purse-seine fleet accounted for 99%. There is a substantial increase (70%) in the catch from the purse-seine fleet from the previous year. For the longline fleet, a reduced total catch was noted (980 mt in 2005 compared with 7.33 mt in 2006). In terms of species, skipjack accounted for 87% of the total weight, followed by yellowfin 10%, bigeye 3% and other tuna species 0.02%.

105. Monitoring of fishing activities is being done through the VMS and the Observer Programme. Both programmes are regional initiatives. The observer coverage, however, is very limited and restricted to USA vessels only. The Tuvalu patrol boat executed six patrolling trips in 2006. No transshipment or other activities (associated) was being undertaken or reported in 2006. Improved rules and fisheries laws, governing all aspects of fishing (especially offshore fisheries) within Tuvalu's EEZ, are now in place following the adoption of the Marine Resources Act in 2006.

United States of America

106. US fisheries include large-scale purse-seine, longline, and distant-water troll fisheries operating on the high seas, within the USA's EEZ, and within the EEZs of other states. US fisheries also include small-scale troll, handline, pole-and-line and miscellaneous-gear fisheries operating in nearshore waters in the EEZs of American Samoa, the Commonwealth of the Northern Mariana Islands, Guam, and Hawaii. This report presents estimates of annual catches of tuna, billfish, and other highly migratory species (HMS), and vessel participation during 2002–2006. All statistics for 2006 are provisional. The purse-seine fishery was the largest US fishery, accounting for 79% of the total US catch of HMS in the WCPO during 2006. The longline, small-scale (troll, handline, pole-and-line, and miscellaneous gear) and distant-water troll fisheries accounted for 18%, 2.6%, and 0.7% of the total catch, respectively. These US fisheries for tunas, billfish and other pelagic species produced an estimated catch of 84,505 mt in 2006. The catch consisted primarily of skipjack tuna (65%), yellowfin tuna (12%) and bigeye tuna (11%). For the

most part, US estimates of catch by weight are actually landings due to lack of data on the weight of discarded fish. Data provided on longline catch in numbers of fish include both retained and discarded catch. Estimates of Hawaii-based longline interactions with non-fish species based on a very comprehensive domestic observer programme are also provided, along with data on fish discards from the purse-seine fishery.

107. The situation of US fisheries was mostly similar to that in 2005. The purse-seine catch decreased and the longline catch increased. The range of the Hawaii-based longline fishery contracted somewhat in 2006, and this was due to early curtailment of fishing for swordfish in order to limit captures of loggerhead sea turtles. The US distant-water troll fishery experienced a decline in participation and catch, with the number of active vessels in the WCPO declining to only eight vessels (only three in the North Pacific) in 2006.

Vanuatu

108. Vanuatu is a member of the regional fisheries management organizations (RFMOs), which includes the IATTC, ICCAT, IOTC and the WCPFC. Vanuatu's membership has enabled its fishing fleet to fish in the waters of these various RFMOs waters for tuna and other highly migratory fish species.

109. Vanuatu's fleet comprises 24 purse seiners, 55 longliners, and 3 pole-and-line fishing vessels. Catch and effort coverage for the Vanuatu fleet has been high but size data coverage are uncertain. In Vanuatu's EEZ, Fiji is the only foreign fleet with high catch and effort data coverage. In the period 2001–2006, annual catch estimates for Vanuatu's fleet have generally increased as did fishing effort (sets) and number of fish per 100 hooks. There were more sets on unassociated fishing schools than on associated schools. The purse-seine fleet's total catch has increased from 11,196 mt to 140,989 mt, and comprises 85% skipjack, 14% yellowfin and 2% bigeye. Unraised and provisional 2006 data show that catches of all major tuna species have increased to around 160,000 mt of skipjack, 20,000 mt yellowfin and 3,000 mt of bigeye harvested. Some of these purse-seine vessels (e.g. PNG) fished under the FSM Arrangement "home party" criteria, and therefore may have been included in the PNG-fleet catch statistics. The longline fleet catch was dominated by albacore (60%), followed by yellowfin (16%) and lastly by bigeye (10%). Unraised and provisional estimates for the longline fleet in 2005 were albacore 9,339 mt, bigeye 1,558 mt and yellowfin 936 mt, but if raised, could be higher. Data for Vanuatu's EEZ were based on unraised logsheet data. The foreign fleets operating in Vanuatu's EEZ were China, Fiji, Taiwan and Korea. The Taiwanese fleet has decreased in number, but the Chinese and Fijian fleets have increased rapidly, based on the number of licenses issued in 2005. However catch and effort distributions for 2006 are uncertain due to the late submission of operational data to SPC.

2.4 Reports from regional fisheries bodies and other organizations

110. The World Tuna Purse Seine Organization made a statement and no other report was presented from regional fisheries bodies and other organizations.

AGENDA ITEM 3 — Specialist Working Groups (SWGs)

3.1 SWG reports

Report of the Biology SWG

111. The Biology SWG (BI-SWG) met for half a day on 19 August. The meeting was convened by Chi-Lu Sun (Chinese Taipei). Five working papers and four information papers were submitted by participants. The five presentations covered research studies on age, growth, maturity, stock structure, behavior and movement. The full report of the BI-SWG is provided as Attachment G. Hitoshi Honda (Japan) was nominated as convener of the Biology SWG for next two years.

Report of the Ecosystem and Bycatch SWG

112. The Ecosystem and Bycatch SWG (EB-SWG) met all day on 16 August. The meeting was co-convened by Paul Dalzell (USA) and Peter Ward (Australia). Thirteen working papers and 17 information papers were submitted by participants, and representatives of the Agreement for the Conservation of Albatross and Petrels (ACAP) and Birdlife International. The 13 presentations covered research and analyses on ecological modeling and risk assessment, seabirds, sea turtles, pelagic sharks and bycatch-related work of observers. The EB-SWG provided advice to the SC for consideration under Agenda Item 5 (Bycatch Mitigation). The full report of the EB-SWG is provided as Attachment H.

Report of the Fishing Technology SWG

113. The Fishing Technology SWG (FT-SWG) met during the morning sessions of 17 August 2007, and was convened by David Itano (USA). Eight working papers and 11 information papers were submitted to the group in response to directives from the SC2 and the WCPFC. Nine papers were presented to the meeting, including studies on the biological, ecological or fishing efficiency related influences of FADs and floating objects on target and non-target species; improvements in targeting desirable catch and avoidance of small tunas; studies relating to the operational characterization of fleets, effort standardization and effective fishing effort; and information requirements for port sampling and observer programmes. Based on reviewed studies, the FT-SWG developed recommendations to the SC that supported the strengthening of collaborative links between scientists and the tuna industry to develop management solutions. An operational research plan for 2007/2008 and a medium-term work programme for the FT-SWG were developed and adopted by the meeting. These recommendations and work programme are included in the full report of the FT-SWG, which is provided as Attachment I to this report. David Itano was reappointed as convener of the FT-SWG.

Report of the Methods SWG

114. The Methods Specialist Working Group (ME-SWG) met during the morning session on Tuesday, 14 August and the afternoon session on Wednesday, 15 August. Robert Campbell (Australia) served as Convenor. Under the Terms of Reference for the ME-SWG this group will coordinate research and make recommendations to the SC on technical questions relating to analytical methods used for fishery management. A specific task of the ME-SWG was a review of research undertaken to address issues identified at WCPFC3 and SC2 as relevant to the ME-SWG. This included reviewing the changes and enhancements made to the MULTIFAN-CL (MFCL) model used for assessing principal target species in the WCPO, the sensitivity of model

outcomes to structural assumptions in the model, and research directed at improving the standardization of longline CPUE and the calculation of indices of stock abundance. The ME-SWG also reviewed the consultancy report on "A brief review of the use of the precautionary approach and the role of target and limit referenced points and management strategy evaluation in the management of highly migratory fish stocks". Seven working papers were presented to and reviewed by the meeting while two additional information papers were also noted. The full report of the ME-SWG is attached as Attachment J.

Report of the Statistics SWG

115. The Statistics SWG (ST-SWG) met for two hours on 13 August and for four hours on 17 August. An additional three hours were spent in informal drafting groups. Kim Duckworth (New Zealand) served as convener. The deliberations of the ST-SWG focused on:

a) addressing gaps in the data available to the Commission (three recommendations were agreed on);
b) revising the Commission's procedures documenting the scientific data to be provided to the Commission (one recommendation was agreed on);
c) revising the Commission's list of scientific objectives and priorities for data to be collected by the Regional Observer Programme (one recommendation was agreed on);
d) developing a minimum list of fields of scientific data to be collected by the Regional Observer Programme (one recommendation was agreed on);
e) revising the Commission's procedures for data confidentiality, security and dissemination (three recommendations were agreed on);
f) the scientific uses of unloadings data and catch/trade documentation scheme data (two recommendations were agreed on).

116. The full report of the ST-SWG is attached as Attachment K to this report. The appendices to the ST-SWG report include a proposed revised list of scientific objectives and priorities for data to be collected by the Regional Observer Programme, a proposed provisional minimum list of fields of scientific data to be collected by the Regional Observer Programme, and a proposed revision to the procedures documenting the scientific data to be provided to the Commission.

Report of the Stock Assessment SWG

117. The meeting of the Stock Assessment Specialist Working Group (SA-SWG) took place 14–15 August. Max Stocker (Canada) and Naozumi Miyabe (Japan) served as conveners of the meeting. Five working papers were presented to the SA-SWG, including the yellowfin tuna stock assessment, yellowfin and bigeye logsheet data analysis, multi-fishery management options, yellowfin recruitment-environment modeling, and bigeye and yellowfin area closure options. The yellowfin assessment represents an update of the assessment undertaken in 2006. The yellowfin assessment utilized MFCL, the standard stock assessment tool that has been applied to tuna and billfish stocks in the WCPO.

118. In 2007, no new assessments were conducted for bigeye, skipjack, south Pacific albacore, southwestern Pacific swordfish, or southwestern Pacific striped marlin. The SA-SWG reviewed and discussed the yellowfin stock assessment and provided advice to the SC for consideration under Agenda Item 4 (Status of the Stocks and Management Advice and Implications).

119. The SA-SWG discussed and identified short- to medium-term research items for Agenda Item 9 (Future Work Programme), and discussed responses to the Commission's requests. Participants of the working group accepted the nomination of Keith Bigelow and Naozumi

Miyabe as the co-conveners of the working group for the next two years. The full report of the SA-SWG is provided as Attachment L.

3.2 Adoption of the reports of the SWGs, including advice and recommendations

120. The SC adopted all SWG reports, including advice and recommendations.

AGENDA ITEM 4 — STATUS OF THE STOCKS AND MANAGEMENT ADVICE AND IMPLICATIONS

121. The Chair introduced Agenda Item 4, emphasizing that the SC is to base its scientific advice to the Commission on the output of the SWGs.

4.1 WCPO bigeye tuna

122. There was no stock assessment undertaken for bigeye tuna in 2007. The latest stock assessment for bigeye tuna is presented in SC2-SA-WP-2. Thus, the stock status description and management recommendations from SC2 are still current.

123. Several members noted the importance of conducting a new assessment next year.

4.2 WCPO yellowfin tuna

Status and trends

124. The 2007 stock assessment conclusions differ slightly from the 2006 assessment, particularly in relation to the $F_{current}/\widetilde{F}_{MSY}$ threshold, with the 2007 assessment being slightly more optimistic than the 2006 assessment. While the point estimate of $F_{current}/\widetilde{F}_{MSY}$ remains slightly less than 1 (0.95), the probability distribution associated with fishing mortality-based reference point indicates that there is almost an equal probability that the value of $F_{current}/\widetilde{F}_{MSY}$ is less than or greater than the reference point. Therefore, the possibility of overfishing is still relatively high (47%). The reference points that predict the status of the stock under equilibrium conditions are $\widetilde{B}_{F_{current}}/\widetilde{B}_{MSY}$ (1.10) and $S\widetilde{B}_{F_{current}}/S\widetilde{B}_{MSY}$ (1.12), which indicate that the long-term average biomass would remain slightly above the level capable of producing MSY at 2002–2005 average fishing mortality. Overall, current biomass exceeds the estimated biomass at MSY ($B_{current}/\widetilde{B}_{MSY}$ >1.0) (i.e. the yellowfin stock in the WCPO is not in an overfished state, although there is a small probability (6.2%) that it is in an overfished state) (Figs. 3 and 4). The change in the estimated MSY in 2007 from that in 2006 may reflect changes in the data structure, fishery designations and levels of uncertainty in the assessment, especially in estimating absolute values, and the change in the scenarios modeled between years.

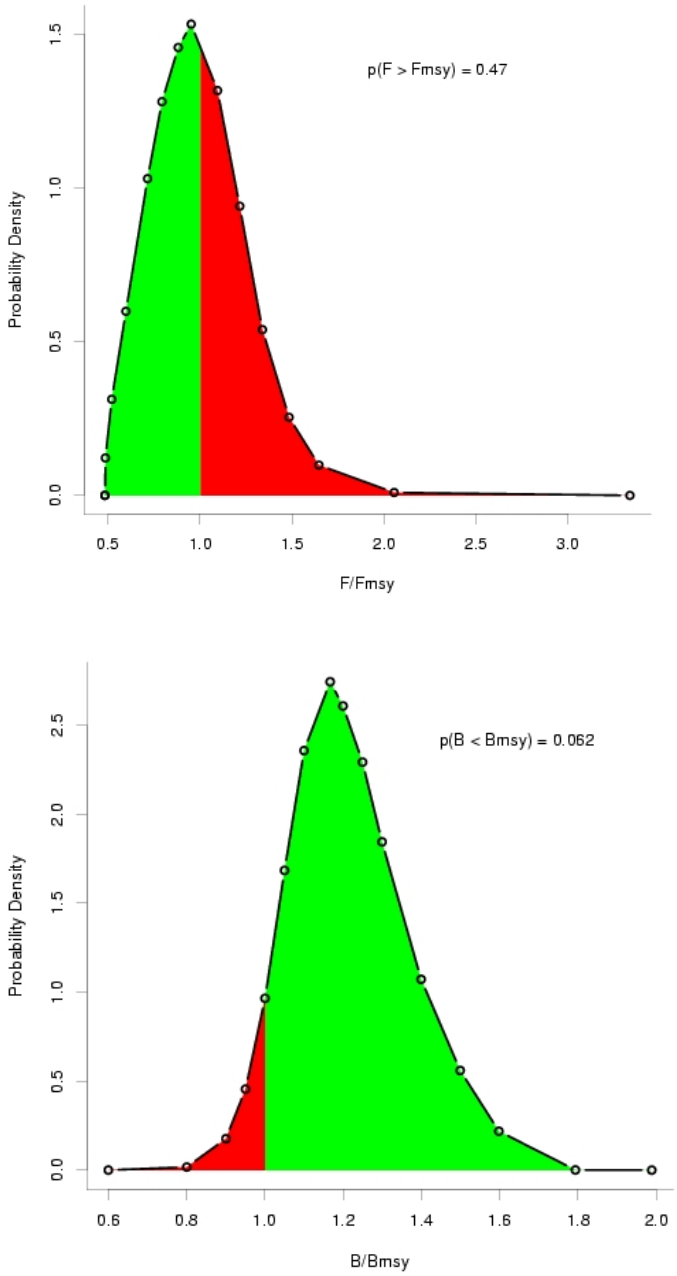

Figure 3. The probability of overfishing for yellowfin tuna occurring in the WCPO (upper panel) and the stock being overfished (lower panel).

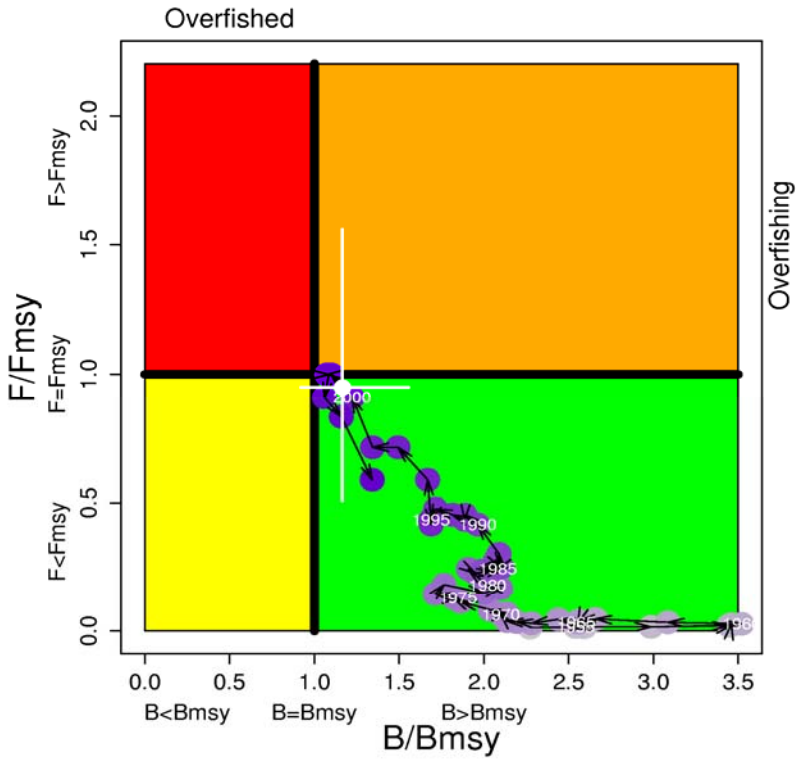

Figure 4. Temporal trend in annual stock status, relative to B_{MSY} (x-axis) and F_{MSY} (y-axis) reference points, for the model period (1952–2006). The color of the points is graduated from mauve (1952) to dark purple (2006) and the points are labeled at five-year intervals. The white point represents the reference points computed for the "current" period (2002–2005) and the white lines represent the associated 95% confidence intervals. (The color figure is attached at the end of the report.)

125. The attribution of depletion to various fisheries or groups of fisheries indicates that the Indonesian and Philippine domestic fisheries have the greatest impact, particularly in their home Region (3) and contribute significantly to the impact in adjacent Regions 1, 4 and 5 through fish movement. The purse-seine fishery also has a high impact in Regions 3 and 4 and accounts for a significant component (~40%) of the recent (2002–2005) impacts in all other regions, except region 6. It is notable that the composite longline fishery is responsible for biomass depletion of about 10% in the WCPO during recent years and generally catches larger, older size classes, while purse-seine fisheries are responsible for a larger percentage of the impacts and generally the catch consists of smaller and younger fish.

Management advice and implications

126. The point estimate of the $F_{current}/\tilde{F}_{MSY}$ ratio (0.95) in the 2007 assessment was lower than the point estimate (1.11) in the 2006 assessment, where "current" period is 2002–2005 for yellowfin stock assessment. This change is largely due to the new configuration of the fisheries, their updated size data, and the modeling improvements. However, the possibility of overfishing is still relatively high (47%).

127. The WCPO yellowfin tuna fishery can be considered to be fully exploited. Both the 2006 and 2007 assessments indicate that there is a high probability that overfishing is occurring (73%

for the base case 2006 assessment and 47% for the base case 2007 assessment). In order to reduce the likelihood of overfishing, and if the Commission wishes to maintain average biomass at levels greater than 5% above B_{MSY}, reductions in fishing mortality rate would be required (Fig. 5). The various levels of fishing mortality reduction required to maintain the biomass at specified levels above B_{MSY} (relative to the average levels for 2002–2005) are given in Figure 5.

128. Stock projections for 2007–2011 — which attempt to simulate the conservation and management measures adopted at WCPFC2 and WCPFC3 — indicate that the point estimate of $B_t/\widetilde{B}_{MSY}$ remains above 1.0 throughout the projection period. However, the increasing uncertainty in the future projections is likely to result in an increased probability of the biomass declining below $\widetilde{B}_{MSY}$ by the end of the projection period.

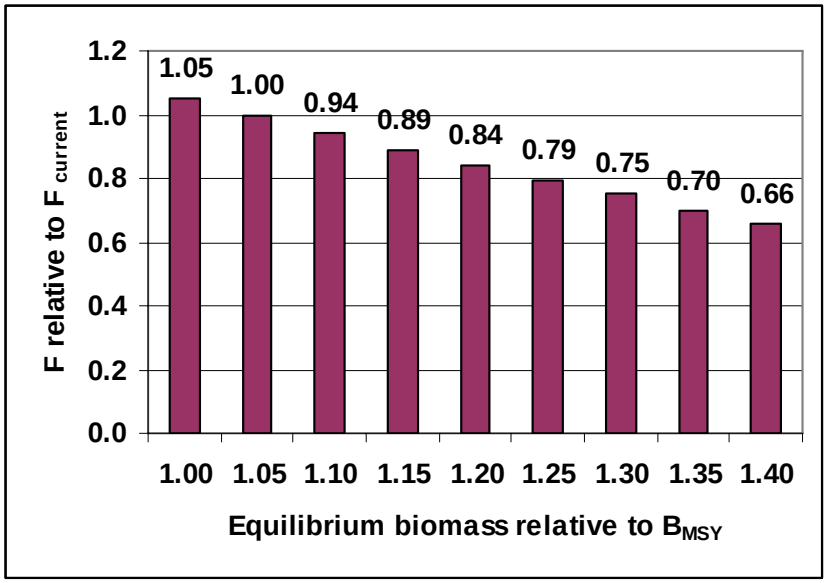

Figure 5. Estimates of the equilibrium level of fishing mortality (relative to current levels) required to sustain biomass at the indicated levels (relative to B_{MSY}).

4.3 WCPO skipjack tuna

129. No new assessment was conducted for skipjack in 2007. Thus, the stock status description and management recommendations from SC1 are still current.

4.4 South Pacific albacore

130. There was no stock assessment undertaken for South Pacific albacore in 2007. Thus, the stock status description and management recommendations from SC2 are still current.

131. It was noted as being interesting and strange that the situation for this species in the South Pacific is so different from that in the North Pacific, and it was suggested that work should be done to obtain more consistency in how the two stocks are assessed.

4.5 Southwestern Pacific swordfish

132. There was no stock assessment undertaken for southwestern Pacific swordfish in 2007. Thus, the stock status description and management recommendations from SC2 are still current.

4.6 Southwestern Pacific striped marlin

133. There was no stock assessment undertaken for southwestern Pacific striped marlin. Thus, the stock status description and management recommendations from SC2 are still current.

4.7–4.9 Northern stocks

134. The Chair introduced the ISC Chair and asked him to report on the recent work and findings of the ISC.

135. Gary Sakagawa, Chair of the ISC, introduced the report of the 7th meeting of the ISC (SC3-GN-IP-5) by noting that the full report, including the annexes, which contain data on the fisheries and results of analyses used in stock assessments, is available on the ISC website (www.ISC.ac.affrc.go.jp). He further noted that he would be briefing the SC on accomplishments for the year. His presentation would be followed by briefings on ISC stock assessments by key scientists who have worked on the assessments.

136. Gary Sakagawa reported that the ISC held its 7th meeting in Busan, Korea, 25–30 July 2007, to review progress with its work plan since its 6th meeting in 2006, and to provide guidance for work during the coming year. Progress for the year included organizing and completing eight working group workshops, completing two full stock assessments (albacore and striped marlin) and one updated stock assessment (Pacific bluefin tuna), reviewing plans for full stock assessments for Pacific bluefin tuna and swordfish by 2010 and completing a number of administrative tasks. For the coming year, the ISC provided conservation advice on albacore, striped marlin and Pacific bluefin tuna, and provided guidance for the working groups on issues to be addressed. It also adopted a number of actions to improve efficiency and governance, including: 1) merging the Swordfish Working Group and Marlin Working Group into one, the Billfish Working Group (BILLWG); 2) approving new Chairpersons for the BILLWG (Gerard DiNardo), Pacific Bluefin Tuna Working Group (Yukio Takeuchi), and Statistics Working Group (Naozumi Miyabe) for the 2007–2010 term; 3) electing Hitoshi Honda as Vice-Chair to serve out the remaining term of Jeong-Rak Koh, who resigned owing to a job change; 4) approving a tentative schedule for workshops to be held in 2007–2009; and 5) approving changes to the ISC charter and operating procedures.

North Pacific albacore

137. Max Stocker presented an overview of the North Pacific albacore stock assessment conducted in 2006, as well as the conservation advice provided by the ISC. The 2006 stock assessment was conducted with the VPA-2BOX model (VPA).

138. Spawning stock biomass (SSB) shows fluctuations around the modeled time series average (1966–2006) of 100,000 mt. The 2006 stock assessment indicated that SSB increased from 2002 (73,500 mt) to 2006 (153,300 mt) and is projected to increase to 165,800 mt in 2007. The increase is attributable to strong year classes in 2001 and 2003. The estimated spawning stock size in 2006 of 153,300 mt is approximately 53% above the overall time series average (1966–2005). Projections (2007–2020), using an average productivity of 27.75 million fish and F equal to 0.75, indicate that the SSB will reach equilibrium by 2015 at 92,600 mt (90% CI=62,700–129,300).

139. The population is being fished at roughly $F_{17\%}$ (i.e., $F_{2002\text{-}2004} = 0.75$). This result is similar to the 2004 assessment. $F_{current}$ (0.75) is high relative to commonly used F reference points. The Albacore WG expressed concern about the considerable decline in total albacore catch since 2002.

140. The conservation advice provided by the ISC for North Pacific albacore is as follows:

> "Previous scientific advice, based on the 2004 stock assessment, recommended that current fishing mortality rate (F) should not be increased. It was noted that management objectives for the IATTC and WCPFC are based on maintaining population levels which produce maximum sustainable yield. Due to updating, and improvements and refinements in data and models used in the 2006 stock assessment, it is now recognized that $F_{current}$ (0.75) is high relative to most of the F reference points (Table 1). On the other hand, the same analysis indicates that the current estimate of the SSB is the second highest in history but that keeping the current F would gradually reduce the SSB to the long-term average by the mid 2010s. Therefore, the recommendation of not increasing F from current level ($F_{current}$(2002–2004) = 0.75) is still valid. However, with the projection based on the continued current high F the fishing mortality rate will have to be reduced. The degree to which, when and how reductions should occur will depend on which reference points are selected and the desired probability and practicability of success of attaining these reference points in a time frame to be agreed. The ISC requires additional guidance on these issues from the management authorities in a timely manner to work further on these issues."

DISCUSSION

141. There was discussion about the relative sizes of, and possible competition among, the small-fish and large-fish fisheries for North Pacific albacore. It was noted that the surface fishery, targeting smaller fish, accounts for about 60% of the catch, compared with about 37% for the longline fishery, and that there appears to be little competition between them.

142. It was questioned, given the near-record high estimates of current SSB in the assessment while the fishing mortality rate was estimated to be quite high (0.75), whether any sensitivity analyses had been conducted to explore the apparent contradictory findings. It was explained by Max Stocker and Ray Conser that many model runs were made to explore different scenarios and intensive diagnostics were undertaken, including sensitivity analyses for the typical input parameters, such as growth, mortality and length-weight relationships. Regarding the apparent contradictory findings, it was explained that the results are robust. The high SSB is due primarily to two very strong year classes, in 2001 and 2003, which are entering the SSB at about age five.

143. It was asked whether the catch pattern reflects fishing effort over time or something else. Max Stocker responded that effort is dropping in some, but not all, components of the fishery. The Canada and US troll fleets, for example, have not fished much on the high seas in recent years because of high fuel costs.

144. It was asked whether, given the relative high estimates of recruitment in the period since 1986, stock projections based on the long-term average recruitment level might be overly pessimistic. Max Stocker affirmed that recruitment has indeed been relatively high since 1986,

with particularly strong years in 2001 and 2003, but assuming a continuing high level of fishing mortality, biomass is projected to decline from the current level.

Table 1. Results from equilibrium analysis of biological reference points (BRP) for North Pacific albacore associated with Model D1: (a) candidate target and limit reference points; (b) corresponding fishing mortality rates (F, yr-1); (c) current F (2002–2004) relative to target F or limit F reference points; (d) MSY proxy or equilibrium catch (1,000 mt); and (e) SSB_{MSY} proxy or equilibrium SSB (1,000 mt). The current F (0.75) reflects the fully-selected F (observed for age groups 8 and 9+) from the mean (geometric) of F-at-age estimates from 2002–2004. All catch and SSB estimates are based on the assumption of constant recruitment of 27.75 million fish per year. All SSB statistics are based on the assumption of a "May 1" reference spawning date.

Candidate Target Reference Points	Target *F* (yr^{-1})	Ratio of Current *F* to Target *F*	MSY Proxy (1,000 mt)	SSB_{MSY} Proxy (1,000 mt)
$F_{40\%}$	0.32	2.31	75	226
$F_{35\%}$	0.38	1.97	79	198
$F_{0.1}$	0.45	1.68	83	171
$F_{30\%}$	0.45	1.67	83	169
Candidate Limit Reference Points	**Limit *F* (yr^{-1})**	**Ratio of Current *F* to Limit *F***	**Equilibrium Catch (1,000 mt)**	**Equilibrium *SSB* (1,000 mt)**
$F_{20\%}$	0.65	1.16	91	113
F_{Max}	2.07	0.36	100	10
$F_{SSB\text{-}Min}$	0.81	0.93	94	83
$F_{SSB\text{-}10\%}$	0.70	1.07	92	102
$F_{SSB\text{-}25\%}$	0.66	1.14	91	110

THIS IS A COPY OF TABLE 5A, FROM ANNEX 5, REPORT OF ISC7 (SC3-GN-IP-5)

145. There was discussion about incorporating tagging data into the stock assessments, and it was explained that ISC's Working Group had reviewed the data and intended to include them in future assessments.

Pacific bluefin tuna

146. On behalf of Yukio Takeuchi, Naozumi Miyabe provided the summarized activities of the ISC Pacific Bluefin Tuna Working Group (PBFWG) during 2006–2007. The total catch for this species indicates considerable fluctuation in the past between 8,500 mt in 1990 and 38,000 mt in 1956. Recent catches are relatively higher, and the average for the past five years was 22,300 mt. During the same period, Japan's catch accounted for 40–60% of the total catch, followed by Mexico and Korea. US catches have declined to a negligible level. The last

assessment was conducted in January 2006, with the application of VPA. The assessment results indicate unresolved inconsistencies between the observed and predicted abundance indices as well as uncertainties observed in the growth for older fish. Because of these problems, the ISC instructed the PBFWG to re-assess the PBF stock in 2008.

147. In order to meet this schedule, a data preparatory meeting was held in May 2007, and comprehensive data reviews for various fisheries, mostly in the western Pacific, including the excavation of old Japanese data (1895–1950), were conducted. WG members promoted biological studies, in particular, the growth of older fish and data review for various fisheries. Extensive sampling of otolith from large fish (>180 cm FL) has begun in several domestic ports in Japan and in Tong Kan port in Taiwan. The latter sampling has been done jointly with colleagues in Chinese Taipei.

148. Another meeting was held just before the ISC plenary meeting in July 2007 in Korea. In this meeting, fishery information with regards to the strength of the 2001 year class (which would have consisted of the major part of adult stock) was investigated using the available size data. Unfortunately, the recruitment of the 2001 year class to the longline catches was not confirmed yet as observed for the 1994 year class, which was considered to be the strongest year class ever. Therefore, the future prospect of this stock appears to be less optimistic, though it was considered premature to draw any conclusion on this point.

149. The ISC plenary kept the same management advice as last year, that is, "Noting the uncertainty in the assessments, the ISC plenary agreed with the WG recommendation that bluefin tuna fishing mortality should not be increased above recent levels as a precautionary measure."

150. The PBFWG will hold another data preparatory meeting in December 2007 in final preparation for the next assessment, scheduled in May 2008.

DISCUSSION

151. The stock structure and migratory patterns of the stock were discussed, with questions raised about the proportion of the stock that migrates from the western Pacific to the eastern Pacific, and the vulnerability of such migrants to the Mexican fishery. Naozumi Miyabe, Gary Sakagawa and Ray Conser explained that there is one population in the Pacific. Spawning occurs on the western side, juveniles travel to the eastern side, and some return to the western side. Attempts have been made, and will continue to be made, to incorporate tagging data into the assessment, but their utility appears to be limited because of the lack of large numbers of tag returns within relatively short periods and because of the difficulty in estimating reporting rates. Consequently, it is expected, for both Pacific bluefin tuna and North Pacific albacore, that tagging information will play a key role outside, but not within, the assessment models.

152. It was noted that catches by some nations have increased recently, and that the recent annual catches by Mexico in its Baja fishery for farming — cited by the IATTC to be 11,000 mt in 2006 but only 4,000 mt thus far this year and quite variable from year to year — constitute a dramatic increase. It was also noted that that the fishery takes a wide variety of fish sizes, including relatively small fish, which is a concern with respect to stock status.

North Pacific striped marlin

153. Jon Brodziak presented an overview of the ISC Billfish Working Group's North Pacific striped marlin (*Tetrapturus audax*) stock assessment. The 2007 stock assessment was conducted

using the Stock Synthesis 2 model. Two assessment model scenarios were developed to bound the uncertainty in the steepness of the stock recruitment relationship; these were the maternal effect scenario in which recruitment is governed by a Beverton-Holt stock-recruitment curve (steepness h=0.7) and the environmentally driven recruitment scenario in which recruitment varies about its mean (h=1.0). Yield- and spawning biomass-per recruit biological reference points and stock projections at $F_{40\%}$, $F_{20\%}$ and $F_{current}$ fishing mortality rates were calculated using the YPR and AGEPRO modules of the NOAA Fisheries Toolbox (http://nft.nefsc.noaa.gov/).

154. Spawning biomass has declined from around 40,000 mt in the early 1970s to about 5,000 mt in the early 2000s. Spawning biomass in 2003 was estimated to be 14–15% of the 1970 level, depending on model scenario. Recruitment estimates also exhibited a long-term decline since the 1970s. Recent average recruitment (1996–2003) is roughly one-half of the long-term average (1965–2003) under both model scenarios. Stock projections from 2004 through 2009 based on re-sampling the distribution of recent average recruitment indicate that both spawning biomass and landings will continue to decline if the current fishing mortality rate (average of F_{2001}-F_{2003}) is maintained, regardless of model scenario.

155. Fishing mortality has increased more than three-fold, from roughly F=0.20 in the early 1970s to over F=0.6 in the early 2000s. The current fishing mortality rate exceeds the $F_{20\%}$ reference point by roughly 60% under both model scenarios. It was also noted that the current fishing mortality rate corresponds to maintaining only 9% of maximum spawning potential ($F_{9\%}$). The Billfish WG expressed concern that current catches are at record low levels.

156. The conservation advice for the North Pacific striped marlin stock from the ISC is as follows: "While further guidance from the management authority is necessary, including guidance on reference points and the desirable degree of reduction, the fishing mortality rate of striped marlin (which can be converted into effort or catch in management) should be reduced from the current level (2003 or before), taking into consideration various factors associated with this species and its fishery. Until appropriate measures in this regard are taken, the fishing mortality rate should not be increased."

DISCUSSION

157. A question was raised about the apparent lack of data for the Japanese longline fishery in Region 5 used in the model (in the EPO). It was explained that effort in that fishery has declined, and that as a result, the CPUE standardization approach could not be used for that fishery. The ISC Billfish WG, did, however, examine that fishery's CPUE by correlation with CPUE in other areas, and found it to be flat or declining. Region 5 is a spawning area and there may be an affinity of larger animals to that area.

158. There was discussion about the habitats and depths inhabited by striped marlin with respect to which fisheries encounter them, and it was noted that most striped marlin are taken incidentally, although in the 1960s there was some directed fishing in Region 5 (in the EPO). It was noted that ways to mitigate catches of striped marlin should be developed and encouraged.

159. There was discussion about the estimate of age-at-maturity used in the model, which was noted as being high to published estimates. It was explained that the knife-edge estimate was based on more than 20 years' worth of data collected in the North Pacific, that some sensitivity analyses were conducted, and that the ISC's Billfish WG identified an urgent need for further age and growth studies.

160. It was noted that since most striped marlin is caught incidentally, developing indices of abundance is difficult. To address those difficulties, the fisheries were divided into two time periods because of shifts in fishing practices and selectivity. The data were also truncated at 1975, and the model was found to be robust with respect to these changes, as well as different model platforms — a long-term decline in biomass was observed in all cases. In the case of the Hawaiian fishery, the index was based on detailed observer data, including detailed information on the time of year, time of day, and location. Nevertheless, room for improvement in the model was acknowledged. It was noted that if the same indices of abundance are used in all the modeling platforms, similar results among all them would be expected; accurate indices are important. It was emphasized that three new CPUE indices were introduced for the period since 1990s, and that all three showed the same declining trend, which was acknowledged as a worrying trend.

North Pacific swordfish

161. Gary Sakagawa provided a brief update on the ISC's work on North Pacific swordfish, noting a plan to complete a full assessment by 2010 and a plan to hold a session at the World Fisheries Congress in Yokohama in October 2007, to be spearheaded by Gerard DiNardo, to address the issue of stock structure.

162. Gary Sakagawa concluded the ISC's presentation by noting that the schedule of future ISC meetings is in the information paper provided to the SC. The next ISC plenary meeting is scheduled for 23–28 July 2008, in either Chinese Taipei or Japan. All are invited to attend. Interested participants should contact the ISC. The ISC website provides more information.

Management advice and implications

163. The Chair initiated a discussion as to how the plenary wanted to treat the information from the ISC and what it wanted to provide to the Commission. It was agreed that the Scientific Committee would acknowledge with appreciation the work of the ISC and not add or detract from its recommendations. However, it was noted by New Zealand that it viewed the ISC's recommendations with some concern because the Scientific Committee was not fully informed about the structure of the models.

Inclusion of North Pacific striped marlin as a northern stock

164. The Chair introduced the issue of whether striped marlin in the North Pacific should be included among the northern stocks, noting that the Northern Committee had proposed such inclusion last year, but in accordance with the Commission's Rules of Procedure, the Commission had tasked the SC with providing a recommendation on the issue. Secretariat Working Paper SC3-GN-WP-3 was referred to for background and relevant information.

DISCUSSION

165. The plenary discussed the standard to be used in determining whether to include a given stock as a northern stock, and it was acknowledged that under the provisions of the Convention, the stock must lie mostly north of 20°N. The information provided in SC3-GN-WP-3 was limited to catch information, and the information presented regarding the ISC's recent stock assessment did not address the spatial distribution of biomass, so it was difficult to evaluate from that information alone whether the stock biomass lies mostly north of 20°N. The members were queried as to whether further information might be made available during the course of the

plenary, but none was provided. It was agreed that given the available information, the SC could not recommend that striped marlin in the North Pacific be considered a northern stock. The Chair of the ISC noted that the ISC is likely to review further information when it meets next year and will provide any relevant information to the SC next year.

4.10 Other stock assessment and management-related matters

Review of reference points

166. The Chair asked Ray Conser to introduce the topic of reference points. Ray Conser referred to SC3-ME-WP-3, "A brief review of the use of the precautionary approach and the role of target and limit reference points and Management Strategy Evaluation (MSE) in the management of highly migratory fish stocks" by Campbell Davies and Tom Polacheck. The review was commissioned by the Commission. Ray Conser also referred to the deliberations from the previous week of the Informal Small Group on reference points. He explained that there was broad representation and good expertise in the group. The group developed a list of key discussion points for the purpose of informing the deliberations of the Methods SWG and the SC plenary, which tended to fall in three categories: science issues, management issues, and interaction among scientists and managers.

167. Ray Campbell presented the main points discussed by the Methods SWG in its review of SC3-ME-WP-3 and its conclusions of the issue (Section 5, Attachment J).

168. Discussion of the issue focused on:

a) the degree of transparency in commissioning the study that produced SC3-ME-WP-3;
b) the relative importance of, and the difficulties in incorporating, socioeconomic factors in a management strategy evaluation (MSE), with agreement that such factors are important and should be incorporated;
c) the importance of ultimately addressing in an MSE the multi-gear, multi-species, and multi-fleet nature of the fisheries under the purview of the Commission;
d) acknowledgment that development of an MSE will be a complex and demanding process, and that the work plan should be structured so as to facilitate the participation of participating territories and developing states; and
e) the next steps to be taken by the Commission, with general agreement that developing a scoping paper and a draft work plan would be useful.

169. As requested by WCPFC3, the SC reviewed the report on alternative stock status reference points requested by SC2 and made the following recommendations and statements in relation to reference points:

a) A future work programme should be commenced to guide the WCPFC on appropriate reference points and the implementation of the precautionary approach in the management of the WCPF.
b) The primary component of a future work programme should be the specification of limit and target reference points for target stocks, with agreed decision rules (i.e. management strategies) and, if feasible, the development of a simulation environment for their evaluation by MSE.
c) The work programme should facilitate the participation of all CCMs including developing states and territories.
d) In noting the fact that the development of decisions rules, which have been adequately evaluated using the MSE approach, will take some time to complete (at least three to five years) and that decisions on the management of the fisheries are

likely to be required during this period, the Commission should develop and adopt interim decision rules and reference points for management action, based on the provisions of the Convention including its incorporation of Annex II of the UN Fish Stock Agreement.

e) The science provider should examine the sensitivity of the management advice, arrived at using the current combination of reference points and assessment methods, to the uncertainties in the assessment inputs and the underlying model uncertainty. This would provide the SC and the Commission with a more comprehensive understanding of the full range of uncertainty in the current estimates of stock status and sustainability of the current levels of fishing, as well as a more informed basis for constructing the operating model that will be required in the MSE context.

f) There is a critical need to ensure that fishery data collection, monitoring (i.e. the use of observers) and verification, which are integral parts of the precautionary approach, are a central to part of any work plan. In addition, it is essential that the basic information requirements for providing meaningful management advice are addressed through research and fishery independent data (e.g. tagging).

170. As a means of progressing a future work programme, the SC made the following recommendations to the Commission:

a) A scoping paper, and draft work plan should be developed over the next year to inform both the SC and the Commission on the potential costs, benefits and difficulties of alternative approaches for identification of appropriate reference points (e.g. MSE) within the WCPO.

b) The scoping paper should include the technical and organizational issues, and any associated difficulties related to undertaking an MSE in the WCPO, and should also include identifying the use of interim management strategies (including reference points and decision rules) while a full MSE is underway. The external consultancy report (SC3-ME-WP-3) along with the report of the informal small group on biological reference points (SC3-ISG-WP-5) should serve as a foundation for developing the scoping paper and draft work plan.

c) A presentation of SC3-ME-WP-3 should be made to the upcoming Commission meeting to inform the Commission about the use of reference points (and approaches of evaluating them) in the management of highly migratory fish stocks in the WCPO.

171. With respect to recommendation 3 on the presentation to be made to the Commission, it was asked who is likely to make the presentation to the Commission. Robert Campbell responded that it would likely be one of the co-authors of SC3-ME-WP-3, most likely Campbell Davies. Japan expressed concern about having an individual that works for the government of a particular member of the Commission making the presentation. The Executive Director explained that there are no Commission rules that would prohibit this, and that it is commonplace for the Commission to make use of the resources available from among its members. Nonetheless, Japan asked the SC to take note of its concern.

172. In consideration of the arrangements for developing the scoping paper, the SC suggested that this would be best progressed through convening an intersessional meeting of technical experts that would be charged with drafting the scoping paper and draft work plan, which would then be reviewed by SC4 before making a future recommendation to the Commission.

173. At the same time, the SC reaffirmed the importance of transparency and fairness in the process, including the opportunity for participation by all CCMs.

174. Japanese statement at the presentation of the Methods SWG report:

"Japan felt some dissatisfaction in adopting the Draft Report of SWG on Methods, we expressed our concern over the issue of biological reference point. We are still very much concerned on the procedures by which this issue was to be carried out for the sake of transparent and solid scientific development of the Scientific Committee as well as the Commission. In particular, Japan was unaware that a contract was made to make the study on the biological reference point. Japan was surprised and dismayed that the study used Commission's budget focused mainly on the promotion of MSE rather than on its major tasks on the investigation of biological reference point(s). Japan feels it is not a good practice that active government experts of certain members were selected by the Secretariat as independent experts, in light of neutrality of its position highlighted in the paper. In future, we request that such lack of communication should not be repeated. When the Secretariat takes any actions on behalf of the Commission or the Scientific Committee on the scientific matters, which significantly affect on the future direction of the Commission (such as the issues relating to the reference points), those should be well informed to the members in advance. Japan also believes that several items referred in the discussion were out of full mandate of the Scientific Committee and therefore do not preclude the result of the discussion at TTC and the Commission pertaining to these items."

175. Statement made by Tonga, on behalf of FFA members:

"Mr Chairman, FFA members support the general approach to the application of the precautionary approach, reference points and MSE set out in the consultancy paper. We also support the preparation of a scoping paper with a draft work plan on reference points and MSE as proposed by the Methods Working Group. We expect that this paper should be presented to the Scientific Committee next year. We have three major comments on the content of the scoping paper. The first is the need for the reference point and MSE process to address multi-species, multi-gear aspects because decision-making in the WCPO ultimately has to deal with trade-offs among areas, fleets and species. We understand that the work may need to begin in a simpler way with a focus on single species. That may provide insights into some technical, research-oriented issues such as exploring uncertainty or planning data collection and assessments. But if MSE is going to be used to inform management decision-making, then it will ultimately have to address multi-species aspects. The second is the issue of effective participation in this work by developing states and territories. Many smaller CCMs are already challenged to find the resources necessary to participate in Commission activities. The MSE process is complex and demanding, and it will take careful planning to ensure effective participation and commitment from developing states and territories in MSE work. For this reason, it is important that the proposed work-plan for MSE should include a structured process for participation by resource-owning developing states and territories. The third is the issue of socio-economic considerations. We understand the complexity of including socio-economic considerations, and the approach proposed by the Methods Working Group to incorporate these considerations in terms of elements such as catch levels, catch rates and catch stability. It will take careful thought to ensure that the model design

provides catch information in a way that enables an appropriate level of consideration of socio-economic considerations."

Information flow of northern stocks

176. The Chair noted that the Commission has a connection with the ISC through an MOU, but that there are concerns about the potential for duplicative work between the ISC and the SC.

177. The Executive Director referred to Information Paper SC3-GN-IP-2, which was produced in response to this issue, noting that it was apparent at SC2 that there were different levels of understanding of the relationship between ISC and the SC and the Commission. Several options on the information flow from the ISC were identified, all involving different degrees of involvement on the part of the SC in the ISC's stock assessments. The Executive Director suggested that the information paper be made available to the independent reviewers of the science structure and function.

178. Gary Sakagawa, ISC Chair, reported that at the 7th meeting of the ISC, in July 2007 in Busan, South Korea, SungKwon Soh, WCPFC Science Manager, presented the Secretariat's information paper on the subject (SC3-GN-IP-2). A fourth option was suggested at the ISC meeting in which the SC would designate someone to attend the workshops of the ISC's working groups. That individual would be the SC representative and would keep the SC informed of the results of the work that was done or to call for further review by the SC. That would give the SC a trusted individual (or individuals) to follow the work of the ISC. The ISC Chair explained that each working group conducts workshops over a period of several years before producing a full assessment, and that it was an intensive process designed to obtain all the relevant information. Page 15 of the ISC7 meeting report (SC3-GN-IP-5) can be referred to for further information.

DISCUSSION

179. The Chair asked the plenary how information from the ISC could best be delivered to the Commission and its subsidiary bodies while avoiding duplicative work, noting the options identified in the information paper, as well as the additional option raised in the ISC.

180. Some members stated that the independent review of the Commission's science structure and function, yet to be discussed in this plenary, is relevant to this issue, and that it should be discussed then. The importance of the independence of the review was emphasized. It was noted that the issue should be discussed in the context of the structure of the Commission as a whole, and that the options identified in the information paper and by the ISC are not exhaustive — the independent review should not be limited to examining those options.

181. The Chair introduced two new agenda items, 4.10.c, on discards of albacore, bigeye and yellowfin in the WCPO longline fishery, and 4.10.d, on catch levels of bigeye and yellowfin in other commercial fisheries. The discussion of both items focused on text from the report of the ST-SWG.

Discards of albacore, bigeye and yellowfin in the WCPO longline fishery

182. Discards by longliners in the WCPFC Statistical Area[1] during 1994–2005 were estimated with the predicted discard rates from observer data and presented in Table 13 in SC3-ST-IP-2.

[1] TheWCPFC Statistical Area is defined in Attachmetn K, Appendix 4, paragraph 8.

The total discard rate in weight for the three target tuna species during the period was 3.6% but the reliability is low due to the low observer coverage rates (0.7%).

183. Discards by purse seiners in the WCPFC Statistical Area, from 20°S to 20°N and excluding the domestic fisheries of Indonesia and the Philippines, during 1995–2005 were estimated from observer data and presented in Table 14 in SC3-ST-IP-2. The total discard rate for the three target tuna species during the period was 4.4%. Reliability in the purse-seine fishery is higher than the longline fishery due to higher observer coverage rates (5.6 %). In comparison, the total discard rate for the purse-seine fleet in the EPO during the same period was 5.3%.

184. Discussion on this topic focused on the degree of detail that should be provided to the Commission on: 1) the reasons for discards, 2) the variability in discard rates among fleets and the relationship between those rates and fishing practices, and 3) the reliability of the discard estimates, particularly given their reliance on observer data and varying degrees of observer coverage among fleets.

Catch level of bigeye and yellowfin in other commercial fisheries

185. The average catch level (2001–2004) of bigeye in commercial fisheries other than longline and tropical purse seine is 16% of the catch in the WCPFC Statistical Area (SC3-ST-IP-4). The average catch level (2001–2004) of yellowfin in commercial fisheries other than longline and tropical purse seine is 37% of the catch in the WCPFC Statistical Area.

AGENDA ITEM 5 — BYCATCH MITIGATION

5.1 Seabirds

186. The Chair reviewed actions required by the Commission in relation to CMM-2006-02, which requires the SC to annually review any current information on new or existing mitigation measures. Where necessary, an updated suite of mitigation measures, specifications for mitigation measures, or recommendations for areas of application, are to be provided to the Commission for its consideration and review as appropriate. The SC is also required to estimate seabird mortality in all fisheries to which the WCPF Convention applies in light of information provided by CCMs and from observer and other monitoring programmes.

187. The SC reviewed the scientific information available to it and decided that at this time there was no need to amend the suite of mitigation measures, or to make changes to the area of application listed in CMM-2006-02.

188. With regard to the technical specifications for mitigation measures, differing views were expressed by SC members on some specifications and complete agreement could not be reached. There was vigorous debate as to whether the technical specifications should include operational considerations such as weather and oceanic conditions. No agreement was reached by the SC on this matter, and it should be considered by the TCC.

189. The following list of specifications reflects the product of these discussions, including the differing views expressed by SC members.

Proposed technical specifications for seabird bycatch mitigation measures

190. The SC adopted the following proposals (areas of non-agreement in square brackets were proposed by Japan and supported by China and Chinese Taipei but could not be endorsed by the SC because of insufficient scientific data).

1a) Tori lines:

- Minimum length: 100 m (if weather and ocean conditions permit).
- Must be attached to the vessel such that it is suspended from a point that is a minimum of 5 m above the water at the stern on the windward side of the point where the hookline enters the water.
- Must be attached so that the aerial extent is maintained over the sinking baited hooks.
- Streamers must be less than 5 m apart, and should use swivels and be long enough so that they are as close to the water as possible.
- [If the tori line is less than 150 m in length, it must have a towed object attached to the end that will create enough drag to meet the 90 m coverage requirement][2]
- If two (i.e. paired) tori lines are used, the two lines must be deployed on opposing sides of the main line.

1b) Tori line (light streamer): [Recognizing that the technical approaches used in this measure are currently used in some regions but that little data were presented on vessel size, sink rates and setting speeds for evaluation, this measure is to be applied on a trial basis for one year, to be reviewed and given full consideration at the next meeting of the SC.]

- [Minimum length of tori line: 100 m or three times the total length of the vessel, if weather and ocean conditions permit].
- [Light-weight streamers (e.g. polypropylene band)].
- [Streamers must be less than 1 m apart and be a minimum of 30 cm in length].
- [Must be deployed so that the aerial extent is maintained over the sinking baited hooks.]

2) Side setting with bird curtain and weighted branch lines:

- Mainline deployed from port or starboard side as far from stern as practicable (at least 1 m), and if mainline shooter is used, must be mounted at least 1 m forward of the stern.
- When seabirds are present the gear must ensure that the mainline is deployed slack so that baited hooks remain submerged.
- Bird curtain must be employed, and should have the following components:
  - pole is aft of the line shooter and is at least 3 m long;
  - A minimum of three main streamers attached to the upper 2 m of the pole;
  - the main streamer diameter should be a minimum of 20 mm;
  - branch streamers attached to the end of each main streamer should be long enough to drag on the water (i.e. no wind present) and have a minimum diameter of 10 mm.

3) Night setting:

- No setting between local sunrise and one hour after local sunset; and

[2] This and other text in brackets within the report indicates issues that have not been agreed on or resolved.

- Deck lighting to be kept to a minimum, noting requirements for safety and navigation.

4) Weighted branchlines:
[The following weight specifications are encouraged:]
   - Minimum weights attached to all branch lines is 45 g, with the following options:
     - less than 60 g weight attached to within 1 m of the hook or;
     - more than 60 g and less than 98 g weight attached to within 3.5 m of the hook or;
     - more than 98 g weight attached to within 4 m of the hook; or
     - minimum weights attached to all branch lines is 45 g, with the following options
   - [more than total 300 g of lead core line.]

Guidelines for Column B mitigation measures

1) Weighted branchlines:
The following weight specifications are encouraged:
Minimum weights attached to all branch lines is 45 g;
   - less than 60 g weight attached within 1 m of the hook;
   - more than 60 g and less than 98 g weight attached to within 3.5 m of the hook;
   - more than 98 g weight attached to within 4 m of the hook; or
   - [more than total 300 g of lead core line.]

2) Blue-dyed bait:
   - The Commission Secretariat shall distribute a standardized color placard.
   - All bait must be dyed to the shade shown on the placard.

3) Management of offal discharge:
   - Either:
     - No offal discharge during setting or hauling; or
     - Strategic offal discharge from the opposite side of the boat to setting/hauling in order to actively encourage birds away from baited hooks.

191. The SC noted it would review this issue at its next meeting and reminded CCMs, as they implement CMM-2006-02 next year, to provide information to the Commission on the specifications of the mitigation measures that they will require their vessels to employ, as well as any data resulting from research undertaken to further develop and refine measures to mitigate seabird bycatch as required by the CMM.

192. The SC considered the requirement of CMM-2006-02 for estimates of seabird interactions and bycatch in the Convention Area. The SC noted that this was a complex task, requiring representative observer coverage, fine-scale distribution of the seabird populations and frequency and interactions between seabirds and fisheries. The SC reaffirmed that seabird mortality estimates would need to be addressed through the 2008–2010 work programme. The Secretariat should be requested to obtain the available estimates of seabird population sizes and trends for the next meeting of the SC. The Secretariat is also requested to include a summary of seabird catch reporting in its coverage of data gaps. Several CCMs reminded the SC that current observer coverage is less than 1% in the longline fisheries and that this seriously compromises the ability to assess wider ecosystem impacts.

5.2 Sharks

Review of CMM-2006-05

193. The Chair reviewed action required by the Commission in relation to CMM-2006-05, which requires the SC to provide advice on the implementation and effectiveness of this measure, on any alternative measures applied under paragraph 11 of the measure, and the application of any additional measures for the management of shark stocks in the Convention Area, as appropriate.

Fin-to-weight ratios

194. The SC generally considered that the average 5% fin-to-carcass ratio was reasonable, given the variations in species composition, size and processing methods. Issues were noted concerning how much of the shark carcass was processed at sea prior to landing and whether undressed carcasses could be processed on landing. There was also discussion about the range of fisheries included in the review presented by Australia and if the fin-to-carcass ratio was influenced by the type of fishery catching sharks and the area of fishing (i.e. tropics vs sub-tropics/temperate waters). There were also some comments on cultural issues surrounding shark finning, and that the Commission should adopt a ratio that is suitable for this Convention Area and not just because it is used by other RFMOs.

Identification of key shark species for annual reporting to the Commission

195. The SC is required to recommend to the Commission the key shark species that CCMs will be required to report on annually to the Commission, and to provide a dedicated shark research programme to support stock assessment of shark species that rank highly in the ERA, in cooperation with other RFMOs. Alternative methods of analysis other than stock assessment were also to be explored.

196. The SC noted that it was important that information on the catch of all shark species be collected. These data are necessary to enable risk assessments and stock assessments to be undertaken and provision of advice to the Commission. If catch data are collected only on the most abundant species, this will be biased towards the more productive species and potentially miss the less productive species that may be at higher risk.

197. The SC recommended that observer programmes should collect information on the catch of all species of sharks, both retained and discarded, to the lowest possible taxonomic level. This information should be provided in the annual reporting to the Commission.

198. It is noted that the WCPFC has obligations to collect data for the management of the oceanic shark taxa defined in the Convention. The Convention defines highly migratory species through reference to Annex 1 of UNCLOS, but the SC noted that several of the species listed there did not occur in the Convention Area. It is likely that the list of shark species (Table 2) that have been observed to be caught in WCPO longline and purse-seine fisheries will increase as observer data increases across the Convention Area.

199. The SC noted that it may not immediately be possible to collect and report data to the species level shown in Table 2. The SC therefore suggested that CCMs may report sharks at the genus or family level, provided that they are implementing a national plan of action (NPOA) that

provides for the identification and reporting of the species composition of their shark catches. The WCPFC will distribute appropriate guidelines and identification guides to assist CCMs in providing data on their shark catches (such as SC3-FT-IP-6 and SC2-FT-IP-3).

Table 2. Species of sharks and rays reported by observers to be caught in WCPO longline or purse-seine fisheries (source: observer data held by SPC).

Common name	Scientific name	Code	Annex 1[1]	Longline		Purse seine		IUCN status
				Recorded	Number	Recorded	Number	
Basking shark	*Cetorhinus maximus*	BSK	YES	YES	138		0	YES[#]
Bigeye thresher	*Alopias superciliosus*	BTH	YES	YES	2,445	YES	3	*
Bignose shark	*Carcharhinus altimus*	CCA	YES	YES	27		0	*
Blacktip reef shark	*Carcharhinus melanopterus*	BLR	YES	YES	344		0	
Blacktip shark	*Carcharhinus limbatus*	CCL	YES	YES	1,441	YES	24	
Blue shark	*Prionace glauca*	BSH	YES	YES	196,192	YES	39	
Broadsnouted sevengill shark	*Notorynchus cepedianus*	NTC		YES	2		0	
Bronze whaler shark	*Carcharhinus brachyurus*	BRO	YES	YES	269	YES	1	
Bull shark	*Carcharhinus leucas*	CCE	YES	YES	15		0	
Bullhead sharks	*Heterodontiformes*	HDQ	YES	YES	121		0	
Carpet shark	*Cephaloscyllium isabella*	CPS		YES	2		0	
Cookie cutter shark	*Isistius brasiliensis*	ISB		YES	106		0	
Crocodile shark	*Pseudocarcharias kamoharai*	PSK	YES	YES	1,799	YES	44	
Dusky shark	*Carcharhinus obscurus*	DUS	YES	YES	514		0	*
Galapagos shark	*Carcharhinus galapagensis*	CCG	YES	YES	648	YES	3	
Great hammerhead	*Sphyrna mokarran*	SPK	YES	YES	62		0	
Great white shark	*Carcharodon carcharias*	WSH	YES	YES	48	YES	2	YES
Grey reef shark	*Carcharhinus amblyrhynchos*	AML	YES	YES	2,059	YES	17	
Hammerhead sharks	*Sphyrna* spp.	SPN	YES	YES	1,320	YES	15	
Long finned mako	*Isurus paucus*	LMA	YES	YES	670	YES	28	
Mako sharks	*Isurus* spp.	MAK	YES	YES	2,986	YES	303	
Manta rays (unidentified)	Mobulidae	MAN		YES	270	YES	1,085	
Oceanic whitetip shark	*Carcharhinus longimanus*	OCS	YES	YES	9,140	YES	4,799	

Common name	Scientific name	Code	Annex 1[1]	Longline		Purse seine		IUCN status
				Recorded	Number	Recorded	Number	
Pelagic sting-ray	*Dasyatis violacea*	PLS		YES	11,950	YES	87	
Pelagic thresher	*Alopias pelagicus*	PTH	YES	YES	703		0	*
Plunkets shark	*Scymnodon plunketi*	F54		YES	4		0	
Porbeagle shark	*Lamna nasus*	POR		YES	16,217		0	YES
Rays, skates and mantas	Batoidimorpha (Hypotremata)	BAI		YES	181	YES	8	
Salmon shark	*Lamna ditropis*	LMD		YES	80	YES	40	
Sandbar shark	*Carcharhinus plumbeus*	CCP	YES	YES	204	YES	1	*
Scalloped hammerhead	*Sphyrna lewini*	SPL	YES	YES	15		0	*
School shark	*Galeorhinus galeus*	GAG		YES	2,439		0	
Seal shark / black shark	*Dalatias licha*	SCK		YES	52		0	
Sharks (unidentified)	Elasmobranchii	SHK		YES	3,420	YES	15,019	
Sharpsnouted sevengill shark	*Heptranchias perlo*	HXT		YES	1		0	
Short finned mako	*Isurus oxyrhinchus*	SMA	YES	YES	5,278	YES	422	*
Silky shark	*Carcharhinus falciformis*	FAL	YES	YES	27,019	YES	21,585	
Silvertip shark	*Carcharhinus albimarginatus*	ALS	YES	YES	1,150	YES	424	*
Smooth hammerhead	*Sphyrna zygaena*	SPZ	YES	YES	38		0	
Spiny dogfish	*Squalus acanthias*	DGS		YES	92		0	
Thresher	*Alopias vulpinus*	ALV	YES	YES	1,108	YES	12	*
Thresher sharks nei	*Alopias* spp.	THR	YES	YES	1,038	YES	83	
Tiger shark	*Galeocerdo cuvier*	TIG	YES	YES	453	YES	2	
Velvet dogfish	*Scymnodon squamulosus*	SSQ		YES	241		0	
Whale shark	*Rhincodon typus*	RHN	YES	YES	2	YES	124	YES
Whip stingray	*Dasyatis akajei*	WST		YES	103	YES	10	
Whitenose shark	*Nasolamia velox*	CNX	YES	YES	12		0	
Whitetip reef shark	*Triaenodon obesus*	TRB	YES	YES	61		0	
Zebra shark	*Stegostoma fasciatum*	OSF		YES	10		0	

[1] Annex 1: Highly migratory species listed in the UN Convention on the Law of the Sea
* Likely to be listed on the IUCN in late 2007
[#] North Pacific stock only

200. The SC was not in a position to define what constitutes a "key" shark species. CCMs shall provide details of the shark species that are caught to assist in the identification of key shark species at next year's SC. Future consideration should include information on the known distribution of those species (e.g. tropical or temperate, coastal or pelagic).

5.3 Juvenile bigeye and yellowfin tuna

201. David Itano (USA) facilitated Agenda Item 5.3, summarizing outcomes from Informal Small Group 3, which examined small tuna issues through intersessional email correspondence. These discussions were summarized in document SC3-ISG-WP-2 (Small Tuna on Floating Objects) that was used to facilitate a lunchtime meeting of Informal Small Group 3 during the first week of the SC. The document was edited to incorporate input received at that meeting, which produced SC3-ISG-WP-6 (Briefing Document: Agenda Item 5.3, Bycatch Mitigation – Small Tuna on Floating Objects) that was presented by David Itano in support of Agenda Item 5.3.

202. The session convener noted that high levels of fishing mortality from three categories of small tuna captured on floating objects are of management concern in the WCPO: 1) undersize tuna that are often sorted out and discarded and have little commercial value; 2) very small skipjack, yellowfin and bigeye that enter the surface catch of the Philippines and Indonesia; and 3) all bigeye and "small-sized" yellowfin taken by purse-seine and ringnet fisheries operating on floating objects. It was suggested that these categories of small tuna be referred to as "small tuna on floating objects (STFO)," replacing the terminology of "juvenile bigeye and yellowfin tuna". Discussion on this recommendation and determination of the size of concern for "small-sized" yellowfin is included in Attachment M and the recommendations to this section.

203. Industry-associated and FAD-related research examining acoustic selectivity, targeting and technical influences on STFO catch rates were briefly reviewed. It was noted that analyses of this type are often data limited, supporting the importance of observer data collection of FAD-related gear and fishing strategies. Other studies highlighted the value of working in close collaboration with professional fishermen to benefit from their accumulated experience and knowledge of tuna behaviour and their ability to estimate school size, species composition and fish size prior to setting on FADs and other drifting objects.

Discussion

204. FFA members noted the importance of reducing fishing mortality of STFO and recognized the need to develop methods to do so. However, FFA highlighted the importance of associated purse-seine effort in their zones, and noted the negative economic and social implications that are likely to arise if restrictive management occurs.

205. Kiribati noted that more research is required so that managers can provide guidance to the purse-seine industry to help them avoid catches of STFO, and encouraged the development of cooperative programmes to address the issue, noting that tuna resources are essential to the FFA countries and fisheries. Kiribati also noted that observer coverage is critical for assessing bycatch levels.

206. Several CCMs, including Australia and Guam, stated that they found the document very useful and felt that it should be preserved in some form within the record of the meeting. However, it was noted by other CCMs that some portions of document SC3-ISG-WP-6 did not fully reflect consensus views from Informal Small Group 3 discussions. The Philippines also

noted that very small yellowfin and bigeye tuna are not a targeted catch in their domestic ringnet fishery but are taken as bycatch from fisheries for other species.

207. The USA and Japan recognized these issues but felt that an edited form of the document or some portion of it should be included in the meeting report. The Convener, in consultation with the meeting Secretariat, proposed that the document be edited on the margins of the meeting to address CCM concerns with the recommendations and summary included in the report of the SC with the modified document included as Attachment M to the report. This proposal was found acceptable by the meeting, with recommendations and the following two summary paragraphs included here:

> "The largest constraint of scientists working with commercial vessels was recognized as the prohibitive charter costs and potential loss of revenue by commercially operating fleets. Some means to offset vessel time while providing cooperating vessels with an incentive to participate will need to be developed. Structured scientific cruises working in close proximity to commercial fleets are desirable but extremely expensive.
>
> The main point is that scientific research cruises attempt to emulate commercial conditions but are not able to better utilize the accumulated experience and knowledge of commercial fishermen who are undeniably the experts on acoustic recognition, school assessment and tuna behavior. Closer collaboration and communication with the tuna industry should be fostered by the Scientific Committee and Commission in order to seek practical and incentive based mechanisms to reduce fishing mortality on small tuna taken in WCPO surface fisheries."

Recommendations

208. The SC adopted the following recommendations.

RESEARCH AND ANALYSES

1) An analysis to determine what size of yellowfin tuna should be considered in discussions of reducing fishing mortality of STFO, incorporating such parameters as stock condition, recruitment indices, yield-per-recruit, and economic considerations.
2) A comparative study on relative rates of STFO and floating-object associated fauna between:
   a) floating objects in the eastern vs. western regions of the WCPO;
   b) analysis of the relative rates of STFO (especially bigeye) between drifting FADs and anchored FADs; and
   c) relative rates of STFO taken in archipelagic areas close to large island environments vs. catch rates offshore or in high seas areas
3) A detailed analysis of skipjack, yellowfin and bigeye catch on floating object sets by time of day.
4) An examination of vessel-specific bigeye quotas with vessel owners as a means to reduce bigeye catch and improve targeting by purse-seine fisheries.

INDUSTRY-ASSOCIATED RESEARCH

1) Survey of purse-seine operators as to their accuracy in estimating set size, species composition and fish size prior to setting.

2) Design acoustic studies onboard commercial purse-seine vessels engaged in commercial fishing operations to document the accuracy of set size, species composition and fish size prior to setting. (Note: this would test the feasibility of vessel or fleet-specific STFO quotas as a management option.)

3) The use of net depth recorders or other depth recording devices in conjunction with ADCP or Doppler current meters and set details to characterize actual pursing depth of WCPO purse-seine gear in different areas and conditions.

4) Closer collaboration and communication between the SC and the tuna industry to seek new ideas and workable solutions to reducing the take of STFO, particularly on drifting and anchored FADs. (Note: designed personal interviews and surveys, as conducted by Moreno et al. 2007[3], should be conducted in the WCPO.)

5.4 Sea turtles

209. The Co-convener of the Informal Small Group on sea turtles reported on SC3-EB-WP-4 and this group's discussions, which can be found in Attachment N. The discussion of the document, focused on the contents of Table 3. Column A in the table contains articles that vessels should carry to safely release hooked sea turtles. Consensus was reached that these tools would be effective in all longline fisheries, if used according to the guidelines. Column B contains sea turtle bycatch mitigation measures that have been shown to reduce the capture or injury of turtles, while maintaining target species catch based on research conducted around the world.

210. There was discussion of the need to specify where the measures within the table would apply and whether such measures were sufficiently flexible to allow fishers to choose between measures and to choose whether to apply the measures at all. The USA explained that the concept of flexibility is built into the document, but that it is intended to provide flexibility for different styles of fisheries, while retaining target catch. That is, the document is not designed to be flexible regarding political boundaries, given that sea turtles cross such boundaries. It was concluded that the measures should be considered for use throughout for the entire Convention Area.

211. There was also discussion of whether the items in the first part of Column B would apply to all longline fisheries or just swordfish fisheries, with Japan asking for the broadening of this provision to include all shallow longline fisheries. The United States noted that the measures provided within the table under the heading of swordfish fisheries were those that have been proven to work with swordfish fisheries, and that to remove this specification would not be based on our scientific understanding of their effectiveness.

[3] See FT-WP-5: Moreno, G., Dagorn, L., Sancho, G., Itano, D. 2007. Fish behaviour from fishermen knowledge: the case study of tropical tuna around drifting fish aggregating devices (DFADs). (summary of Canadian Journal of Fisheries and Aquatic Sciences. in press).

Table 3. Effective strategies to reduce sea turtle interactions in fisheries (Discussion was not completed on the items in Column B due to reservations by Japan, and will continue at further meetings of the WCPFC and its committees).

A: All longline fisheries	B: Optional methods for longline fishing
• Carry and use dipnets (where appropriate), line cutters and dehookers to handle and release sea turtles using guidelines to be established by WCPFC	For shallow-set fisheries (majority of hooks <100 m) targeting swordfish, with possible bycatch of loggerhead or leatherback turtles: • Use large circle hooks[1] • Use fish bait as a replacement for traditional use of squid bait For other fishery sectors than that described above (if applicable): • Replace non-circle hooks with circle hooks[1] that are at least as wide (minimum width) as those replaced • Replace non-circle hooks with hooks[1] (any style) that are at least 20% wider (minimum width) • Use only fish for bait • Eliminate the shallowest-set hooks (i.e. <100 m) in deep-set fishing • Replace the shallowest set hooks (i.e. <100m) with circle hooks[1]
[1] For all methods, hooks should not have points offset any greater than 10^{o}. Review has shown that greater offsets can have negative effects in increasing the frequency of deep hooking as opposed to mouth hooking.	

212. Chinese Taipei noted that it is difficult to address sea turtle bycatch issues without a better understanding of sea turtle distribution and ecology. FFA member nations concurred with this statement and that measures should remain flexible until the SC is aware of sufficient scientific information, particularly as it applies to measures within Column B. FFA also stressed the importance of the Regional Observer Programme in assessing turtle issues and that the Regional Observer Programme should use standards similar to those already in existence, which is critical to gathering this type of information.

213. There was continued discussion and concerns expressed about most of the measures within Column B, with Japan and Korea suggesting that some of them be removed to provide additional flexibility. Australia and New Zealand noted that removing optional measures would actually result in less flexibility. These measures were retained. However, Japan indicated that there were still several measures within the table that it could not agree to. Japan lodged a specific reservation to the language in the document just prior to the table. In addition, measures listed in Column B did not receive endorsement from some CCMs, but will be discussed at future WCPFC meetings.

5.5 Ecological risk assessment

214. The meeting recalled that SC2 had endorsed ecological risk assessment (ERA) in general, and productivity-susceptibility analysis (PSA) in particular, as an appropriate way to assist the Commission in prioritizing species for management action or further research.

215. The SC heard a presentation by David Kirby (SPC-OFP), who provided a summary of ERA and the updated PSA (SC3-EB-WP-3) and three-year (2008-2010) ERA Research Plan (SC3-EB-WP-3) that had been presented to the Ecosystem and Bycatch Specialist Working Group (EB-SWG).

216. The presentation also addressed the relationship between ERA and stock assessment. It was recognized that the Commission will always want to know stock status for target species and that ERA helps to address those obligations arising under the Convention with regard to non-target associated and dependent species.

217. It was noted that the Commission for the Conservation of Antarctic Marine Living Resources (CCAMLR) applied a risk assessment approach to identify statistical areas that are more or less at risk of adverse effects of fishing on seabirds, and that other RFMOs are also in the process of implementing ERA.

218. It was further noted that a recent publication " Recommended Best Practices for Regional Fisheries Management Organizations"[4] calls for "risk-based impact assessment of the effect of fishing activities on non-target species, followed by explicit analytical assessments and/or action when risk is determined to be high".

219. The ERA Research Plan was developed by SPC-OFP, following discussions at a workshop convened by SPC-OFP and hosted by the US Western Pacific Regional Fisheries Management Council (WPRFMC) in Honolulu, 6–9 August 2007. Workshop participants were technical experts with prior experience in developing and/or applying ERA in a fisheries management context. It was noted that representatives of some CCMs wish to attend any future technical meetings as the ERA progresses.

220. The high-level output of the ERA Research Plan is the:

- Identification of highly migratory species and associated or dependent species that are at relatively high risk of adverse effects due to fishing, for consideration by the SC in terms of further research or management responses.

221. The research outputs are:

- Enhanced PSAs that are comparable, transferable and for which uncertainty has been quantified;
- Identification of highly migratory species, or associated/dependent species at high apparent risk that can be assessed using existing data and models;
- Identification of data requirements, through fisheries monitoring or bio/ecological research, in order for other high-risk species to be assessed;
- Scientific support for small island developing states in implementing ERA/ ecosystem approach to fisheries management (EAFM) at the national level, as requested by countries/territories and in collaboration with FFA.

[4] Lodge et al. 2007. Royal Institute of International Affairs, Chatham House, London.

- The results of the ERA will be presented to the SC, which may then use the results to: 1) identify non-target species for which stock assessment or further, detailed analysis, IS or IS NOT necessary; 2) determine which areas/fisheries/times are relatively high/low risk for particular species and species groups; and 3) identify, evaluate and recommend bycatch mitigation measures.

222. On behalf of FFA members, Samoa thanked SPC-OFP for their work. FFA members feel that ERA is a timely response for non-target species. FFA members recognize that the focus of ERA is on the risk posed by fishing to all species caught and that ERA complements the FFA EAFM, which provides the framework for managing domestic fisheries in the zones of FFA members. More time, research effort and training workshops are needed to examine the results of ERA, to raise awareness and to build capacity. FFA members offered their support for ERA and the three-year ERA Research Plan presented, and are pleased to support the establishment of best practice in assessing the risk posed by fishing to non-target associated and dependent species.

223. Japan reiterated the concerns it voiced in the EB-SWG concerning participation in the workshop, and recognized that while this type of approach is necessary for future management, there are relatively few researchers currently engaged in this field. There are many important factors to consider when studying ocean ecosystems, which are inherently difficult to sample compared with terrestrial systems, and it is not clear that ERA will be able to incorporate these.

224. French Polynesia thanked SPC-OFP for the presentation and supported the continuation of such studies.

225. Kiribati supported the statement made by Samoa in support of ERA and noted the importance of building confidence in assessing the right level of risk.

226. New Caledonia added its voice to that of FFA countries and French Polynesia, which had expressed support for the work undertaken and proposed. It is an appropriate response to Article 5 of the Convention, which requires an ecosystem approach to management of fisheries and the preservation of biodiversity.

227. New Zealand also voiced their support for the ERA Research Plan, noting that many comments made during the week regarding data gaps and the need for a holistic approach would be addressed under the research proposed. They recognized it as cutting edge science that would provide focus for research prioritization and would be very useful for management at the national and Commission level.

228. Australia supported the comments from FFA members and others supporting the ERA Research Plan, while acknowledging the hesitation expressed by Japan regarding the newness of the ERA approach. The meeting was informed that ERA has been used in more than 20 fisheries in Australia, with PSAs completed for all of them, and detailed Level 3 (full quantitative assessment) initiated for one of the fisheries.

229. Tonga supported Australia and recognized that ERA provides a way to move forward and make progress in this important area.

230. The SC Chair noted that ERA is now familiar to most of us and it is especially beneficial to bycatch species. He presented some text for the approval of the meeting (high level and research outputs of the ERA Research Plan in paragraphs 220 and 221).

231. Canada asked for clarification that the ERA under discussion was the same as that included in the draft SC work programme, due to be discussed under Agenda Item 9. SPC-OFP replied that it was indeed the same work.

232. Japan expressed the wish to reserve judgment on the ERA Research Plan until it can be discussed alongside other work proposed in the SC work programme.

233. The Chair stated that ERA already had a two-year (2007, 2008) endorsement and funding commitment from SC2 and that the ERA Research Plan and the SC work programme would extend this endorsement for the three-year period 2008–2010.

234. Japan stated that SC2 had only approved an indicative budget for 2008, and that both the SC and WCPFC4 must approve the budget for 2008 and beyond. Some Japanese delegates had concerns about the practicality of ERA, and Japan would like to consider the ERA Research Plan alongside other research priorities.

235. SPC-OFP stated that they would actively seek to identify and address any shortcomings in the ERA and would discuss these at future meetings of the SC.

236. The Chair then closed this particular agenda item, noting that the meeting had endorsed the substance of the ERA Research Plan and that it is incorporated in the draft SC work plan for 2008–2010, which will be discussed under Agenda Item 9.

AGENDA ITEM 6 — DATA AND INFORMATION

6.1 Regional Observer Programme

237. The SC provided recommendations on:
1) Scientific priorities and objectives of the ROP;
2) Minimum fields of scientific data to be collected by the ROP;
3) Improving the documentation of the meaning of each proposed field of data.

238. The SC endorsed these recommendations together with the notes that follow.

Scientific priorities and objectives of the ROP

239. The text contained in paragraph 192 (Observer objectives and priorities for longline and purse-seine fisheries) of the WCPFC-SC2 Summary Report was used as a starting point for formulating a more generic set of scientific priorities and objectives for the Regional Observer Programme.

240. Recommendation: There are six scientific objectives that should be considered in the development of the Regional Observer Programme, all of which are high priority. That the text contained in Appendix II of Attachment K be the scientific priorities and objectives for the Regional Observer Programme.

241. The SC noted that observer programmes may not necessarily be the best way to sample the length and species composition of species that are landed from purse-seine vessels.

Minimum fields of scientific data to be collected by the ROP

242. There were a wide range of opinions held regarding the minimum fields of scientific data that should be collected by the ROP. A combination of SC3-GN-WP-6 (Data standards for the Regional Observer Programme) and SC3-DP-4 (Comments on alternative data standards proposed by China, Chinese Taipei, Japan and Korea) was accepted as a basis for moving forward.

243. Recommendation: That the text contained in Appendix III of Attachment K is used as the starting point for future discussions on the minimum fields of scientific data to be collected by the ROP.

244. The SC noted that:

a) The list of data fields contained in Appendix III of Attachment K is provisional and requires more consideration and refinement (by other subsidiary bodies of the Commission and subsequent sessions of the ST-SWG);
b) Many delegations expressed a strong desire for further opportunities to add items to, or subtract items from, this list;
c) The SC only considered scientific needs for the fields of data to be collected by the ROP;
d) At the ST-SWG, a consensus agreement was reached on slightly over 100 fields of data (those not square bracketed in Appendix III) that should be collected by the ROP, but consensus was not reached with regard to other fields; and
e) In some instances the discussion of data fields was made more complicated by the lack of shared understanding regarding the meaning and purpose of each proposed field.

Improve the documentation of the meaning of each proposed field of data

245. Recommendations: Two items should be added to the SC's work programme:

a) The draft list of minimum data fields for the ROP (contained in Appendix III of Attachment K) be annotated with explanations of what each field is and why it is needed;
b) The draft list of minimum data fields for the ROP be annotated with detail describing the format (units of measure, codes etc) to be used when collecting each field (completing the work that was started in SC3-GN-WP-6).

6.2 Data confidentiality, security, and disseminations

246. The SC provided recommendations on:

- Procedures for the access to and dissemination of data compiled by the Commission;
- Information Security Policy.

247. The SC endorsed these recommendations, together with the notes that follow.

248. The SC noted that there was general support for the draft framework for access by CCMs, draft data request form, and draft data confidentiality agreement (contained in SC3-ST-WP-1). Some views were noted that the draft confidentiality agreement needed to be modified to impose more obligations on the person(s) wanting to receive non-public domain data.

249. The SC also noted that the draft framework would need to be modified to conform with any revisions to the "Rules and procedures for the access to and dissemination of data compiled by the Commission".

Rules and procedures for access to and dissemination of data compiled by the Commission

250. The SC considered the Commission's current "Rules and procedures for the access to and dissemination of data compiled by the Commission" (as adopted at WCPFC3) and a set of proposed revisions to these Rules and Procedures contained in SC3-ST-IP-9. The SC noted that SC3-ST-IP-9 was a generally superior text.

251. The SC forwards suggestions made by the ST-SWG (in SC3-ST-IP-9) so that they might be considered by TCC3 and the Commission.

Information Security Policy

252. The draft Information Security Policy contained in SC3-ST-IP-1 consists of a priorities document (which is intended for a small evolving commission), an information security document (which describes the Secretariat's direction and support for information security), and a draft framework for a full set of operational security standards.

253. The SC recommended that:

- the Secretariat proceed immediately with the implementation of the Information Security Policy; and
- if CCMs wish to provide written comments on the Information Security Policy they do so before 16 November 2007 (and preferably before TCC3).

6.3 Indonesia and Philippines Data Collections Project (IPDCP) update and review

254. The Executive Director briefed the Committee on the Fourth Meeting of the Steering Committee for the IPDCP, which met in Honolulu, Hawaii during the first week of the SC3. He reported that, in addition to representatives from Indonesia and Philippines the Steering Committee meeting was attended by representatives from Chinese Taipei, Japan, New Caledonia, New Zealand, Korea, SPC-OFP and WWF. The Steering Committee recalled discussion in the Statistics and Stock Assessment Specialist Working Groups, which underscored the importance of data from Indonesia and the Philippines to the work of the Commission, noting that catches of tuna from Indonesia and the Philippines represented 26.4% of the total catch of albacore, bigeye, skipjack and yellowfin in the WCPFC Statistical Area in 2005. While recent progress has been made in the Philippines, the gaps in data from Indonesia and the Philippines continue to be a major source of uncertainty in stock assessments for the Commission. The Steering Committee reviewed activities supported under the Project during 2007, noting with satisfaction that the Indonesian component had finally commenced with an inception workshop early in the year. The Steering Committee had also reviewed a provisional three-year work programme and budget for the Project. The total proposed budget for 2008, endorsed by the Steering Committee, was USD188,696, some of which might be supported from the Commission's core budget with the remainder being raised from other sources including through an appeal for voluntary contributions to the IPDCP project fund.

255. The SC noted the report, and encouraged additional funding support for the activities that have been initiated and continue to be supported under the IPDCP.

6.4 Tagging initiatives

256. Antony Lewis provided a progress report to the SC on the PNG Tuna Tagging Project, pointing to documents SC3-GN-WP-9 and SC3-BI-WP-4, which provide additional information. The PNG tagging work is considered to be Phase 1 of a larger regional project involving the three tropical tuna species. Two chartered pole-and-line vessel cruises were carried out in August–November 2006 and February–May 2007, resulting in over 61,000 conventional tags, 283 archival tags and 195 sonic tags being released, primarily in the archipelagic waters of PNG. The majority of releases were anchored FAD-associated fish, in line with project objectives, and comprised mostly small-medium sized fish, with skipjack and yellowfin numbers far exceeding expectations, but bigeye releases much lower than hoped. Close to 5,000 tag recoveries had been received by the end of July, following extensive publicity work and establishment of tag recovery mechanisms in key locations, and will continue for some years, with final recapture rates possibly exceeding 20%. The project has thus met most operational objectives and future analyses will likely provide the range of information sought in support of stock assessments and associated work. The archival and sonic tag work will also provide a wealth of information on the dynamics of FAD associations and tuna behavior generally. The success of the project has provided a good platform for Phase 2 activities in the future.

257. Project implementation by SPC and the PNG National Fisheries Authority was noted, with significant funding support from the PNG National Fisheries Authority as well as New Zealand's Agency for International Development (NZAID), Australian Centre for International Agricultural Research (ACIAR), Global Environment Facility, EC and the University of Hawaii Pelagic Fisheries Research Program (PFRP).

258. John Hampton summarized information on the development of a Phase 2 regional tuna tagging project proposal through intersessional efforts of the WCPFC Regional Tagging Project Steering Committee. The achievements and progress of the group, and the development of the proposal, are well described in SC3-GN-IP-6. The project proposal is available to the SC as SC3-GN-WP-10, which proposes the creation of a Pacific Tuna Tagging Project (PTTP) consisting of the recently completed Phase 1 PNG Project, a Phase 2 expansion into the Equatorial WCPO, and a series of sub-regional or national projects implemented under the PTTP by national authorities and the IATTC in EPO waters.

259. The objectives, study design and implementation of Phase 2 were presented in detail and are available for closer examination in SC3-GN-WP-10. It is proposed that Phase 2 will be planned by SPC in collaboration with WCPFC and implemented by both organizations in conjunction with national agencies and the IATTC. Study results will concentrate on obtaining data useful for reducing uncertainty in WCPO tuna stock assessment efforts, and gaining more information on mixing and habitat utilization with some emphasis on FAD effects. A combination of conventional, archival and sonic tags will be used to address different aspects of the project objectives. All components will be closely aligned and standardized. Tag releases are proposed to begin within two years of field operations, ideally taking place from mid 2008–2010.

260. John Hampton described the importance of tag recovery mechanisms and rewards throughout the planning and implementation of the PTTP. It was noted that the total budget is proposed at approx USD9.8 million, with USD 2.4 million of this already secured.

261. John Hampton presented a Draft Recommendation to the Scientific Committee endorsing the proposal for a PTTP as presented in SC3-GN-WP-10. It was proposed that a voluntary fund be created and that CCMs consider a) making direct contributions to the fund and b) developing

collaborative tagging projects under the umbrella of the PTTP that would contribute to its objectives.

Discussion

262. Chinese Taipei suggested that it be included on the list of primary recovery locations and asked if there was any way to increase bigeye releases to meet all project objectives. Antony Lewis noted that their understanding was of limited tuna landings directly in Chinese Taipei with most of their catch being transshipped or landed to other processing centers in the western Pacific and elsewhere. It was noted that every effort was made to increase and target bigeye during the PNG tagging cruises, but the project found a general lack of local abundance, particularly during Cruise 2.

263. PNG expressed thanks to the tagging team and acknowledged the efforts of SPC and the PFRP in training National Fisheries Authority (NFA) counterparts in archival and sonic tagging techniques. It was noted that NFA will continue sonic tagging research in PNG waters in collaboration with the PFRP, particularly to increase data and information on bigeye tuna.

264. USA commended those working on the proposal and efforts to develop the project. It was noted that the proposal has included ways to estimate tag reporting levels but that reporting (or non-reporting) by some longline fleets remains problematic. The meeting was urged to assist in publicizing the tagging programme and the importance of returning tags with their domestic fishing fleets and particularly for distant-water longline.

265. Several CCMs noted their appreciation for hard work and dedication of the SPC, NFA and the tagging personnel in contributing to the success of Phase I and supported continuation into Phase 2 activities.

266. French Polynesia noted the unique geographic location of French Polynesia between the WCPO and the EPO that supports importance of tagging in this region. It was noted that discussions have already begun between SPC and French Polynesia with the hopes of developing a sub-regional tagging project centered in the northern French Polynesian zone.

267. The EC commended the Phase 2 proposal and strongly supported the implementation of the broader project. He further noted that he will investigate and seek funding support from EC sources.

268. PNG strongly supported the project and noted that PNG's NFA will provide funding support of USD100,000 for Phase 2. He noted that 30% of the WCPO catch is now taken in PNG waters, indicating the importance of this project to PNG and the region.

269. The USA reiterated the importance of obtaining strong collaboration from all longline countries in the return of tags from larger fish. Australia supported previous comments and noted the importance of work already completed in PNG both of itself and in preparation for Phase 2.

270. Chinese Taipei supported the project and noted that efforts would be made to solicit their purse-seine and longline fleets to improve tag return rates. The importance of the project to produce data necessary for stock assessment and regional management was stressed.

271. Niue noted the importance of the tagging work to small island developing states for resource sustainability, and thanked countries and members who contributed to Phase 1 and the development of Phase 2.

272. Several CCMs, including New Zealand, Fiji, Kiribati, China, and the Philippines voiced their appreciation to those involved in the Phase 1 tagging implementation, and the SC voiced general support for the continuation of Phase 2 activities.

Recommendations

273. The SC noted its strong support for the Phase 1 component of the Regional Tuna Tagging Project in PNG. The SC recommended that:

- The Commission endorse the Phase II extension of the tagging project as a Commission-sponsored research project;
- A Steering Committee be established to plan the Phase II component of the project;
- A voluntary fund be established by the Commission to encourage CCMs to provide the necessary funding for the project.

6.5 Other matters

274. The SC noted the discussions that had occurred in the ST-SWG on data gaps and procedures for the provision of data to the Commission.

275. The SC provided recommendations on:

1) Data gaps, and
2) Procedures for the provision of data to the Commission.

276. The SC endorsed these recommendations, together with the notes that follow.

Data gaps

277. The SC noted that the timely provision of data was a very important issue for the work of the SC, and in particular for the stock assessments.

278. The SC noted that data gaps (including late and/or absent data) are impacting on the ability to provide the best available scientific advice, particularly for the assessment of stocks.

279. Recommendations:

- The Commission should note that data gaps (including late and/or absent data) are impacting on the ability to provide the best available scientific advice, particularly for the assessment of stocks;
- The Secretariat should deploy — within the next 12 months on the WCPFC website — a prototype computer programme that will allow data gaps to be easily identified; and
- A study should be undertaken to identify the causes of data gaps. This study should be from a holistic perspective, paying particular attention to those instances where data were not collected.

Procedures for the provision of data to the Commission

280. The SC noted that based on the experience gained in implementing procedures for the provision of scientific data to the Commission, and the changes implemented by the Commission since the procedures for the provision of data were originally adopted in 2005, the "Procedures for the provision of data to the Commission" need to be updated. A number of editorial changes were proposed (including the common names for fish species and logical regrouping of some fish species), and some rearrangement or rewording to improve clarity and consistency, and four substantive changes (documented in the paragraph 14 of Attachment K).

281. The ST-SWG recommended that the "Scientific data to be provided to the Commission" be that documented in Appendix IV of Attachment K.

282. The SC noted the need for further consideration (at the Commission level) of the wording related to provision of data on fishing activities outside the Convention Area.

Species composition data

283. The EC delegate noted that the large uncertainties in the species composition of purse-seine landings have been a major pending question in the WCPFC area, as large discrepancies have been observed between the species composition obtained from observer sampling and from port samplings conducted by various countries in the area. The EC expressed to the SC its deep regrets that this fundamental problem was not discussed by the statistics experts and that no action or recommendation could be envisaged by the ST-SWG to solve this problem. The EC noted that this is of fundamental importance because the yearly catches at size taken by purse seiners are a critical component in both yellowfin and bigeye stock assessments. The SC should recognize the fact that the species composition of purse-seine landings has been successfully conducted in all the other oceans using large scale and routine port sampling schemes: in the Atlantic and Indian oceans since 1980 and since 2000 in the EPO. The EC prepared a paper (SC3-ST-IP-7) that tentatively demonstrated that the present species sampling done by observers in the WCPFC area was necessarily biased, overestimating catches of large yellowfin and widely underestimating the catches of small yellowfin and small bigeye landed by purse seiners (as these small tunas are often misclassified in log books and landing statistics as being skipjack). Unfortunately, time constraints did not allow the EC delegate to present the paper during the ST-SWG session and so this major statistical problem was not discussed. The EC considers that WCPFC should urgently conduct the research actions recommended in the paper in order to solve this major uncertainty: 1) in the short term through a validation of the best sampling procedure of purse-seine landings, and 2) in the medium term through the implementation of a well coordinated unbiased sampling programme of the purse seine species composition catches. Australia supported the need for additional data collection measures in the purse-seine fishery and noted that a catch documentation scheme could be of assistance in this regard.

284. SPC noted that the issue of biased species composition sampling by observers onboard purse seiners has been known for some time and that a study by the SPC-OFP was reported in 2005 (see SC1-ST-WP-4). While observer data cannot be used to estimate the complete species composition, the data can still be used to obtain estimators of certain parameters of interest, such as the relative proportions of bigeye and yellowfin in the combined catch of bigeye and yellowfin (see SC3-ST-IP-5). Logistical constraints, such as the multitude of ports in the WCPO and the usually unannounced visits by purse seiners due to the continuous movement of vessel across the region, have so far impeded the development of "large-scale" port sampling programmes in the

Pacific islands, with the exception of sampling of the United States vessels that regularly land their catch in Pago Pago, American Samoa. The Secretariat noted that observers are effective in longline fisheries.

AGENDA ITEM 7 — COOPERATION WITH OTHER ORGANIZATIONS

7.1 Review of existing MOUs

285. The Executive Director introduced SC3-GN-WP-11 relating to memoranda of understanding (MOUs) between WCPFC and other organizations.

Secretariat of the Pacific Community (SPC)

286. The Executive Director advised that the arrangement with SPC for the provision of scientific and data management services continued to work well. He expressed appreciation to the SPC-OFP staff for the responsiveness and flexibility in responding to Secretariat requests relating to the existing service provider arrangement. He noted that the future tasks and activities to be assigned to SPC-OFP under the scientific services provider agreement would be dependent on the scientific work programme approved by the Commission.

Commission for the Conservation for Southern Bluefin Tuna (CCSBT)

287. The Executive Director advised that the Secretariat collaborated with the CCSBT through the informal collaborative arrangement known as the t-RFMO.

International Scientific Committee for Tunas and Tuna-like Species in the North Pacific Ocean (ISC)

288. The Executive Director advised that the MOU with ISC had been executed early in 2007 and that collaboration in respect of northern stocks continued to develop in both the SC and Northern Committee.

Inter-American Tropical Tuna Commission (IATTC)

289. The Executive Director advised that, reflecting the special relationship between IATTC and WCPFC, the MOU with IATTC was signed following its approval at the WCPFC3 in Samoa in 2006. He advised that the First Consultative Meeting between the two Secretariats had taken place at Cancun, Mexico on Sunday, 24 June, 2007. In addition to the MOU, the meeting had reviewed a draft work programme that could be subsequently considered by the respective Commissions to operationalize collaboration between the two organizations. The draft included work to develop a mechanism for the exchange of scientific and fisheries data, research collaboration, particularly in respect of bigeye tuna, Pacific bluefin, sharks and billfish and including ecosystem issues. The Executive Director noted that a means to exchange data with IATTC was central to developing a mutually beneficial relationship with IATTC. He noted that the Rules and Procedures for Access to and Dissemination to Commission Data were currently under review and that this matter was getting attention in that review. He noted that IATTC would need an authorization that provided for reciprocity in relation to data exchange. The SC reaffirmed that IATTC and WCPFC need to develop a close working relationship but that, in the interests of transparency, CCMs need to be fully consulted on any initiatives to operationalize areas of cooperation.

Pacific Islands Forum Fisheries Agency (FFA)

290. The SC noted the draft MOU that had been prepared by the WCPFC and FFA secretariats to provide a platform for cooperation between the two organizations.

Commission for the Conservation of Atlantic Tunas (ICCAT)

291. The Executive Director advised that the Secretariat collaborated with the ICCAT through the informal collaborative arrangement known as the t-RFMO.

7.2 Development of new MOUs

292. In response to recommendations from SC2, endorsed by WCPFC3, the Executive Director presented draft MOUs for: the Agreement for the Conservation of Albatross and Petrels (ACAP), the Secretariat of the Pacific Regional Environment Programme (SPREP), the Commission for the Conservation of Antarctic Marine Living Resources (CCAMLR), and the Indian Ocean Tuna Commission (IOTC).

293. The SC, recalling that further review will occur at the TCC and at the Commission, noted the developments in relation to these organisations. The SC was invited to provide written comments on the draft MOUs to the Secretariat by 20 September 2007 so that those comments could be taken into account when the TCC reviews the draft at its Third Regular Session, from 27 September–2 October 2007.

7.3 Other cooperative activities

UN Food and Agriculture Organization (FAO)

294. The Executive Director reported that although collaborative arrangements with FAO have not yet been formalized, as is provided for in Article 22 of the Convention, relations continue to evolve and strengthen. Consultation and collaboration have involved data issues, particularly in relation to the Fisheries Global Information System (FIGIS), the Fisheries Information Resource Management System (FIRMS) and the Coordinated Working Party on Fisheries Statistics (CWP).

295. Jacek Majkowski (FAO) reported on FAO activities relevant to WCPFC, including the Japanese-financed Management of Tuna Fishing Capacity project, the outcomes of which were presented at the Meeting of Tuna Regional Fishery Management Organizations (RFMOs) at Kobe, Japan in January 2007. He advised the Committee that the Project supported another workshop in May 2007 to further develop, test and apply a method for the estimation of tuna fishing capacity from stock assessment-related information. Noting that the Project was scheduled to conclude in the near future the workshop recommended that the existing Technical Advisory Committee (TAC) of the Project be transformed into a Technical Coordination Committee (TCC) to continue to provide a forum to consider and resolve the technical issues involved in the management of tuna fishing capacity, and to coordinate the related research. Concluding his presentation, he mentioned the status of tuna catch data in FAO`s Fisheries Geographical Information System (FIGIS), and the outcome of the 5–9 March, 2007 Meeting of the Committee on Fisheries (COFI).

Coordinated Working Party on Fishery Statistics

296. The Executive Director reported on his attendance at the 22nd meeting of the FAO Coordinating Work Party on Fisheries Statistics (CWP22) meeting in March 2007, as recommended by SC2. He noted the CWP's activities included the coordination and harmonization of fishery statistics collected by regional fisheries bodies and fishery data quality indicators. He also noted that at the meeting, the South East Asian Fisheries Development Centre (SEAFDEC) had proposed a change in boundaries between FAO Fishing Areas 57 and 71 in the Malacca Strait. As this had implications for the Convention Areas of both IOTC and WCPFC, the meeting had recommended that SEAFDEC consult with these two organizations to ensure that such a change was acceptable to them. He reported that the Secretariat is awaiting a formal communication from SEAFDEC in relation to this matter.

Fishery Information Resource Management System

297. The Executive Director reported on his attendance at the 4th Steering Committee meeting of the Fishery Resources Monitoring Systems (FIRMS) in March 2007 as recommended by SC2. He noted that FIRMS is a partnership between international organizations and is based at FAO. The SC noted positive developments in relation to the implementation of FIRMS and proposed that the Secretariat and CCMs continue to monitor these developments.

AGENDA ITEM 8 — CONSIDERATION OF THE SPECIAL REQUIREMENTS OF DEVELOPING STATES AND PARTICIPATING TERRITORIES

8.1 Special Requirements Fund

Review of 2006/2007 activities

298. John Hampton provided an update of activities in stock assessment training for small island developing states. Funding has been secured from GEF with additional support from the Japanese Trust Fund (JTF). Future funding has not been secured but there is strong support for the continuation of the workshop programme. Also, there is a need for knowledge retention through ongoing revision and assessment, possibly using web-based tools. A proposal has been submitted to the JTF for support in coming years.

299. PNG, Samoa, Kiribati, Philippines and Niue supported the current work, appreciated the support from the donors, and agreed there was a need for ongoing support. Japan supports the work and will endeavor to secure funding for the stock assessment workshops.

300. John Hampton also thanked the EC and WCPFC for their financial support.

301. The EC suggested that developed countries provide opportunities and funding for students, especially at the PhD level, from small island developing states to study stock assessment.

Advice and recommendations to the Commission

302. The SC recommended the continuation of the stock assessment workshop.

8.2 Other matters

303. No other matters were raised.

AGENDA ITEM 9 — FUTURE WORK PROGRAMME

9.1 Strategic research plan 2007–2011 for the Scientific Committee

304. This agenda item was deferred for consideration at SC4.

9.2 Review of 2007 work programme

305. The Secretariat reported the work accomplished during the past year. There was no discussion on this item.

9.3 2008 Work programme and budget, and 2009–2010 provisional work programme and indicative budget

306. The SC recommended to the Commission the work programme and provisional budget for 2008–2010 as outlined in Attachment O. The SC also recommended that during 2008 the Commission provide funding support from its core budget to several high priority research projects as indicated in Table 4.

307. The SC recommended that the WCPFC Secretariat, together with the Chair, Vice-Chair and SWG conveners, and in consultation with CCMs and the Commission's Science Service Provider, draft guidelines outlining the process for formulating the work programme and budget of the SC to ensure that the process is efficient, transparent and facilitates broad participation in the scientific work programme. These guidelines are to be presented to SC4 for review, adoption and implementation.

308. The conveners of the SWGs met to consider the size of the indicative research budget for 2009 and 2010. Consideration was given to the scope of the work programme adopted by the SC (which itemizes 59 substantive research projects) and the commensurate management issues for which scientific advice is required. Taking account of these issues, the conveners therefore suggested that the 2008 budget be seen as a minimum budget level to fund research in the WCPO. Conveners suggested that the Commission should give consideration to significantly increasing this budget over future years.

Discussion

309. The SC's work programme and budgeting process has been *ad hoc*. There is a need for a better structured and more transparent process. These improvements should be undertaken during the course of the coming year and should be reviewed by SC4.

310. In cooperation with the scientific services provider, the Secretariat should complete work on the budget details, based on an indicative budget of USD625,000 for 2008 as noted within the WCPFC3 report, before the Commission is asked to approve the work programme at WCPFC4.

311. The indicative budget for 2008 (USD625,000) could be used as a minimum budget for 2009 and 2010.

Table 4. Selected items from the SC work programme for 2008–2010 and (indicative) budget that require funding from the Commission's core budget (USD)

Strategic Research Activity or Project with priority identified at SC3 (Attachment O)	2008		2009		2010	
	Core	Other	Core	Other	Core	Other
1. Collection, compilation and verification of data from the fishery						
Project 14. (Priority = High) Indonesia and Philippines Data Collection Project (IPDCP)	**115,000**		**115,000**		**115,000**	
Indonesia • An outline of a full project proposal for the IPDCP 2008-2010 in Indonesia was reviewed by the Steering Committee on the IPDCP and briefed at the SC3. USD61,000 is proposed for each year for 2008-2010 to be funded from the General Account Fund. • A preliminary research was commenced in June 2007 with a support of USD 30,000 from the Commission. Its progress report was provided at the 4th Steering Committee. Philippines • The Philippines has successfully finished two-year IPDCP in the country. It focused on the establishment of data collection system. The Commission considered the importance of the continuity of data collection in Philippines and supported Philippines basic funds to run the established system. A proposal and budget level for this continuity was submitted to the Steering Committee on IPDCP and the estimated budget agreed for each year of the period 2008-2010 was USD54,000.							
Project 16. (Priority = Medium) Publication and distribution of Commission's training and educational materials.	**7,500**		**7,500**		**7,500**	
• SWG conveners may recommend items to be published and distributed for the Commission's work. For example, during 2007 additional guides were developed by the FT-SWG on longline and purse seine bycatch species. Funding support to provide colour reprints of these guides as well as tuna guides in languages deemed useful for Commission objectives. • Includes development of training materials and the production of material to facilitate the identification of target and non-target species by fishermen, observers, and port samplers with the objective of improving data quality.						

2. Monitoring and Assessment of Stocks						
2a. Stock assessment and modeling						
Project 26. (Priority = High) - NEW **Revised Stock assessment on southern swordfish**	**7,500**	**110,000**				

- CMM 2006-03 states that "The Commission will review this measure in 2008 on the basis of advice from the scientific committee following their consideration of an updated swordfish stock assessment…" and so this became a SA-SWG priority.
- This species is not one of the principal target species assessed by the SPC-OFP but is an important target species for a number of CCMs. Australian and New Zealand scientists are proposing to undertake this work but are seeking some funds from the Commission as the research is directly addressing a request from the Commission and will have broader regional benefits. Funding from the Commission would also help secure funds from funding sources from Australia and New Zealand.

2b. Biological Studies						
Project 35. (Priority = High) **Refinement of bigeye parameters Pacific-wide: A comprehensive review and study of bigeye tuna reproductive biology.**	**15,000**		**30,000**	**170,000**	**30,000**	**170,000**

Objectives

- To obtain accurate scientific information on maturity, spawning locations, sex ratios, and fecundity for inclusion in stock assessments of bigeye (including yellowfin and albacore) tuna in the Pacific Ocean.

Items to be considered as a joint research between IATTC and WCPFC

- Based on tagging studies to date, the movements of bigeye are geographically restricted. The limited amount of mixing across the Pacific Ocean can create differences in life history characteristics as a function of differences in oceanography and genetic structure. Therefore, obtaining size and age based estimates of bigeye reproductive characteristics from spatial strata across the Pacific Ocean would be useful for inclusion in bigeye stock assessments, since current estimates are based on inadequate spatial strata and limited sample sizes to have much confidence for inclusion in Pacific-wide assessments.

Funding

- The level of required budget may depend on the scope and duration of such biological researches in a joint proposal. The anticipated duration for bigeye biological study is 3 years with a rough amount of USD 400,000.

- Budget can be shared with IATTC, a preliminary study for feasibility in 2008 (USD 15,000) and two-year project $200,000 each year for 2009 and 2010. Any specific research and analysis requested by the Commission will be supported by the Commission's core budget.
- In addition, obtaining adequate numbers of bigeye samples may require a collaborative sampling effort by scientists from China, Japan, Korea, and Taiwan from their nation's commercial and research long-line vessels.

Notes

- It is important to address some of the outstanding issues related to the biological parameters for bigeye, but we also need to ensure work is done on other species for which much less data are available. Hopefully, the priority species will identify themselves through the Ecological Risk Assessment process. In the WCPO, we have a range of similar or even more critical issues related to yellowfin and albacore tuna.
- Though this is a high priority project, there appears to be no expectations of SPC-OFP support here.

Project 39. (Priority = High) - NEW Regional study of the stock structure and life-history characteristics of South Pacific albacore.	**25,000**	**190,000**	**25,000**	**190,000**	**25,000**	**190,000**

- This project was identified as a BI-SWG priority and a proposal to undertake this work is being developed by Australia and conjunction with New Zealand, SPC-OFP and other CCMs (e.g. New Caledonia, French Polynesia, FFA countries). It may directly addresses stock assessment needs for one of the principal target species in the WCPO and will be of direct benefits to a range of CCMs.
- Funding from the Commission would also help secure funds from funding sources from Australia and New Zealand. A better description of the work and justification for the funding requested from WCPFC will be available during the WCPFC4, if necessary.

3. Monitoring and assessment of the ecosystem						
Project 42. (Priority = High) Pacific-wide tagging project	**10,000**		**10,000**	**2,500,000**	**10,000**	**2,500,000**

Objectives: The main objectives of these tuna tagging experiments are to obtain information on movement, stock structure, growth, mortality, behaviour, habitat utilization, and vulnerability for use in stock assessments for yellowfin, bigeye and skipjack tuna.

Progress of Pacific-wide tagging project (Joint tagging between IATTC and WCPFC)

- Phase-1 tagging project was done in PNG waters. A Phase-2 tagging project was proposed at SC3.
- IATTC are holding a tagging workshop in October 2007.

Level of budget and funding

- Funding is a limiting factor for Pacific Ocean tuna tagging experiments and should be sought from a broad range of sources, including member and non-member countries with substantial financial interests in these fisheries, GEF, and non-governmental organizations, particularly foundations interested in supporting scientifically based tuna conservation efforts.
- The budget required for a 2 year pan-Pacific tagging project would need at least USD 9 million to do a wide coverage project in the WCPFC-CA alone. Approximately USD 2.4 million has been identified through SPC projects. To provide some additional perspective, the IOTC tagging project over 3 years in a much smaller area than the Pacific (or even the WCPFC-CA) cost USD 19 million.
- The core budget will be used for the coordination of the project, including having a workshop, consultancy, and travel fee for the participation of experts.

Sub-projects included

- Undertake a preliminary analysis of the vertical distribution of skipjack, yellowfin and bigeye tuna associated with fish aggregation devices, as indicated by acoustic tagging data. Scientists from other CCMs will participate in this project and related data analysis.
- Ongoing and newly funded research with sonic and archival tags in Hawaii, PNG and other areas.

Project 43. (Priority = High) **Ecological Risk Analysis, including PSA.**	**130,000**		**130,000**		**130,000**	

- On-going ERA Work Programme was presented to SC3 and the substance of the ERA Research Plan was endorsed as a three-year project by the SC3.
- Annual budget includes USD30,000/year for identifying areas of spatial and temporal overlap of seabird and sea turtle interactions with tuna fisheries and estimating seabird mortality as requested from CMM-2006-02.
- More details on the project and priority of this project relative to other projects will be provided at WCPFC4, if necessary.

Project 56. (Priority = Medium) - NEW **Utilize underwater videos and other tools to characterize species, size composition and spatial distribution of tunas aggregating around floating objects.**	**5,000**					

• Utilize underwater videos and other tools to characterize species, size composition and spatial distribution of tunas aggregating around floating objects as a FT-SWG Priority • The unit used in the EPO by IATTC cost approximately $3000. On advice from IATTC, it will likely be necessary that gear be suitable to depths of at least 100 m due to deeper thermocline and mixed layer depth in the WCPO. This will require greater pressure ratings and length of cables.						
4. Evaluation of management options						
Project 57. (Priority = High) - NEW Development of Scoping Paper, and draft Work Plan, on the potential costs, benefits and difficulties of alternative approaches for identification of appropriate reference points and implementation of an MSE within the WCPO.	**10,000**		**10,000**		**10,000**	
• Development of Scoping Paper, and draft Work Plan, on the potential costs, benefits and difficulties of alternative approaches for identification of appropriate reference points and implementation of an MSE within the WCPO • This project was a ME-SWG Priority and recommended by the SC3 to be undertaken in 2008. • Research will be continued to further develop and refine the Commission's management tool. A workshop will be considered and CCMs may be able to fund travel for their respective scientists to participate in this process.						
Project 60. Unallocated budget			**60,500**		**66,550[a]**	
• This contingency fund is prepared for any scientific research, analysis or project as requested by the Commission. Based on the amount of USD 55,000 for 2008, 10% of annual inflation rate was applied for 2009 and 2010.						
SUB-TOTAL (NON SPC-OFP SERVICES)	**325,000**	**300,000**	**388,000**	**2,860,000**	**394,050**	**2,860,000**
TOTAL SPC-OFP	**713,104**		**N/A**		**N/A**	
SUB-TOTAL (SPC-OFP SERVICES minus SPC-OFP subsidy)	**325,000**		**357,500**		**393,250[a]**	
GRAND TOTAL minus SPC-OFP subsidy	**650,000[b]**	**300,000**	**745,500**	**2,860,000**	**787,300**	**2,860,000**

[a] An annual increase of 10% was applied.
[b] An increase of USD15,000 from the indicative budget of USD625,000

312. A more thorough review of projects funded during the previous year should be undertaken at each SC meeting.

313. While not preventing the SC from forwarding its recommendation on the work programme and provisional budget to the Commission for consideration and approval, Japan requested that further cost-saving efforts should be sought in order to reduce the total budget level and to accommodate the many research requests under the restricted budget, and that developed members should mobilize their own financial resources for the proposed research rather than asking for a pay-back of the core budget. Japan also emphasized that the core budget should be utilized to maximize the benefit of a wider range of members in particular developing states, in an equitable manner.

AGENDA ITEM 10 — ADMINISTRATIVE MATTERS

10.1 Rules of procedure

314. The Vice-Chair (Keith Bigelow) provided a summary of the history of the development of Rules of Procedure for the Commission's subsidiary bodies. He noted that during the SC an informal working group reviewed intersessional comments (Chinese Taipei, FFA, Japan, New Zealand and the USA) on the current status of the Rules of Procedure, but could not reach consensus on this issue.

315. Several CCMs commented favorably on a suggestion by Chinese Taipei that the SC mandates the Executive Director to informally consult with all CCMs in order to consolidate their different views on the existing draft Rules of Procedure. This consultation should be conducted and a report prepared for presentation to SC4. The Executive Director should also provide a recommendation on this matter to WCPFC4 for its consideration, or at the latest, to WCPFC5.

316. Niue stated that FFA members support the draft Rules of Procedure recommended by SC2, noting that they were drafted to be applicable to all subsidiary bodies of the WCPFC. FFA members have consistently stated that for simplicity there should be a single set of Rules of Procedure for all subsidiary bodies. Given that the SC has twice considered this issue and that the Northern Committee (NC) and the Technical and Compliance Committee (TCC) are yet to consider in great detail their respective Rules of Procedure, FFA members propose that the SC's draft Rules of Procedure (as recommended by SC2) be maintained in their current form. FFA members further proposed that the SC recommends its draft Rules of Procedure to TCC and NC for their consideration before the SC gives this issue further consideration.

317. China insisted that the Rules of Procedure should comply with the principles of the Commission's Rules of Procedure. China has different opinions on some items in draft Rules of Procedure.

318. Japan suggested that given the difficulty of obtaining a consensus position on this issue, it should be referred back to the Commission for guidance.

319. The USA commented that proposals by Chinese Taipei and FFA members were not mutually exclusive and could be combined.

320. Recommendation: The SC recommended that the Executive Director consult with CCMs regarding the issue of Rules of Procedure for subsidiary bodies and, taking into account the comments tabled at, or provided during, the SC on the draft Rules of Procedure recommended by

SC2, and any comments provided by NC3 and TCC3, provide to WCPFC4 options for progressing this issue.

10.2 Independent review of the science structure and functions of the Commission

321. The Vice-Chair presented the outcomes of an Informal Small Group that considered issues associated with the proposed Independent Review of the Commission's Transitional Science Structure and Functions (SC3-ISG-WP-7). The SC made recommendations on the proposed review's scope, steering committee, terms of reference for the steering committee, reviewer attributes, dissemination of expressions of interest, budget and indicative schedule (Attachment P).

10.3 Future operation of the Scientific Committee

322. The Vice-Chair presented several of his suggestions regarding the future operation of the SC so that it can achieve its primary objective of providing scientific advice on Commission requests and making recommendations on resource status and fisheries impacts. These suggestions included consideration of whether or not informal small working groups successfully produce draft text on a particular agenda item. On the issue of efficiency, the Vice-Chair asked how the SC could reduce repetition in the consideration of papers and discussion of issues, queried the scientific value in technical discussions occurring within the SWG context and broader discussions in the Scientific Committee plenary, queried whether or not all SWGs need to meet annually, sought suggestions for a mechanism for improved flow of information from information papers, queried whether some of the SC's work could be done during sessions dedicated to a particular issue, and whether a particular issue could be added to a meeting of another forum (e.g. Pelagic Fisheries Research Program, Pacific Science Forum).

323. In response to a question from the EC regarding whether all meeting papers should be classified as working papers and the Chair deciding which papers should be presented, the Vice Chair said that there should be a distinction between working papers and information papers. On this issue, the USA commented that information papers should be relevant to the terms of reference of the group to which they are submitted, e.g. working papers should be supported by relevant information papers.

324. Several CCMs supported Canada's comments that 1) at SWGs, participants should be considered as scientists, not as CCM delegates, 2) SWG time should not be spent clearing SWG reports while ensuring due process, and 3) steps should taken to strengthen the scientific output of the SC in a fair and transparent manner.

325. The SC noted that many policy and administrative issues had been raised at SC3. It was difficult to prevent this, although the Chair, Vice-Chair, and Secretariat might have a role in insuring that agendas of future meetings are focused on providing scientific advice to the Commission.

326. Chinese Taipei suggested that to improve independence and efficiency, the use of professional rapporteurs should be considered. It was further suggested that SC meetings would benefit from the presence of a legal advisor to provide professional advice on legal matters.

327. Papua New Guinea commented that consideration should be given to ensuring that Pacific Island scientists are not disadvantaged but are given every opportunity to participate in all

SC and SC-associated meetings to develop their understanding of all science issues relating to the management of tuna and other highly migratory fish stocks in the region.

328. The Vice-Chair, in thanking delegations for their suggestions, stated that efforts would be made to implement transitional improvements to SC processes.

10.4 Review of Part 1 of the Annual Report to the Commission

329. Papua New Guinea presented the outcomes of the Informal Small Group that considered the issue of a Review of Part 1 of the Annual Report to the Commission (SC3-ISG-WP-8), noting that consensus was achieved on 90% of the proposed template. By default, this means that the Commission will continue to use the current format approved by WCPFC2.

330. The SC agreed to continue its consideration of this issue at SC4.

10.5 Next meeting

331. The SC accepted Papua New Guinea's offer to host SC4 at Port Moresby from 11–22 August 2008.

AGENDA ITEM 11 — OTHER MATTERS

11.1 Priorities for stock assessment for 2008

332. The SC recommended that the following species be fully assessed in 2008, subject to the completeness of SPC-OFP's data holdings:

1) WCPO bigeye (with consideration given to a Pacific-wide bigeye stock assessment with IATTC);
2) South Pacific albacore; and
3) WCPO skipjack (2008/2009).

AGENDA ITEM 12 — ADOPTION OF REPORT

12.1 Adoption of the Summary Report and Executive Summary of the third regular session of the Scientific Committee

333. The Summary Report and the Executive Summary of the Third Regular Session of the Scientific Committee were adopted by consensus.

AGENDA ITEM 13 — CLOSE OF MEETING

334. In closing the meeting, the Chair thanked, on behalf of the SC, the Government of the USA for hosting SC3. He also thanked all staff of the Western Pacific Regional Fisheries Management Council and NMFS Pacific Islands Fisheries Science Center and all participants for their wonderful preparation and contributions to the meeting. He thanked again the Vice-Chair, SWG convenors, Informal Small Group facilitators, rapporteurs, and the staff of the Secretariat for their hard work throughout the meeting. The Chair acknowledged the financial support provided by the Commission.

335. In responding to the Chair's closing remarks, the Executive Director also thanked all participants for their cooperation and collaboration and highlighted meeting outcomes. He also expressed appreciation to the government of the USA for its significant support to the meeting. Augustine Mobiha, on behalf of the FFA, thanked all participants for working together to address various issues and expected to see everyone next year in Port Moresby. Christofer Boggs also added thanks from the USA in appreciation for all participants coming to Honolulu and truly appreciated being able to host the meeting.

336. The meeting was closed on Friday, 24 August 2007.

Commission for the Conservation and Management of Highly Migratory Fish Stocks in the Western and Central Pacific Ocean

Scientific Committee
Third Regular Session

Honolulu, HI, U.S.A.
13-24 August 2007

ATTACHMENTS

Attachment A

The Commission for the Conservation and Management of Highly Migratory Fish Stocks in the Western and Central Pacific Ocean

Scientific Committee
Third Regular Session

Honolulu, HI, USA
13–24 August 2007

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Attachment B

Commission for the Conservation and Management of Highly Migratory Fish Stocks in the Western and Central Pacific Ocean

Scientific Committee
Third Regular Session

Honolulu, HI, USA
13–24 August 2007

WELCOME ADDRESS
by
SAMUEL POOLEY
Director, NOAA Pacific Islands Fisheries Science Center

Aloha and good morning. On behalf of the United States and the Pacific Islands Fisheries Science Center I would like to warmly welcome everyone to the Third Regular Session of the Scientific Committee of the Western and Central Pacific Fisheries Committee.

The agenda for this meeting is ambitious as befits the tasks ahead of the Commission. I am aware that you the scientists from the member countries and from the Commission's scientific consultants have been working very hard over the past year to enhance our understanding of these fisheries and fish stocks in order to make available the best scientific information for conserving and managing these species. Now is the time to bring all this information together to provide pragmatic advice to the Commission. I am sure you will work in a spirit of consensus, and I am also sure you will have a successful meeting.

With that said, let me also acknowledge our partners in providing the venue for this year's meetings: the Pacific Islands Regional Office of NOAA Fisheries and the Western Pacific Fisheries Management Council. We hope you find everything to your liking.

Finally, although we like to think of Hawaii as paradise, we are in the middle of the Pacific Ocean and are subject to the occasional natural calamity. The weather has conspired to send a tropical storm in this direction, and the small possibility of earthquakes and tsunamis is always present. With that in mind, please read the disaster preparedness materials provided by your hotel or ask any of our host staff or the Convention Center staff for guidance. Safety first.

On that cheery note, have a good meeting and good luck.

Attachment C

Commission for the Conservation and Management of Highly Migratory Fish Stocks in the Western and Central Pacific Ocean

Scientific Committee
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OPENING STATEMENT
by
EXECUTIVE DIRECTOR
WCPFC Secretariat

Officials representing Honolulu, State of Hawaii and US Federal Offices, Distinguished representatives from CCMs, Observers and Ladies and Gentlemen,

On behalf of the WCPFC Chair, Mr Glenn Hurry, and the Secretariat I welcome you all to the Third Regular Session of the WCPFC Scientific Committee. I would like to extend a special welcome to the delegations from the United States, Guam, Commonwealth of Northern Mariana Islands and American Samoa who are participating in the work of the Commission for the first time as full members. Congratulations to all those involved in getting the ratification of the Convention through the system – we all know that it was a demanding task.

Again we have a very full agenda in both the Specialist Working Group and the plenary sessions.

While we continue to concentrate the work of the Scientific Committee on the requirements and requests of the Commission in respect of its work relating to conservation and management measures for target and non-target species I would like to take this opportunity to focus on a specific (albeit broad) issue that will benefit from some increased debate and consideration in the Scientific Committee.

The functions of the Scientific Committee, which include the review of assessments and analyses for target stocks, non-target or associated or dependent species in the Convention Area, is critically dependent on the quality of data that is available to inform these assessments and analysis. I would like to focus this Opening Statement on very serious challenges that we are facing here in this Commission – the significant gaps in our data holdings.

Comprehensive data is a basic requirement for providing quality scientific advice to fishery managers – our Commission. A quick review of the paper on data gaps to be discussed in the Statistics Specialist Working Group (ST IP1) highlights the areas of the WCPO fishery where data is poor. It covers:

- operational catch and effort data for both in-zone and high seas operations for fleets and fisheries targeting highly migratory species,
- aggregated stock wide data, area and species specific catch composition data,
- by-catch data,
- obviously data relating to IUU activities in the WCPF Convention Area, and

- biological data – which is particularly important if we are to advance our efforts to promote an ecosystems approach to managing the fisheries.

There is no doubt that, collectively and individually for many CCMs, significant additional effort is required to address these fundamental concerns.

One important means to start addressing some of these gaps is through expanded support for activities that provide full-coverage data to verify catch at the vessel trip level, such as through observer programmes, and programmes that capture unloadings and transshipment data. The Committee should give some detailed consideration to initiatives such as these as a means to start addressing some of the more obvious data deficient areas impacting our work.

The Indonesia Philippines Data Collection Project is one Commission initiative that is attempting to address come quite challenging data-related challenges in the western region of the Convention Area. Some useful work has been supported in the Philippines over the last few years and an initial workshop to start a related activity in Eastern Indonesia took place in Jakarta early this year. As these western fisheries account for approximately 15% of the total WCPO tuna catch, and 30% of the yellowfin catch, it is critically important that adequate information be available from them to support scientific work in the Commission. While the Commission has stated that CCMs need to take some responsibility for basic obligations such as data provision, there is a need to continue to support the work started by the IPDCP for some considerable time yet. I hope that many of you will be able to participate in the IPDCP Steering Committee meeting scheduled for later this week so that together we may consider means to address this additional area of need.

Another important data-related Steering Committee will also meet this week – the Regional Tagging Steering Committee. This group will review the results and experience of the successful tagging exercise that was completed during two 3-month field exercises in PNG in late 2006 and early 2007 during which 62,000 skipjack, yellowfin and bigeye tuna were tagged. Drawing on the direction provided by the Commission's Strategic Research Plan, which was adopted at last year's Commission meeting, the review will be used to prepare a proposal to expand this initial tagging effort to the equatorial tropical Pacific. Initial drafts of a proposal, which have benefited from contributions from a large number of scientists experienced in the implementation of tagging programmes, look very comprehensive. Large-scale tagging is the only methodology that we have for highly migratory species that can provide fishery-independent data, which is critical for robust stock assessments. It is therefore hoped that this initiative will find wide-spread support in the Commission.

One of the central issues to be discussed over the next two weeks is the matter of FAD-associated fisheries and the implications for the bigeye and yellowfin resources. The Fishing Technology Specialist Working Group will start the exchange of information and discussion on this important topic. We are hopeful that representatives from industry will fully engage - sharing their information and experience in this important area. I hope that during this discussion we can focus on the science that will support the Commission's consideration of a Conservation and Management Measure for FAD-associated fisheries at WCPFC4, as called for at the last session of the Commission. Implementation and policy considerations associated with such a Measure are the concern of our Technical and Compliance Committee and the Commission itself. Our discussion needs to focus on scientific matters associated with FAD-related fisheries - such as the analysis from SPC which identifies spatial and temporal patterns for juvenile bigeye catches in WCPO purse seine fisheries (SA WP4). Understanding the impact of FADs on small tuna behavior and distribution, biology and vulnerability to different gears are all potentially important areas of future research that the Scientific Committee can usefully provide guidance on. Not only

is the Commission looking to the Scientific Committee for advice in respect of its commitment to adopt a FAD-related Measure at this year's Commission meeting but CCMs will benefit from such discussion in the lead up to the preparation of FAD Management Plans which are called for in CMM-2006-01 by 1st January 2008.

There are several other important issues before us this next two weeks, including matters relating to by-catch and consideration of reference points. However, I think I will close by drawing your attention to the item concerning the independent review of the interim arrangements for the science structure and function of the Commission. The Preparatory Conference envisaged that such a review would be required in the period 3-5 years after the Commission became operational. The possibility of a review was on the agenda of both previous meetings of the Scientific Committee and is again tabled for discussion at this meeting. I hope that, as we progress through the agenda of this meeting and reflect on the arrangements for science services to the Commission during the last two years, we can draw on that experience to identify the key issues that should be addressed during any review aimed at securing the best available scientific advice for the Commission.

Before finishing I would like to express appreciation to a large group of people who have contributed to the planning and preparations for this meeting since early in the year. In addition to the Chair, Dr Dae Yeon Moon, and the two individuals who served in the role of Vice-Chair for different periods since our last meeting (firstly Dr Shelton Harley of New Zealand and Keith Bigelow from the USA), John Hampton and the staff of the SPC-OFP, Bill Robinson and Sam Pooley and their staff at NOAA Pacific Islands Region Office, Kitty Simmonds, Paul Dalzell and the staff of the Western and Central Pacific Regional Fishery Management Council, all Conveners and the Commission's Science Manager, SungKwon Soh and our staff in the office at Pohnpei who have provided invaluable support. It has been a tremendous team effort which has taken up a lot of personal time for these people. I just hope that their efforts are suitably rewarded with a productive meeting that generates sound practical advice and recommendations for the Commission.

Thank you.

Attachment D

Commission for the Conservation and Management of Highly Migratory Fish Stocks in the Western and Central Pacific Ocean

Scientific Committee
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AGENDA FOR THE THIRD REGULAR SESSION OF THE SCIENTIFIC COMMITTEE

AGENDA ITEM 1 OPENING OF MEETING

1.1 Welcome address
1.2 Election of Vice-Chair
1.3 Adoption of agenda
1.4 Meeting arrangements
1.5 Reporting arrangements
1.6 Intersessional activities of the Scientific Committee

AGENDA ITEM 2 REVIEW OF FISHERIES

2.1 Overview of western and central Pacific Ocean (WCPO) fisheries
2.2 Overview of eastern Pacific Ocean (EPO) fisheries
2.3 Fishery reports from members, participating territories and cooperating non-members (CCMs)
2.4 Reports from regional fisheries bodies and other organizations

AGENDA ITEM 3 SPECIALIST WORKING GROUPS (SWGs)

3.1 Reports of SWGs
3.2 Adoption of the reports of the SWGs, including advice and recommendations

AGENDA ITEM 4 STATUS OF THE STOCKS AND MANAGEMENT ADVICE AND IMPLICATIONS

4.1 WCPO bigeye tuna
- **a. Status and trends**
- **b. Management advice and implications**

4.2 WCPO yellowfin tuna
- **a. Status and trends**
- **b. Management advice and implications**

4.3 WCPO skipjack tuna
- **a. Status and trends**
- **b. Management advice and implications**

4.4 South Pacific albacore tuna
- **a. Status and trends**

b. Management advice and implications

4.5 Southwest Pacific swordfish

a. Status and trends

b. Management advice and implications

4.6 Southwest Pacific striped marlin

a. Status and trends

b. Management advice and implications

4.7 North Pacific albacore

a. Status and trends

b. Management advice and implications

4.8 North Pacific striped marlin

4.9 Other Northern stocks considered by the Northern Committee

a. Status and trends

b. Management advice and implications

4.10 Other stock assessment and management-related matters

a. Review of the reference points

b. Information flow of northern stocks

c. Discards of albacore, bigeye and yellowfin in the WCPO longline fishery

d. Catch level of bigeye and yellowfin in other commercial fisheries

AGENDA ITEM 5 BYCATCH MITIGATION

5.1 Seabirds

5.2 Sharks

5.3 Juvenile bigeye and yellowfin tuna

5.4 Turtles

5.5 Ecological risk assessment

AGENDA ITEM 6 DATA AND INFORMATION

6.1 Regional Observer Programme

6.2 Data confidentiality, security, and dissemination

6.3 Indonesia and Philippines Data Collection Project (IPDCP) update and review

6.4 Tagging initiatives

6.5 Other matters

AGENDA ITEM 7 COOPERATION WITH OTHER ORGANISATIONS

7.1 Review of existing MOUs

7.2 Development of new MOUs

a. Indian Ocean Tuna Commission (IOTC)

b. Agreement for the Conservation of Albatrosses and Petrels (ACAP)

c. Secretariat of the Pacific Regional Environment Programme (SPREP)

d. Commission for the Conservation of Antarctic Marine Living Resources (CCAMLR),

7.3 Other cooperative activities

a. Coordinating Working Party on Fisheries Statistics (FAO-CWP)

b. Fishery Resources Monitoring System (FAO-FIRMS)

AGENDA ITEM 8 CONSIDERATION OF THE SPECIAL REQUIREMENTS OF DEVELOPING STATES AND PARTICIPATING TERRITORIES

8.1 Special Requirements Fund
- **a. Review of 2006/2007 activities**
- **b. Advice and recommendations to the Commission**

8.2 Other matters

AGENDA ITEM 9 FUTURE WORK PROGRAMME AND BUDGET

9.1 **Strategic Research Plan 2007–2011 for Scientific Committee**
9.2 Review of 2007 work programme
9.3 2008 work programme and budget, and 2009–2010 provisional work programme and indicative budget

AGENDA ITEM 10 ADMINISTRATIVE MATTERS

10.1 Rules of Procedure
10.2 Independent review of the science structure and function of the commission
10.3 Future operation of the Scientific Committee
10.4 Review of Part 1 of the Annual Report to the Commission
10.5 Next meeting

AGENDA ITEM 11 OTHER MATTERS

AGENDA ITEM 12 ADOPTION OF THE REORT OF THE THIRD SESSION OF THE SCIENTIFIC COMMITTEE

12.1 Adoption of the Summary Report and Executive Summary of the Third Regular Session of the Scientific Committee

AGENDA ITEM 13 CLOSE OF MEETING

Attachment E

The Commission for the Conservation and Management of Highly Migratory Fish Stocks in the Western and Central Pacific Ocean

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ABBREVIATIONS AND ACRONYMS USED

ACAP	Agreement for the Conservation of Albatross and Petrels
AIDCP	Agreement on the International Dolphin Conservation Program
ALB	Albacore (*Thunnus alalunga*)
$B_{current}$	average biomass over the designated current period
B_t	biomass at year t (used in projections)
BET	bigeye tuna (*Thunnus obesus*)
BI-SWG	Biology Specialist Working Group
B_{MSY}	biomass that will support the maximum sustainable yield
c&f	cost and freight
CCAMLR	Commission for the Conservation of Antarctic Marine Living Resources
CCM	Members, Cooperating Non-members and participating Territories
CCSBT	Commission for the Conservation of Southern Bluefin Tuna
COFI	Committee on Fisheries (FAO)
the Commission	The Commission for the Conservation and Management of Highly Migratory Fish Stocks in the Western and Central Pacific Ocean
the Convention	The Convention for the Conservation and Management of Highly Migratory Fish Stocks in the Western and Central Pacific Ocean
the Convention Area	The area of competence of the Commission
CPUE	catch per unit of effort
CSIRO	Commonwealth Scientific and Industrial Research Organization (Australia)
DWFN	distant water fishing nation
EB-SWG	Ecosystems and Bycatch Specialist Working Group
EEZ	exclusive economic zone
ENSO	El Niño-Southern Oscillation
EPO	Eastern Pacific Ocean
ETBF	Eastern Tuna and Billfish Fishery (Australia)
EC	European Community
EU	European Union
F	fishing mortality rate

FAD	fish aggregating device
FAO	Food and Agriculture Organization of the United Nations
$F_{current}$	average fishing mortality over the designated current period
FFA	Pacific Islands Forum Fisheries Agency
FIGIS	Fisheries Global Information System
FIRMS	Fishery Resource Monitoring System
FL	fork length
F_{MSY}	fishing mortality that will support the maximum sustainable yield
FSM	Federated States of Micronesia
FSMA	Federated States of Micronesia Agreement
FT-SWG	Fishing Technology Specialist Working Group
F/V	fishing vessel
GEF	Global Environment Facility
GLM	generalized linear model
GRT	gross registered tonnage
GSI	gonad somatic index
HBF	hooks between floats
IATTC	Inter-American Tropical Tuna Commission
ICCAT	International Commission for the Conservation of Atlantic Tunas
IOTC	Indian Ocean Tuna Commission
IPDCP	Indonesia and Philippines Data Collection Project
ISC	International Scientific Committee for Tuna and Tuna-like Species in the North Pacific Ocean
IUU	illegal, unregulated and unreported fishing
m	meters
ME-SWG	Methods Specialist Working Group
MFCL	MULTIFAN-CL (a stock assessment modeling approach)
MOU	memorandum of understanding
MSY	maximum sustainable yield
mt	metric tons
NZAID	New Zealand Agency for International Development
OFP	Oceanic Fisheries Programme of the Secretariat of the Pacific Community
pa	per annum
PFRP	Pelagic Fisheries Research Program (Hawaii, US)
PNA	Parties to the Nauru Agreement
PNG	Papua New Guinea
PSA	productivity susceptibility analysis
RFMO	regional fisheries management organization
RMI	Republic of the Marshall Islands
SA-SWG	Stock Assessment Specialist Working Group
SEAPODYM	spatial ecosystem and population dynamics model
SKJ	skipjack tuna (*Katsuwonus pelamis*)
SPC	Secretariat of the Pacific Community
SSB	spawning stock biomass

SST	sea surface temperature
ST-SWG	Statistics Specialist Working Group
STFO	small tuna on floating objects
SWG	Specialist Working Group
TAC	total allowable catch
TCC	Technical and Compliance Committee of the WCPFC
TOR	terms of reference
TUFMAN	Tuna Fisheries Management Database
UNCLOS	1982 United Nations Convention on the Law of the Sea
USA	United States of America
WCPFC	Western and Central Pacific Fisheries Commission (the Commission)
WCPO	Western and Central Pacific Ocean
WWF	World Wildlife Fund
YFT	yellowfin tuna (*Thunnus albacares*)

Attachment F

The Commission for the Conservation and Management of Highly Migratory Fish Stocks in the Western and Central Pacific Ocean

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LIST OF DOCUMENTS

MEETING INFORMATION PAPERS

WCPFC-SC3-2007/01	Meeting notice and information
WCPFC-SC3-2007/02	Provisional agenda for the meeting
WCPFC-SC3-2007/03	Provisional annotated agenda for the meeting
WCPFC-SC3-2007/04	Indicative schedule for the meeting
WCPFC-SC3-2007/05	Registration form
WCPFC-SC3-2007/06	List of documents
WCPFC-SC3-2007/07	Guidelines in submitting Specialist Working Group (SWG) papers

GENERAL PAPERS

Working Papers		
GN-WP-1	SPC. **Overview of tuna fisheries in the western and central Pacific Ocean, including economic conditions – 2006**.	
GN-WP-2	IATTC. **The fishery for tunas and billfishes in the eastern Pacific Ocean in 2006**.	
GN-WP-3	Secretariat. **Discussion paper for the inclusion of northern striped marlin as a** "**northern stock**" **in accordance with Annex 1 of the Commission's Rules of Procedure**.	
GN-WP-4	Secretariat. **The relationship between the International Scientific Committee, the Northern Committee and the Scientific Committee in respect to the northern stocks**.	**Moved to GN-IP-2**
GN-WP-5	SPC. **Report of the Ecological Risk Assessment (ERA) Workshop,** 6–9 August 2007, Honolulu, USA.	**Refer to EB-WP-3**
GN-WP-6	Secretariat. **WCPFC data standards for regional observer programme.**	
GN-WP-7	Secretariat. **Report of the Fourth Steering Committee on IPDCP,** 14–15 August 2007, Honolulu, USA.	

GN-WP-8	Secretariat. **Report of the Eastern Indonesia Tuna Fishery Data Collection Workshop,** 30–31 January 2007, Jakarta, Indonesia.	
GN-WP-9	SPC. **PNG tagging project: progress report**.	
GN-WP-10	SPC. **Regional tuna tagging: Phase 2 proposal**.	
GN-WP-11	Secretariat. **Cooperation with other organizations**.	
GN-WP-12	Secretariat. **The Coordinating Working Party on Fisheries Statistics (FAO-CWP)**.	
GN-WP-13	Secretariat. **The Fishery Resources Monitoring System (FAO-FIRMS)**.	
GN-WP-14	SPC. **Report on the 2007 Stock Assessment Workshops for the Oceanic Fisheries Management Project**.	
GN-WP-15	Secretariat. **Independent review of the Commission's transitional science structure and functions**.	
Information Papers		
GN-IP-1	Secretariat. **Review of Part 1 of the Annual Report to the Commission**.	
GN-IP-2	Secretariat. **The relationship between the International Scientific Committee, the Northern Committee and the Scientific Committee in respect to the northern stocks**.	
GN-IP-3	Secretariat. **Issues arising from WCPFC3, 11–15 December 2006, Apia, Samoa.**	
GN-IP-4	Secretariat. **Intersessional activities of the Scientific Committee [For SC3].**	
GN-IP-5	ISC. **Report of the Seventh Meeting of the International Scientific Committee for Tuna and Tuna-like Species in the North Pacific Ocean** (Plenary Report Only)**.**	
GN-IP-6	Secretariat. **Agenda Item 9.2 Review of 2007 Work Programme.**	
GN-IP-7	Secretariat. **Report of the fourth meeting of the IPDCP Steering Committee**.	

BIOLOGY SPECIALIST WORKING GROUP (BI-SWG)

BI-SWG Working Papers		
BI-WP-1	Young, J., R. Humphreys, and J. Uchiyama. **Comparison of swordfish maturity and ageing from Hawaiian and Australian waters**. CSIRO Marine and Atmospheric Research Hobart Australia, and NMFS, NOAA Aiea Labs Hawaii.	
BI-WP-2	Sun, C.-L., C.-H. Liu, and S.-Z. Yeh. **Age and growth of black marlin (*Makaira indica*) in waters off eastern Taiwan.** Institute of Oceanography, National Taiwan	

	University.	
BI-WP-3	Holdsworth, J.C., T.J. Sippel, and P.J. Saul**. An investigation into swordfish stock structure using satellite tag and release methods**. Blue Water Barine Research Ltd, New Zealand.	
BI-WP-4	Leroy, B., D.G. Itano, and S. Nicol. **Preliminary analysis and observations on the vertical behaviour of WCPO skipjack, yellowfin and bigeye tuna in association with anchored FADs, as indicated by acoustic and archival tagging data.** Secretariat of the Pacific Community, Oceanic Fisheries Programme, Noumea, New Caledonia; Pelagic Fisheries Research Program, University of Hawaii, JIMAR, Honolulu, Hawaii, USA.	
BI-WP-5	Matsumoto, T. et al. **Report of the ongoing tagging project on tropical tunas in the southern part of Japan.** National Research Institute of Far Seas Fisheries, Shimizu, Japan.	
BI-SWG Information Papers		
BI-IP-1	Smith, P.J., B. Diggles, and S. Kim. **Evaluation of Parasite Markers to Assess Swordfish Stock Structure**. National Institute of Water and Atmosphere Research, New Zealand.	
BI-IP-2	Davies, N.M. and L. Griggs. **Port sampling in New Zealand of tuna longline catches for swordfish (*Xiphias gladius*) size composition in 2005–06**. National Institute of Water and Atmospheric Research Ltd., New Zealand.	
BI-IP-3	Dagorn, L., K.N. Holland, and D.G. Itano. **Behavior of yellowfin (*Thunnus albacares*) and bigeye (*T. obesus*) tuna in a network of fish aggregating devices (FADs).** IRD, HIMB, and PFRP.	
BI-IP-4	Semba, Y. **Introduction of experimental tagging research for bigeye tuna in the East off Japan.** National Research Institute of Far Seas Fishery, Fishery Research Agency, Japan.	

ECOSYSTEM AND BYCATCH SPECIALIST WORKING GROUP (EB-SWG)

EB-SWG Working Papers		
EB-WP-1	Kirby, D. et al. **Ecological Risk Assessment for species caught in the WCPO tuna fishery: updated Productivity-Susceptibility Analysis**. Secretariat of the Pacific Community, Noumea, New Caledonia.	
EB-WP-2	Kirby, D. et al. **Regime shifts in the western and central Pacific Ocean**. Secretariat of the Pacific Community, Noumea, New Caledonia.	
EB-WP-3	Kirby, D. et al. **Ecological Risk Assessment Research Planning Workshop Report**. Secretariat of the Pacific	

	Community, Noumea, New Caledonia.	
EB-WP-4	Hindmarsh, S. **A Review of Fin-weight Ratios for Pelagic Sharks**. Bureau of Rural Sciences, Canberra, Australia.	
EB-WP-5	Ward, P., E. Lawrence, R. Darbyshire and S. Hindmarsh. **Large-scale experiment shows that banning wire leaders helps pelagic sharks and longline fishers**. Bureau of Rural Sciences, Canberra, Australia.	
EB-WP-6	Black, A., C. Small and B. Sullivan. **Recording seabird bycatch in longline observer programmes**. BirdLife International, BirdLife Global Seabird Programme, UK.	
EB-WP-7	Boggs, C.H. and Y. Swimmer. **Developments (2006-2007) in scientific research on the use of modified fishing gear to reduce longline bycatch of sea turtles**. NOAA Fisheries, Honolulu, USA.	
EB-WP-8	Norris, W. and S. Brouwer. **TCC Draft Report and Information Paper of the Voluntary Small Working Group on Seabird Bycatch Mitigation**. Australian Fisheries Management Authority, Canberra, Australia. Ministry of Fisheries, Wellington, New Zealand.	
EB-WP-9	Swimmer, Y. [1], M. Chaloupka[2], L. M^{c}Naughton[3], M. Musyl[3]. **Bayesian hazard regression modelling of factors affecting post-release mortality of loggerheads caught in pelagic longline fisheries**. [1] National Marine Fisheries Service, Pacific Island Fisheries Science Center, Honolulu, USA. [2] Ecological Modelling Services P/L, University of Queensland, St Lucia, Australia. [3] Joint Institute for Marine and Atmospheric Research, University of Hawaii, Hawaii, USA.	
EB-WP-10	Kleiber, P. [1], S. Clarke[2], K. Bigelow[1], M. McAllister[3]. **North Pacific blue shark stock assessment**. [1] NOAA Fisheries, Honolulu, Hawaii, USA. [2] Imperial College London, United Kingdom. [3] University of British Columbia, Canada.	**Withdrawn**
EB-WP-11	Kim, S.-S., D.H. An, D.-Y. Moon and S.-J. Hwang. **Comparison of circle hook and J hook catch rate for target and bycatch species taken in the Korean tuna longline fishery during 2005-2006**. NFRDI, Busan, Korea.	
EB-WP-12	Secretariat. **Status of the regional observer programme intersessional working group**. WCPFC, Pohnpei, FSM.	
EB-WP-13	Yolota, K., H. Minami, M. Kiyota. **Effective factors of tori-poles in reducing incidental catch of seabirds in the Japanese longline fishery**. National Research Institute for Far Seas Fisheries, Shimizu, Japan.	
EB-WP-14	ACAP. **Seabird bycatch mitigation: minimum standards for pelagic longline fishing and priorities for further research**. Agreement on the Conservation of Albatrosses	

	and Petrels.	
EB-SWG Information Papers		
EB-IP-1	Beverly, S. and L. Chapman. **Interactions between Sea Turtles and Pelagic Longline Fisheries**. Secretariat of the Pacific Community, Noumea, New Caledonia.	
EB-IP-2	Williams, P. **Specification of a Database System to manage and facilitate access of information covering (i) By-catch and (ii) By-catch mitigation on behalf of the Western and Central Pacific Fisheries Commission (WCPFC)**. Secretariat of the Pacific Community, Noumea, New Caledonia.	
EB-IP-3	Scott, M. **IATTC Research on Reducing Shark Bycatch in the Tuna Purse-Seine Fishery in the Eastern Tropical Pacific Ocean**. IATTC, La Jolla, USA.	
EB-IP-4	Véran, S., O. Gimenez, E. Flint, W.L. Kendall, P.F. Doherty Jr., and J-D. Lebreton. **Quantifying the impact of longline fisheries on adult survival in the black-footed albatross. Journal of Applied Ecology 2007**. C.E.F.E., Centre d'Ecologie Fonctionnelle et Evolutive, Montpellier, France.	
EB-IP-5	Dutton, P.H. et al. **Status and Genetic Structure of Nesting Populations of Leatherback Turtles (*Dermochelys coriacea*) in the Western Pacific**. NOAA Fisheries, La Jolla, USA.	
EB-IP-6	Phillips, R.A., G. Tuck and C. Small. **Assessment of the impact of ICCAT fisheries on seabirds: proposed methodology and framework for discussion**. British Antarctic Survey, Cambridge UK.	
EB-IP-7	Phillips, R.A., C. Small and E. Howgate. **Studies of distribution, population dynamics and bycatch rates of seabirds in the Atlantic**. British Antarctic Survey, Cambridge, UK; CSIRO, Hobart, Australia; Seafood Choices Alliance, London, UK.	
EB-IP-8	Allain, V., T. Essington, R. Olson, T. Okey, J. Dambacher, D. Kirby and S. Nicol. **An Ecopath with Ecosim model of the WCPO warm pool pelagic ecosystem**. Secretariat of the Pacific Community, Noumea, New Caledonia.	
EB-IP-9	Allain,V. [1], J.-A. Kerandel [1], S. Andréfouët [2], F. Magron [1], M. Clark [3], and F. Muller-Karger [4]. **Enhanced seamount location database for the western and central Pacific Ocean: screening and cross-checking of 20 existing datasets**. [1]SPC, Nouméa, New Caledonia. [2] IRD, Nouméa, New Caledonia. [3] NIWA, Wellington, New Zealand. [4] Institute for Marine Remote Sensing, University of South Florida, USA.	
EB-IP-10	NMFS. **Guide for Complying with Regulations to Reduce**	

	Interactions between Seabirds and Hawaii-Based Longline Vessels. NOAA Fisheries, USA.	
EB-IP-11	FFA. **FFA Update on the Application of the Ecosystem-Based Approach to managing Tuna Fisheries amongst FFA Member Countries and Territory in the WCPO: specific to lessons from stakeholder consultations in countries**. FFA, Honiara, Solomon Islands.	
EB-IP-12	Olson, R. and J. Young. **CLIOTOP/PFRP Workshop: The Role of Squid in Pelagic Marine Ecosystems**. IATTC, La Jolla, USA; CSIRO, Hobart, Australia.	
EB-IP-13	Kim, S.S., D.H. An, D.Y. Moon and S.J. Hwang. **A Summary of the Korean Tuna Fishery Observer Programme for the Pacific Ocean in 2006**. NFRDI, Busan, Korea.	
EB-IP-14	Minami, H., K. Yokota and M. Kiyota. **Examination of tori-pole configuration in middle-sized longline vessels**. National Research Institute for Far Seas Fisheries, Shimizu, Japan.	
EB-IP-15	Gilman, E. **Shark capture and disposition in the Hawaii pelagic longline swordfish and tuna fisheries.** Blue Ocean Institute and IUCN Global Marine Programme.	
EB-IP-16	Gilman, E.[1] and T. Moth-Poulsen[2]. **Review of measures taken by intergovernmental organizations to address sea turtle and seabird interactions in marine capture fisheries (Draft, not yet formally cleared by FAO).** [1] Blue Ocean Institute and IUCN Global Marine Program. [2] FAO Fishing Technology Service, Fisheries and Aquaculture Department Rome.	
EB-IP-17	BirdLife International. **Distribution of albatrosses and petrels in the WCPFC Convention Area and overlap with WCPFC longline fishing effort.** BirdLife International for the Agreement on the Conservation of Albatrosses and Petrels.	
EB-IP-18	Okamura, H.[1], M. Kiyota[1], H. Kurota[1], and T. Kitakado[2]. **Estimation of fisheries bycatch and risk assessment for short-tailed albatross using a Bayesian State-Space Model.** [1] National Research Institute of Far Seas Fisheries, Fisheries Research Agency, Japan. [2] Tokyo University of Marine Science and Technology, Japan.	
EB-IP-19	Molony, B. **Commonly captured sharks and rays for consideration of the Ecosystem and Bycatch SWG at SC3.** Secretariat of the Pacific Community, Noumea, New Caledonia.	

FISHING TECHNOLOGY SPECIALIST WORKING GROUP (FT-SWG)

FT-SWG Working Papers		
FT-WP-1	Campbell, R. **Use of TDRs and hook-timers to ascertain fishing depths and times of capture in the Australian Eastern Tuna and Billfish Fishery.** CSIRO, Hobart, Australia.	**Withdrawn**
FT-WP-2	Schaefer, K.M. and D.W. Fuller. **Acoustic imaging, visual observations, and other information used for classification of tuna aggregations associated with floating objects in the Pacific Ocean.** IATTC, La Jolla, California, USA.	
FT-WP-3	Itano, D. **An examination of FAD-related gear and fishing strategies useful for data collection and FAD-based management.** PFRP, University of Hawaii, Honolulu, Hawaii, USA.	
FT-WP-4	Keisuke, S., Ta. Matsumoto, H. Okamoto, K. Watanabe, H. Saito, K. Uosaki, K. Ikehara and H. Honda. **Preliminarily results of the relationship between catch ratio of bigeye tuna to total catch and length of underwater structures.** NRIFSF, Shimizu, Japan.	
FT-WP-5	Moreno, G.[1], L. Dagorn [2], G. Sancho [3], D. Itano [4]. **Fish behaviour from fishermen knowledge: the case study of tropical tuna around drifting fish aggregating devices (DFADs).** (summary of Can. J. Fish. Aquat. Sci. In press). [1] AZTI, Sukarrieta, Spain. [2] IRD, Sete, France. [3] College of Charleston, Grice Marine Laboratory, Charleston, South Carolina, USA. [4] PFRP, University of Hawaii, Honolulu, Hawaii, USA.	
FT-WP-6	Ward, P.[1] and R.A. Myers [2]. **Bait loss and its potential effects on fishing power in pelagic longline fisheries**. (*reprint from Fisheries Research 86 (2007) 69-76*). [1] BRS, Canberra, Australia. [2] Dalhousie University, Halifax, Nova Scotia, Canada.	
FT-WP-7	Ye, X. and L. XU. **Observation of Chinese Purse Seine Fishery in the WCPFC Waters during 2006-2007**. Shanghai Fisheries University, Shanghai, China.	
FT-WP-8	Kumoru, L. **Catch information from the FAD-based domestic tuna purse seine fishery in Papua New Guinea.** Fisheries Management Division, National Fisheries Authority, Papua New Guinea.	
FT-SWG Information Papers		
FT IP–1	Lennert-Cody, C.E.[1], J.J. Roberts [2], and R.J. Stephenson [3]. **Effects of gear characteristics on the presence of bigeye tuna (*Thunnus obesus*) in the catches of the purse-seine fishery of the eastern Pacific Ocean.** (*submitted ICES Journal of Marine Science, June 2007*). [1] IATTC, La Jolla, California, USA. [2] Duke University Marine Geospatial	

	Ecology Laboratory, Durham, North Carolina, USA. [3] contact via [1].	
FT IP–2	Harley, S.J.[1] and J.M. Suter [2]. **The potential use of time-area closures to reduce catches of bigeye tuna (Thunnus obesus) in the purse-seine fishery of the eastern Pacific Ocean.** [*reprint from Fish. Bull. 105:49-61 (2007*)] [1] Ministry of Fisheries, Wellington, New Zealand. [2] IATTC, La Jolla, California, USA.	
FT IP–3	Itano, D. **Compilation of TDR longline studies and coverage in the WCPO region.** PFRP, University of Hawaii, Honolulu, Hawaii, USA.	
FT IP–4	Itano, D. **A summary of operational, technical and fishery information on WCPO purse seine fisheries operating on floating objects.** PFRP, University of Hawaii, Honolulu, Hawaii, USA.	
FT IP–5	Itano, D. [1] and S. Fukofuka [2]. **Handbooks for the identification of yellowfin and bigeye tunas in (a) Fresh, (b) Frozen and (c) Fresh but Less than Ideal Condition – *versions available in English, French, Spanish, Bahasa Indonesia, Japanese, Korean, and Chinese: newly translated versions available in Vietnamese language (a. b. c) and Bahasa Indonesian (c).*** [1] PFRP, University of Hawaii, Honolulu, Hawaii, USA. [2] SPC, Noumea, New Caledonia.	
FT IP-6	McAuliffe, J.A. [1], D.G. Itano [2], and S. Arceneaux [3]. **Photographic identification guide for billfish, sharks, rays, tuna-like and non-tuna finfish taken in WCPO pelagic longline fisheries (v1)**. [1] University of North Carolina at Wilmington, Wilmington, South Carolina, USA. [2] PFRP, University of Hawaii, Honolulu, Hawaii, USA. [3] NOAA Fisheries, Pacific Islands Regional Office, Honolulu, Hawaii, USA.	
FT IP-7	Fukofuka, S.[1] and D.G. Itano [2]. **Photographic identification guide for non-target fish species taken in WCPO purse seine fisheries**. [1] SPC, Noumea, New Caledonia. [2] PFRP, University of Hawaii, Honolulu, Hawaii, USA.	
FT IP-8	Chavance, P.N. **Gathering relevant information on pelagic ecosystem, tuna resources and related fisheries, for widespread local diffusion: A general synthesis for New Caledonian stakeholders**. ADECAL. ZoNeCo programme for the sustainable management of marine resources in New Caledonia EEZ. Noumea, New Caledonia.	
FT IP-9	Miyake, P.M. **Socio Economic Factors Affecting Exploitation and Management of Top Predators.** Federation of Japan Tuna Fisheries Co-operative	

	Associations, Tokyo, Japan.	
FT IP-10	Babaran, R.P. **Recalculation of the Philippine tuna production from the WCPO.** College of Fisheries and Ocean Sciences, University of the Philippines in the Visayas, Philippines.	
FT IP-11	Koren, L.N.H. **An assessment of independent fishery tuna data collected from tuna landings from purse seine vessels in Madang for the year 1999 and 2005.** Fisheries Management Division, National Fisheries Authority, Papua New Guinea.	

METHODS SPECIALIST WORKING GROUP (ME-SWG)

	ME-SWG Working Papers	
ME WP–1	Hoyle, S. and A. Langley. **Regional weighting factors for yellowfin tuna in WCP-CA stock assessments**. Secretariat of the Pacific Community, Noumea, New Caledonia..	
ME WP–2	Hampton, J.[1], P. Kleiber[2] and D. Fournier[3]. **Reducing parameter complexity in MULTIFAN-CL stock assessments: catch conditioning.** [1] SPC, Noumea, New Caledonia. [2] NOAA Fisheries, Honolulu, USA. [3] Otter Research Ltd., Sidney, B.C., Canada.	
ME WP–3	Davies, C. and T. Polacheck. **A brief review of the use of the precautionary approach and the role of target and limit reference points and Management Strategy Evaluation in the management of highly migratory fish stocks.** CSIRO, Hobart, Australia.	
ME WP–4	Campbell, R.[1], J. Prince[2], C. Davies[1], D. Kolody[1], N. Dowling[1], P. Ward[3] and K. McLoughlin[3]. **Development of an Empirical-Indicator based Harvest Strategy for the Australian Eastern Tuna and Billfish Fishery**. [1] CSIRO Marine and Atmospheric Research, Hobart, [2] Biospherics Consulting, Perth, [3] Bureau of Rural Sciences, Canberra.	
ME WP–5	Kolody, D. et al. **Application of a harvest strategy evaluation approach to the Australian swordfish fishery.** CSIRO, Hobart, Australia.	
ME WP–6	Hoyle, S. and A. Langley. **Comparison of South Pacific albacore stock assessments using MULTIFAN-CL and STOCK SYNTHESIS 2.** SPC, Noumea, New Caledonia.	
ME WP–7	Ward, P. **Preliminary estimates of the relative catchability of pelagic longline fishing gear**. Fisheries and Marine Sciences, Bureau of Rural Sciences, Canberra, Australia.	
	ME-SWG Information Papers	
ME IP–1	Hoyle, S.[1], K. Bigelow[2], A. Langley[1] and M.	

	Maunder[3]. **Proceedings of the pelagic longline catch rate standardization meeting.** [1] SPC, Noumea, New Caledonia. [2] NOAA Fisheries, Honolulu, USA. [3] IATTC, La Jolla, USA.	
ME IP-2	Ward, P. **Preliminary estimates of historical variations in the fishing power and catchability of pelagic longline fishing gear - description of methods.** Fisheries and Marine Sciences Program, Bureau of Rural Sciences, Canberra, Australia.	

STATISTICS SPECIALIST WORKING GROUP PAPERS (ST-SWG)

	ST-SWG Working Papers	
ST-WP-1	Secretariat**. Framework for Access to Different Types of Non-Public Data, and Draft Data Request Form and Draft Confidentiality Agreement**. WCPFC, Pohnpei, FSM.	
ST-WP-2	SPC. **Objectives and priorities for data to be collected by observers for fisheries other than purse-seine and longline**. Secretariat of the Pacific Community, Noumea, New Caledonia.	
ST-WP-3	SPC. **Proposed Revisions to the Procedures for the Provision of Data**. Secretariat of the Pacific Community, Noumea, New Caledonia.	
ST-WP-4	Duckworth, K. **Proposed Revisions to the Rules and Procedures for Access to and Dissemination of Data Compiled by the Commission**. Ministry of Fisheries, Wellington, New Zealand.	
	ST-SWG Information Papers	
ST-IP-1	Secretariat. **Commission's Information Security Policy**. WCPFC, Pohnpei, FSM.	
ST-IP-2	SPC. **Estimates of annual catches in the WCPFC Statistical Area**. Secretariat of the Pacific Community, Noumea, New Caledonia.	
ST-IP-3	SPC. **Scientific data available to the Western and Central Pacific Fisheries Commission**. Secretariat of the Pacific Community, Noumea, New Caledonia.	
ST-IP-4	Williams, P. and J. Hampton. **Recent annual catch and effort estimates relating to conservation and management measures adopted by the Commission**. Secretariat of the Pacific Community, Noumea, New Caledonia.	
ST-IP-5	Lawson, T. **Further analysis of the proportion of bigeye in 'yellowfin plus bigeye' caught by purse seiners in the WCPFC Statistical Area**. Secretariat of the Pacific Community, Noumea, New Caledonia.	

ST-IP-6		**Withdrawn**
ST-IP-7	Fonteneau, A. **Species composition of tuna catches taken by purse seiners.** IRD, Centre de Recherche Halieutique Méditerranéenne et Tropicale Avenue Jean Monnet, France.	
ST-IP-8	Duckworth, K. **Convenor's proposed text for ST-SWG recommendation on the scientific objectives and priorities of the ROP**.	
ST-IP-9	Duckworth, K. **Rules and procedures for the access to, and dissemination of, data compiled by the Commission (Revision 1.2).**	

STOCK ASSESSMENT SPECIALIST WORKING GROUP (SA-SWG)

SA-SWG Working Papers		
SA-WP-01	Langley, A.[1], J. Hampton[1], P. Kleiber[2], and S. Hoyle[1]. **Stock assessment of yellowfin tuna in the western and central Pacific Ocean, including an analysis of management options.** [1] Oceanic Fisheries Programme, SPC, Noumea, New Caledonia. [2] Pacific Islands Fishery Science Center, National Marine Fisheries Service, Honolulu, USA.	
SA-WP-2	Hoyle, S. and A. Langley. **Structural uncertainty in the yellowfin tuna assessment.** Secretariat of the Pacific Community, Noumea, New Caledonia.	**Withdrawn**
SA-WP-3	Langley, A. and J. Hampton. **Multi-fishery management options analyses for bigeye and yellowfin tuna**. Secretariat of the Pacific Community, Noumea, New Caledonia.	
SA-WP-4	Langley, A.[1] and S. Harley[2]. **Spatio-temporal patterns of purse seine catches of skipjack and juvenile bigeye and yellowfin tuna caught in association with floating objects**. [1] SPC, Noumea, New Caledonia. [2] Ministry of Fisheries, Wellington, New Zealand.	
SA-WP-5	A. Langley [1], K. Briand[1], D. Kirby[1], and R. Murtugudde[2]. **Influence of oceanographic variability on recruitment of yellowfin tuna *Thunnus albacares* in the western and central Pacific Ocean (Abstract only)**. [1] SPC, Noumea, New Caledonia, [2] Earth System Science Interdisciplinary Center, College Park, USA.	
SA-WP-6	Langley, A. **Analysis of yellowfin and bigeye catch and effort data from the Japanese and Korean longline fleet collected from regional logsheets.** Secretariat of the Pacific Community, Noumea, New Caledonia.	
SA-WP-7	Kleiber, P.[1], S. Clarke[2], K. Bigelow[1], M. McAllister[3]. **North Pacific blue shark stock assessment**. [1] NOAA Fisheries, Honolulu, Hawaii, USA. [2] Imperial College London, United Kingdom. [3] University of British	**Withdrawn**

	Columbia, Canada.	
SA-SWG Information Papers		
SA IP-1	Molony, B. **Trends in size composition of longline-caught albacore in the South Pacific**. Secretariat of the Pacific Community, Noumea, New Caledonia.	
SA IP-2	Kolody, D.[1], R. Campbell[2] and N. Davies[3]. **South-West Pacific Swordfish Stock Assessment work-plan proposal for 2008**. [1] CSIRO Marine and Atmospheric Research, Hobart, Australia, [2] CSIRO Marine and Atmospheric Research, Aspendale, Melbourne, Australia. [3] NIWA Ruakaka, New Zealand.	
SA-IP-3	Reid, C., S. Sauni and L. Clark. **Economic and management implications of stock assessments on key tuna stocks in the WCPO**. Forum Fisheries Agency, Honiara, Solomon Islands.	

NGO OBSERVERS

	Greenpeace**. Bold measures needed to protect declining tuna stocks.** Greenpeace Australia Pacific.	

ANNUAL REPORTS (PART 1) FROM MEMBERS AND COOPERATING NON-MEMBERS
(Annual Report, Part 1 – Information on Fisheries, Research, and Statistics)

AR WP-1	American Samoa	**See AR WP-31**
AR WP-2	Australia	
AR WP-3	Canada	
AR WP-4	China	
AR WP-5	Cook Islands	
AR WP-6	European Union	
AR WP-7	Federated States of Micronesia	
AR WP-8	Fiji Islands	
AR WP-9	France	
AR WP-10	Guam	**See AR WP-31**
AR WP-11	French Polynesia	
AR WP-12	Indonesia (cooperating non-member)	
AR WP-13	Japan	
AR WP-14	Republic of Kiribati	
AR WP-15	Republic of Korea	
AR WP-16	Republic of the Marshall Islands	

AR WP-17	Republic of Nauru	
AR WP-18	New Caledonia	
AR WP-19	New Zealand	
AR WP-20	Niue	
AR WP-21	Northern Mariana Islands	**See AR WP-31**
AR WP-22	Republic of Palau	
AR WP-23	Independent State of Papua New Guinea	
AR WP-24	Republic of the Philippines	
AR WP-25	Independent State of Samoa	
AR WP-26	Solomon Islands	
AR WP-27	Chinese Taipei	
AR WP-28	Tokelau	
AR WP-29	Kingdom of Tonga	
AR WP-30	Tuvalu	
AR WP-31	United States of America	
AR WP-32	Republic of Vanuatu	
AR WP-33	Wallis and Futuna	

SC3 WORKING DOCUMENTS

Delegation Papers		
DP-1	Japan. **Comments on Draft Rules of Procedure for the WCPFC Scientific Committee**.	
DP-2	Japan. **Tentative comments on proposed minimum ROP format**.	
DP-3	Japan. **Comments on the Rules and Procedures for the Access to, and Dissemination of, Data Compiled by the Commission (Draft Revision 1.0)**.	
DP-4	China, **Chinese Taipei, Japan and Korea. Minimum Standards for ROP Data**.	
DP-5	Japan. **(Proposal) Revised version of Attachments 1 and 2, Conservation and Management Measure-2006-2**.	
Informal Small Group Documents		
ISG-WP-1	Conser, R. **Summary of ISG-1 on biological reference points**.	

ISG-WP-2	Itano, D. **Summary of ISG-3 on small tuna on floating objects**.	
ISG-WP-3	Bigelow, K. **Outcomes of ISG-10 to consider independent review of the Commission's transitional science structure and functions**.	
ISG-WP-4	Itano, D. **Comments on SC3-GN-WP-6: WCPFC data standards for Regional Observer Programme**.	
ISG-WP-5	Conser, R. **Summary of discussion points identified by ISG-1 for consideration by the Scientific Committee on the report of the expert consultancy on reference points**.	
ISG-WP-6	Itano, D. **Briefing document: Agenda Item 5.3 (Bycatch mitigation – small tuna on floating objects)**	
ISG-WP-7	Bigelow, K. **Outcomes of IWG-10 to consider: Independent Review of the Commission's Transitional Science Structure And Functions**.	
ISG-WP-8	Mobiha, A. **Outcomes of ISG-11 to consider: Review of Part 1 of the Annual Report to the Commission**.	
ISG-IP-1	Secretariat. **Overview of recommendations made by SC2 on the Regional Observer Programme**.	

Attachment G

The Commission for the Conservation and Management of Highly Migratory Fish Stocks in the Western and Central Pacific Ocean

Scientific Committee
Third Regular Session

Honolulu, HI, USA
13–24 August 2007

REPORT OF THE BIOLOGY SPECIALIST WORKING GROUP

1. Opening of meeting

1. The Convenor Chi Lu Sun (Chinese Taipei) opened the meeting and thanked participants for their attendance on a Saturday morning. He also welcomed Scientific Committee Vice-Chair Keith Bigelow as Co-Convenor for the meeting.

2. Selection of rapporteurs

2. David Kirby (Secretariat of the Pacific Community's Oceanic Fisheries Programme (SPC-OFP) was appointed rapporteur for the meeting.

3. Adoption of agenda

3. The agenda circulated for the meeting was accepted with the modification of Agenda Item 4a to recognize the working papers and presentations to be made on studies on age at maturity (Appendix 1).

4. Research

a. Age, growth and maturity

SC3-BI-WP-1: J. Young, R.L. Humphreys, Jr., J.H. Uchiyama. Comparison of swordfish maturity and ageing from Hawaiian and Australian waters.

4. Robert L. Humphreys (USA) presented this paper on behalf of his co-authors. Numerous studies of ageing and reproduction in swordfish have shown a wide range of estimates for length and age at maturity. Recent size at maturity studies conducted in eastern Australia and Hawaii based on their swordfish longline fisheries, have yielded estimates of 144 cm and 193 cm eye–fork length (EFL), respectively, for female size at 50% maturity (L50: the length at which 50% of females attained sexual maturity). Whether this later variability is the result of differential responses to the environment or to different methodologies employed by research agencies is not clear. A preliminary comparison of methods used in the Hawaii and Australia studies was initiated. The senior author (Young) travelled to Hawaii in June–July 2007 to collaborate with the junior authors at their laboratory in order to directly compare a representative set of specimens from both the maturation (ovarian histology slides) and age estimation (cross-sections of second anal fin spines) studies from the two regions. Preliminary effort was directed at the size at

maturation methodologies employed in the two regional studies. The major difference uncovered was the use of morphological features (lamellae structure and vascularization) within ovarian histological sections to differentiate true immature fish from mature but reproductively inactive females. Applying these criteria to the histological samples of the Australian study was difficult as many of these sections were not in a condition adequate for this determination. However, if all the stage 2 classified ovaries (early yolk development) were classified as mature but reproductively inactive, the Australian estimate for female L50 would reduce to 154 cm EFL, a value close to that obtained from the Hawaiian and Taiwanese studies. Also, apparent systematic differences in interpretation of second anal fin ray sections (based on a preliminary matched examination of 28 Australian samples) may also affect determination of the von Bertalanffy growth curves. The study highlights the need for increased communication and collaboration between laboratories undertaking such studies. In particular, validation of age-length relationships through tag recapture studies is encouraged.

Discussion

5. The Chair noted that comparative studies such as this are very important. Discussion then took place on how to define swordfish feeding and spawning grounds. With good fisheries statistics it is possible to map catches to sea surface temperature, and feeding grounds have been identified in the temperature range 15–18ºC. It is, however, hard to identify the spawning grounds, as they are often very seasonal in fished areas. In both New Zealand and Hawaii, swordfish spawning has been shown to depend on sea surface temperature >24ºC. In Hawaii, a DNA technique was developed for billfish eggs, through which the role of salinity has also been identified (ca. 34.5), but in other areas this may not be valid. Sea surface temperature is relatively easily observed from satellites but salinity is not, although it is available from ocean general circulation models. In some areas we do not have a good understanding of spawning ground definition; the initial work was carried out in 1994–1997 and has not been considered since. If the topic is considered more closely it is likely to reveal even more variability. Monitoring of swordfish reproductive state relies on the commercial fishery as research laboratories do not have the resources to carry out a continuous study.

6. The histological study was considered to be an established and useful technique but other advanced techniques to detect physiological cues would help to progress the field. Hormone levels, using samples from ripe and immature fish, have shown some interesting results, but they are tentative and there are some misclassifications of reproductive state. A microarray technique for gene expression is under development, which takes tissue from the fish and investigates which genes are activated at the onset of reproductive activity. This would provide direct evidence regarding the reproductive state. While there is no major breakthrough yet, it would be interesting to apply to field studies.

7. The coordination of research effort was recognized as being important for the identification of stock structures in the whole Pacific. Earlier research combined ongoing studies in Chile, Mexico, Japan, Taiwan, Hawaii (there were no studies in Australia at that time). Questions concerning stock structure are important and present a significant research challenge. Samples from different areas are available but they are usually from adult fish, which could have originated from different places. There is a need to sample smaller, younger animals.

8. Larval studies using research ships with plankton nets may only catch one swordfish larva per hour. The alternative sampling method is commercial longline, which can catch young-of-the-year swordfish, with length <100 cm EFL and age ca. six months. Samples can then be compared genetically. These fish are therefore a good resource for addressing questions of stock structure.

The Hawaiian and Australian swordfish appear from genetic studies to be different stocks, so northwestern and southwestern Pacific stocks appear to be discrete. For the eastern Pacific Ocean (EPO) the situation is unclear. The Hawaiian study sampled the subtropical area 20ºN–27ºN, 140ºW–170ºW. For Australia, the area was much bigger, encompassing the range of the eastern tuna and billfish fishery.

9. Otolith studies from Ecuador, Hawaii and other longline fisheries that catch small swordfish, provide a good opportunity for sampling and are better than the main fishing grounds. In order for sampling of commercial vessels to be successful there is a need for good contacts at the local level to collaborate with fishers. Observer programmes can also be used.

10. Given the potential for population differences there was some concern as to how to incorporate this uncertainty into the stock assessment for SW Pacific swordfish. It is not possible to redo the Australian age and growth study but it can be recalibrated and the growth curve re-estimated. Growth rate curves are not calibrated for age but time at liberty is used to estimate age, after assigning age when tagged. For maturity, it is not clear that the definition is resolved so the plan is to run different possibilities as different scenarios.

11. Present sample sizes may be too small to detect differences in growth rates between areas. The present comparison is based on 28 fish so the point of the study was to check whether apparent differences were real or due to differences in methodology. They seem to be methodological. The female growth curve in Hawaii was based on 800–900 anal fin spine sections. Samples must include very old swordfish to enable valid extrapolation from the growth curve. The oldest female studied was 12 years old and there were only two or three individuals of this age. Looking at otolith increments can help to age smaller sizes but for larger, older fish this is very difficult to do. This is a recurring problem in growth studies. Chile gets very large animals, as does Chinese Taipei.

12. For management to be effective there is a need for more knowledge about fish species in the whole Pacific Ocean, not just arbitrarily divided regions, and there needs to be more biological and ecological knowledge to support stock assessment. There are some parameter estimates that have not been re-analyzed for some time. There are probably localized populations, variable estimates of age at maturity, and research into these aspects should be extended to other species. For example, yellowfin are smaller in PNG waters than other areas, which suggests that the population is vulnerable to fishing pressure. Is this just a PNG problem or is it stock-wide? More work must be done on the biology of highly migratory species to assist with stock assessments.

13. There are also probably differences due to environmental variability. Swordfish in Hawaii exhibit faster early growth than they do in Chinese Taipei; growth in Chilean waters is also fast, so there seems to be Pacific-wide variation in growth from west (slow) to east (fast). There are also interesting patterns in the Mediterranean Sea, which have been fished for millennia.

SC3-BI-WP-2: C.-L. Sun, Chien-Shan Liu, and Su-Zan Yeh. Age and growth of black marlin (*Makaira indica*) in the waters off eastern Taiwan.

14. Age and growth of black marlin (*Makaira indica*) in the waters off eastern Taiwan was studied from the growth rings on cross sections of the third dorsal spines. Length and weight data, and the first dorsal fins were collected monthly at Shinkang Fish Market in southeastern Taiwan from July 2004 to April 2006. In total, 923 dorsal fins were collected, of which 874 (95%) (187 males and 687 females) were aged successfully. Trends in the monthly mean marginal increment ratio indicated that growth rings formed once a year. Two methods were used to back-calculate

the length of presumed ages and growth was described using the standard and generalized von Bertalanffy growth function. The most reasonable and conservative description of growth assumes that length-at-age follows the standard von Bertalanffy function and that the relationship between spine radius and lower jaw fork lengths (LJFL) follows a power function. Growth differed significantly between sexes, with females growing faster and reaching larger size than males. The maximum sizes in our sample were 368.2 cm LJFL for females and 261.5 cm LJFL for males.

Discussion

15. Sexual dimorphism was noted for black marlin, which is possibly due to gear selectivity, different growth rates, or different longevity (natural mortality). From the length–frequency distributions by gear and the growth curves of this study (SC3-BI-WP-2), longevity difference seems to be a more likely reason. Fish are mostly caught in winter-time in eastern Taiwan waters, and then disappear. In Japan, the small coastal gillnet fishery takes place in autumn, slightly earlier than in eastern Taiwan waters. The marginal increment ratio for females — showing clearly >1.0 in October to December — suggested that the width of the increment should be shrinking. Marginal increment ratios validate that one ring was formed per year. Speare (2003: Marine and Freshwater Research 54:307–314) also found a consistent increase in the size of fin spines from a tetracycline-injected and recaptured fish with the calculated grow curves derived from counts of presumed annual zones, and believed that one ring was formed each year for the black marlin.

b. Stock structure

SC3-BI-WP-3: J. C. Holdsworth, T. J. Sippel, P. J. Saul. An investigation into swordfish stock structure using satellite tag and release methods.

16. The project tracked swordfish (*Xiphias gladius*) tagged in New Zealand waters using electronic satellite tags over a period when they would be expected to visit sub-tropical spawning grounds and return to temperate waters.

17. Twelve pop-off satellite archival transmitting tags (PAT) (Wildlife Computers, Redmond, WA, USA) were deployed on swordfish. Seven data sets have been decoded using the SST Kalman filter. These tags yielded between 8 and 36 usable light level geolocations each, plus the tagging and pop-up coordinates giving a total of 160 locations. On average there are five locations per month from these tags. The results to date indicate that the newest generation of Wildlife Computers PAT tags are capable of providing data to track the movement of swordfish. From the small sample size we have at present, there appears to be a different pattern of movement for fish tagged north of New Zealand which came back down the west coast. Fish tagged to the east and northeast returned to those areas or came down the east coast. This may warrant further investigation.

Discussion

18. The possibility of targeting really large swordfish that are probably female and definitely mature was discussed. However, there is no good way to determine sex at time at capture, so information is being lost as long as we don't have a tissue approach for sex determination.

19. The possibility of tagging potential spawners was discussed but the problem is that really big fish are quite aggressive and die when hooked. Satellite tags are expensive so there is no point

tagging fish that do not have a good chance of survival. The instructions are to tag the biggest fish possible. It may be possible to get some indication of sex if tags are recovered. New Zealand has good observer coverage so it might be able to pick up on that.

20. Basking behaviour was discussed with regard to the possibility of tagging using harpoons. They were not thought to bask in New Zealand and if they did they would be larger individuals, as the smaller ones don't come to the surface during the day.

21. Swordfish movement is apparently related to underwater structures, with many fish undertaking big movements but coming back to close to where they are tagged. They probably habituate to bathymetry but there is not enough data to answer this question.

22. Similar north–south movements have been seen in Australia but the data have not been analysed closely yet.

SC3-BI-IP-1: Smith, et al. Evaluation of parasite markers to assess swordfish stock structure.

23. A preliminary trial was undertaken to determine if there are appropriate parasites in broadbill swordfish (*Xiphias gladius*) for testing residency hypotheses and stock relationships. The gills and guts of 34 swordfish, eight from New Caledonia, 10 from Australia (Queensland), and 16 from New Zealand, were examined for parasites. Three species of monogenean were found on the gills (*Tristoma adintegrum*, *Tristoma adcoccineum* and an unidentified capsalid); three species of nematode in the stomach (*Maricostula* sp., *Hysterothylacium* sp. A, and *Hysterothylacium* sp. B); two cestodes in the stomach and encysted in the mesenteries (*Pseudeubothrium* sp. and *Hepatoxylon* sp.); and one digenean in the stomach (*Hirudinella* sp.). Swordfish from New Caledonia were also examined for ectoparasites. The parasite fauna of swordfish from the three areas was dominated by adult nematodes. The largest of the nematodes, *Maricostula* sp., showed differences in abundance among the three areas. The other two nematodes, species of *Hysterothylacium*, also showed significant differences between areas, but these adult worms may have limited application as a biological tag, reflecting short-term feeding patterns of the host. Three parasites were identified that are potential markers of movement of swordfish between tropical and temperate waters. 1) The digenean *Hirudinella* is likely to be a short-lived parasite acquired in tropical areas. 2) Larval cestodes of *Hepatoxylon* sp. are thought to be acquired in temperate areas. 3) A pennellid copepod recorded in swordfish from New Caledonia, is likely to be acquired in tropical areas. This large ectoparasite is readily observed on whole swordfish, and presence/absence could be recorded by fishery observers, without the need for returning samples to the laboratory.

Discussion

24. The results are not conclusive, but tropical copepods were identified on some fish when they returned to New Zealand and these died in cooler waters. If they are found in temperate waters then it is safe to assume that the fish has been to the tropics fairly recently. This is an interesting result but not powerful enough to use for stock discrimination at this stage.

c. Behavior and movement

SC3-BI-WP-4: Leroy, B. et al. Preliminary analysis and observations on the vertical behaviour of WCPO skipjack, yellowfin and bigeye tuna in association with anchored FADs, as indicated by acoustic and archival tagging data.

25. Archival and sonic tagging was carried out in support of a collaborative tuna resource assessment project in Papua New Guinea implemented by the Oceanic Fisheries Programme of the SPC, the Papua New Guinea National Fisheries Authority (NFA) and the University of Hawaii, Pelagic Fisheries Research Program (PFRP). Electronic tagging addressed the specific project objective to obtain species-specific data on the spatial and temporal behaviour of tropical tuna found in association with or near large areas of FADs subject to high exploitation rates. Over 250 archival tags were implanted in bigeye (40), yellowfin (214) and skipjack (2) tuna in the Bismarck and Solomon Seas. Acoustic tags were released in the tame areas in 195 tuna of all three species while 27 tuna (8 bigeye, 19 yellowfin) received both an archival and a sonic tag. Archival tag data was filtered using depth bins developed in consultation with published information on tuna vertical behaviour adjusted to conditions in the WCPO. Archival data from 25 recaptured archival tags was thus filtered and resulted in the identification of three vertical behaviour modes for bigeye and four valid modes for yellowfin. Preliminary analysis of acoustic data reveals short-lived residence times and strong school cohesion of monitored tuna aggregations. Vertical data from simultaneous residence of skipjack, yellowfin and bigeye tuna derived from depth recording acoustic tags was examined, suggesting slight vertical separation of species but a high degree of mixing, particularly in early morning hours when purse seining normally occurs. The recapture of two bigeye tuna having both sonic and archival tags confirm simultaneous anchored FAD residence and the Type 3 bigeye vertical behaviour defined from archival data in this study. This suggests that the relative amounts of time bigeye spend on FADs in this region may be estimated from archival data. However, further research and analysis will be required.

SC3-BI-WP-5: Matsumoto, et al. Report of the ongoing tagging project on tropical tunas in the southern part of Japan.

26. SC3-BI-WP-5 summarizes results of Japanese tagging project in the southwestern part of Japan about 24-29ºN, 123-130º on tropical tunas (mainly yellowfin and bigeye tunas) up to the end of 2006. Fish were mainly caught by pole-and-line, handline or trolling. In total 2,083 bigeye and 9,155 yellowfin have been tagged with dart tag and released. As of July 2007, 223 bigeye (recapture rate is 10.7%) and 732 yellowfin (8.0%) have been recaptured. Fork length of tagged fish ranged between 30 cm and 70 cm with the mode around 50 cm for bigeye tuna, while the mode of yellowfin was around 40 cm. Although many bigeye and yellowfin tunas were recaptured near Nansei Islands where they were released, when they moved long distances, both species usually moved northeastward to east off Japan with some exceptions of southward movement to Taiwan or the Philippines. Of the 105 bigeye and 80 yellowfin attached with archival tags, 19 bigeye and 5 yellowfin were recaptured. Archival tag data indicated that both of bigeye and yellowfin tunas usually dive deeper during the daytime and stayed in the shallower depths during the night. In the last presentation, in addition to the tagging study above, SC3-BI-IP-4 introduces briefly on the Japanese tagging activity at high latitudinal area of North Pacific off Japan.

Discussion

27. It was commented that the low number of tag recaptures in tropical areas might be due to a gap in the reporting system, because about 25 Japanese tags were recovered through SPC's recovery programme in Thailand from purse-seine catches in the equatorial Pacific. Whether or not these recaptured Japanese tags came from the tagging that occurred near Japan or in the equatorial waters is being verified. The collaborating tagging study between Japanese sub-regional programme and the new WCPFC Regional Tuna Tagging Project through enhanced effort in recovering tags would be mutually beneficial.

28. The Chair drew the meeting's attention to the following Information Papers:

SC3-BI-IP-3: Dagorn, et al. Behaviour of yellowfin (*Thunnus albacares*) and bigeye (*T. obesus*) tuna in a network of fish aggregating devices (FADs).

SC3-BI-IP-4: Semba, et al. Experimental tagging research for bigeye tuna (*Thunnus obesus*) in the Eastern offshore of Japan.

d. Other

SC3-BI-IP-2: Davies and Griggs. Port sampling in New Zealand of tuna longline catches for swordfish (*Xiphias gladius*) size composition in 2005–06.

5. Research Planning

a. Short- and median-term research plan

29. The short- and medium-term research plan considered collaboration with IATTC on the basis of the first WCPFC-IATTC consultative meeting that was held on 24 June. This meeting discussed Pacific-wide tagging and refinement of bigeye life history parameters for use in regional and Pacific-wide assessments. More research about stock structure through genetic studies would be useful. More research is also needed on age and growth of young bigeye, and apparent regional differences in growth from length–frequency data for yellowfin, which is probably the same for bigeye. There is a project proposal from SPC-OFP to do this using otoliths. There is no project under current planning for large-scale sampling.

30. The fact that regional variation in yellowfin growth may affect assessments was reported in this year's yellowfin assessment document; growth in the northwest Pacific area is apparently substantially faster than in the equatorial area, perhaps due to different productivity in those areas. There have been similar discussions on east–west variation in productivity and effects on growth. There was general agreement that this work was a good short- to medium-term priority.

31. Research on age, growth and maturity of South Pacific albacore was discussed and seen as a high priority. The BI-SWG noted that Australia is proposing a project to undertake this work.

32. It was acknowledged that while there are high priority target species there is also a need for biological information on bycatch, especially those species that the Scientific Committee may identify as being at relatively high risk, such as marlins and sharks. The need for a dedicated research programme for each species group was recognized. There was some debate about which was the most appropriate group to carry out this work and it was generally recognized that biological research should be carried out by the Biology SWG, with data collection appropriate to the types of analysis to be undertaken.

b. Detail operational research plan for 2007–2008 with budget

33. This will be considered in plenary under Agenda Item 9.

c. Work programme for 2009–2010

34. There was general agreement on the need for a better structured and coordinated work plan at a Convention Area-wide scale applying to all the highly migratory species and non-target

associated and dependent species, for which WCFC has responsibility. This encompasses all the important life history characteristics to address biological uncertainties identified in stock assessments and in ecological risk assessment: these include lifespan, length and age at maturity, fecundity, sex ratio, trophic studies, identification of habitat use and spawning areas.

35. It is essential that data be well handled in a biological database. There are sampling programmes in other oceans covering species of interest, and WCPFC should investigate their biological data collection and management protocols. There is already a plan to put biological information on target species and bycatch onto the WCPFC website, along with information in mitigation measures, and this should be further developed through collaboration among the various SWGs.

6. Administrative matters

a. Election of convener

36. BI-SWG Convenor Chi Lu Sun (Chinese Taipei) was thanked for his work and re-nominated by Japan and seconded by Papua New Guinea, but he did not accept the nomination. The Convenor therefore nominated Hitoshi Honda (Japan) as Convenor and this nomination was seconded by Papua New Guinea.

b. Other matters

37. The SC Vice-Chair asked the meeting to consider its future role and whether it needed to continue as an SWG or merge its subject matter with the Ecosystems and Bycatch SWG (EB-SWG). There were interventions to the effect that the work of the BI-SWG underwrites that of other groups and its work would likely expand as the ecological risk assessment progresses. However, there was no immediate consensus and this item will be discussed further in plenary under Agenda Item 10.3.

7. Adoption of report (including a one page summary)

38. The report was adopted by consensus.

8. Close of meeting

39. The Chair thanked the SWG participants and the rapporteur for their contributions.

Attachment G, Appendix 1

The Commission for the Conservation and Management of Highly Migratory Fish Stocks in the Western and Central Pacific Ocean

Scientific Committee
Third Regular Session

Honolulu, HI, USA
13–24 August 2007

AGENDA FOR THE BIOLOGY SPECIALIST WORKING GROUP

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1. Opening of meeting
2. Selection of rapporteurs
3. Adoption of agenda
4. Research
   a. Age and growth studies
      WP-1: Young, et al. *Comparison of swordfish maturity and ageing from Hawaiian and Australian waters*.
      WP-2: Sun, et al. *Age and growth of black marlin (Makaira indica) in waters off eastern Taiwan.*
   b. Stock structure
      WP-3: Holdsworth, et al. *An investigation into Swordfish Stock Structure Using Satellite Tag and Release Methods.*
   c. Tagging studies
      WP-4 Leroy, B. et al. *Preliminary analysis and observations on the vertical behaviour of WCPO skipjack, yellowfin and bigeye tuna in association with anchored FADs, as indicated by acoustic and archival tagging data.*
      WP-5 Matsumoto. *Report of the ongoing tagging project on tropical tunas in the southern part of Japan.*
5. Research planning
   d. Short- and median-term research plan
   e. Detail operational research plan for 2007–2008 with budget
   f. Work programme for 2009-2010 with indicative budget
6. Other matters
7. Adoption of the report (including a one-page summary)
8. Close of meeting

Attachment H

The Commission for the Conservation and Management of Highly Migratory Fish Stocks in the Western and Central Pacific Ocean

Scientific Committee
Third Regular Session

Honolulu, HI, USA
13–24 August 2007

REPORT OF THE ECOSYSTEM AND BYCATCH SPECIALIST WORKING GROUP

Introduction

1. Paul Dalzell and Peter Ward, the Ecosystem and Bycatch Specialist Working Group (EB-SWG) co-conveners, opened the meeting. Rapporteurs for the session were Ilona Stobutzki, Eric Gilman, Warrren Papworth, Steve Brouwer and Peter Williams. Meeting agenda is attached as Appendix 1.

Report summaries

2. **Progress of productivity and susceptibility assessment (PSA)**

SC3-EB-WP-1: Ecological risk assessment for species caught in the WCPO tuna fishery: Updated productivity-susceptibility analysis.

SC3-EB-WP-3: Ecological risk assessment research planning workshop report

3. David Kirby (SPC-OFP) gave a talk on ecological risk assessment (ERA) for the effects of fishing in the western and central Pacific Ocean (WCPO). He presented updated productivity-susceptibility analyses (PSAs) for the WCPO (SC3-EB-WP-1) and an ERA Research Planning Workshop Report and draft Research Plan (SC3-EB-WP-3).

4. SPC-OFP has developed the ERA project in collaboration with the Commonwealth Scientific and Industrial Research Organisation (CSIRO), Australia. The updated PSAs use input data from a bycatch database that is being developed for WCPFC. Three different PSAs were carried out for two different fisheries (deep and shallow longline). PSAs have not yet been carried out for purse-seine fisheries.

5. At this stage, the PSA results presented are indicative rather than conclusive; nonetheless, it is possible to draw some general conclusions.

6. Seabirds were generally at high risk of adverse effects due to fishing. This is because they are long-lived, have delayed maturity and low reproductive output (high risk score for *productivity*) and they generally do not survive being hooked (high risk score for *susceptibility*). The inclusion of spatial indicators will identify areas where seabirds are at relatively lower risk

due to reduced susceptibility, either because they are not present in that area or they are not feeding and therefore not attracted to fishing gear.

7. Turtles were generally at high/medium risk, except leatherbacks, which are classified as being at medium/low risk. In the case of leatherbacks, this is because they are relatively deep ranging and therefore not always susceptible to fishing gear. They are most often caught as juveniles and they are generally likely to survive the encounter.

8. Some carcharinid sharks were assessed as being at high risk (e.g. bronze whaler, grey/blacktip reef shark) although it was recognized that species identifications may not always be accurate. Further work will identify those species at relatively High risk and amenable to stock assessment, additional analysis or in need of mitigation measures. Some rays and dogfish were also assessed as being at high risk. Marine mammals almost always ranked as high risk, mainly due to their low productivity. Some teleosts ranked as being at high risk (e.g. blue and striped marlin, sailfish, frigate and Spanish mackerel, longtail tuna, wahoo, monchong) mainly due to their high susceptibility.

9. The principal target tuna species were all ranked as being at medium risk.

10. An ERA Research Planning Workshop was convened by SPC-OFP in the week before SC3, in order to develop a three-year research plan for submission to SC. Participants came from several agencies, NGOs and universities, invited on the basis of their technical expertise and prior experience in ecological risk assessment. The workshop was held at the offices of the US Western Pacific Regional Fisheries Management Council (WPRFMC), in Honolulu. ERA workshop participants discussed a range of methodological and data issues, which are documented in detail in SC3-EB-WP-3. SPC-OFP then drafted a three-year research plan based on workshop discussions. The outputs of the proposed research plan are below.

11. High-level output: Identification of highly migratory species and associated/dependent species that are at relatively high risk of adverse effects due to fishing, for consideration by the Scientific Committee (SC) in terms of further research or management responses.

12. Research outputs:

- Level 1 analyses for WCPFC Convention Area or particular sub-regions, carried out through sessions of the EB-SWG at future SC meetings.

- Enhanced productivity-susceptibility analyses (PSAs) that are comparable, transferable and for which uncertainty has been quantified explicitly and appropriately.

- Identification of highly migratory species, or associated/dependent species, that is at high apparent risk and is assessable at Level 3 (full quantitative assessment) using existing data sources and models.

- Identification of fisheries monitoring requirements (i.e. data quality and quantity) in order to generate sufficient data for other high-risk species to be assessable at Level 3.

- Scientific support for small island developing states in implementing ERA at the national level, as requested by the countries/territories concerned and in collaboration with FFA.

- Identification and evaluation of bycatch mitigation measures.

13. The PSAs are dependent upon good quality observer data and their future successful application will depend upon the quality of data from the Regional Observer Programme (ROP). Some CCMs have good observer coverage and quality control and these CCMs are encouraged to carry out PSAs for their own zones and/or fleets. Observer coverage is generally inadequate over the Convention Area, especially high seas areas. The ROP must meet minimum standards regarding species identification, recording of condition/fate, gear attributes and use of mitigation measures, as detailed in SC3-GN-WP-6.

Discussion

14. Several participants congratulated SPC on the progress that had been made on the ERA analysis, particularly the PSA analysis. The work undertaken by FFA and participants on national EAFM processes was also noted (SC3-EB-IP-11). There was general agreement that these risk assessments will assist the SC in examining bycatch issues and providing advice to the Commission. The EB-SWG received the ERA Research Plan and looked forward to SPC-OFP reporting on its outputs at future meetings. SPC-OFP is encouraged to convene an ERA Technical Advisory Group during the course of the project, with participation from interested CCMs on a self-funded basis. The Special Requirements Fund might be appropriate to support the involvement of some participants.

15. There was discussion about the technical aspects in the PSA analysis. Clarification was provided regarding:

- The PSA has the potential to assess the performance of management measures, depending on the susceptibility criteria included.

- The PSA covered over 200 species and used biological information drawn from the CSIRO database on biological characteristics of species.

- In the case of missing values, the average for species groups had been used. The PSA will identify species that should be the focus of dedicated research.

- The definitions of level of risk in the PSA will to some extent always be arbitrary. Where a Level 3 analysis is available it may help in providing an exact definition of high risk. Species identified as being of high relative risk by the PSA should be examined more closely to understand the basis.

- Ecosystem modeling approaches, such as ECOSIM, would be a type of Level 3 analysis. The value of incorporating trophic level within the PSA will be examined in the next stage of research.

- A substantial number of scientists from Australia and other countries have provided technical expertise and review of the PSA process. These have included scientists from stock assessment and conservation biology backgrounds. The SC also provides a forum for all CCMs to discuss the ERA approaches.

16. It was also noted that the International Commission for the Conservation of Atlantic Tuna (ICCAT) is engaging in a similar approach to risk assessment, focused on seabirds. There has been discussion between those involved in the ICCAT process and SPC.

Biology of high risk species

17. The EB-SWG also noted that the work programme for the BI-SWG should include research into the biology of species identified as high risk in the ERA and data on attributes that are used in the risk assessment.

Ecosystem impacts on fisheries

SC3-EB-WP-2: Regime shifts in the western and central Pacific Ocean

18. David Kirby from SPC-OFP gave a presentation on "Ocean variability, regime shifts and tuna recruitment". This presentation reported on a project that had been developed following concern expressed at SCTB 16 about whether apparent shifts in tuna recruitment estimates were due to the introduction of purse-seine fisheries at that time or genuine shifts in the environment. The analysis is described in more detail in SC3-EB-WP-2.

19. "Regime shifts" are decadal scale changes from one relatively stable state to another. The concept and statistical tests for their existence may be applied to single time series (e.g. recruitment) or to multivariate ecosystem indicators (e.g. principal component scores). Regime shifts are apparent in basin-scale climate indicators (e.g. SOI: southern oscillation index; PDO: Pacific decadal oscillation) and ecosystem effects of these have previously been documented for the North Pacific. However, their existence in the WCPO and relevance to tuna recruitment were unknown.

20. Oceanographic model output for the Pacific Ocean over the period 1948–2004 was analyzed statistically for the presence of regime shifts. A statistical model building exercise (SC3-SA-WP-5) identified areas and scales where environmental variability was most closely linked to tuna recruitment during periods for which there was good confidence in the recruitment estimates. Environmental variables were then analyzed for those areas by principal components analysis, with significant principal components then serving as quantitative indicators of oceanographic state. Tests were applied to determine the existence of statistically significant regime shifts in time series of both ecosystem indicators and tuna recruitment estimates. The key conclusions are as follows:

- Tuna recruitment variability can be predicted by ocean variability provided the appropriate areas, scales and time periods are selected in the model building exercise.

- Environmental regime shifts are apparent in the WCPO, with shifts found at times that are broadly consistent with other studies for the north Pacific (1976, 1989, and 1998) although earlier shifts (ca. 1964) appear to be just as significant. The best single indicator for monitoring the effect of long-term environmental variability on yellowfin tuna recruitment appears to be the area of the western Pacific warm pool.

- These environmental regime shifts are synchronous with shifts in the recruitment of yellowfin tuna, not for bigeye, which has a significant shift in 1994 that is not synchronous with shifts in the environment.

- The strongest mode of environmental variability (i.e. first principal component) does not necessarily lead to the strongest effect in recruitment, and weaker modes (e.g. third principal component; primary production) can have strong effects.

- The "regime shift" concept is simplistic as there are many temporal scales of environmental variability. It is better than assuming equilibrium however, and the use of oceanographic predictors of tuna recruitment may help to reduce uncertainty in stock assessments.

Discussion

21. There was discussion on the predicative ability of some of the indices discussed. While there have been some improvements in the predictability of events, such as El Niño, predictability at decadal timescales is more difficult. The value of this work in the WCFPC context is probably more for generating plausible scenarios for stock assessment projections.

22. The analyses suggest that the western Pacific warm pool was the best indicator for yellowfin tuna recruitment. There was a significant linear correlation explaining 52% of the variability. However, for bigeye tuna it was more complex, requiring higher dimensions to explain the variation. The method for determining whether a regime shift had occurred was based on NOAA Fisheries research.

23. In response to a question regarding the relationship between regime shift and the El Niño phenomenon, Kirby clarified that the El Niño variability is usually indicated by the SOI and is predominantly internal. This project is examining decadal variation that may be due to regime shifts, and is examining the effects of this on tuna recruitment. Kirby also clarified that the analysis was based on an oceanographic model that includes all components of ocean currents, and that analysis of geostrophic currents may be appropriate for finer-scale analyses.

24. There was discussion on whether similar work on tuna populations in other oceans had shown similar oceanographic features, such as the western Pacific warm pool. Work to date in other oceans has adopted different approaches and the oceanographic features do not appear as clearly defined.

25. It was noted that this type of work is valuable for stock assessment and supports the Commission's move to an ecosystem approach to fisheries.

26. It was also noted that there is a 10-year international research programme on climate change on top predators (CLIOTOP) being undertaken as part of GLOBEC, which will have its first symposium in December 2007 in La Paz, Mexico.

Sharks

27. Paul Dalzell opened this agenda item with a simple graphic which showed the shark species reported in the annual country reports prepared for SC3. The most commonly reported species were blue sharks, makos, silky sharks, oceanic white tips.

Identification of key shark species for annual reporting to the Commission

SC3-EB-IP-15: Shark capture and disposition in the Hawaii pelagic longline swordfish and tuna fisheries

28. Eric Gilman provided an overview of shark capture and disposition in Hawaiian longline tuna and swordfish fisheries. The information for this SC information paper and presentation are taken from a report completed earlier this year entitled, "Shark Depredation and Unwanted Bycatch in Pelagic Longline Fisheries: Industry Practices and Attitudes, and Shark Avoidance Strategies". This paper includes information from 12 pelagic longline fisheries in eight countries, including the two Hawaiian longline fisheries. The report is available from the WPRFMC and UNEP websites.

29. Gilman noted that government fishery measures that have affected fisheries' practices with sharks. In March 2002, legislation came into effect in the US, which requires the total weight of retained shark fins to be ≤5% of the total dressed "live" weight of shark carcasses. Since finning restrictions came into effect, finning has stopped, and few sharks are retained, and discarded bycatch has increased. In 1999, before restrictions on shark finning were instituted, over 65% of caught sharks were finned while carcasses of only 1% of caught sharks were retained for combined Hawaiian longline fisheries.

30. In 2004, the Hawaiian longline swordfish fishery was required to discontinue using 9/0 J hooks and squid bait and start using wider 18/0 circle hooks with mackerel type bait. Since the fishery made this change in baits and hooks there has been a large and significant (36%) decrease in their shark catch rate. This large and significant decrease in shark CPUE observed in the Hawaiian swordfish fishery is consistent with controlled and comparative studies, which found that switching from squid to fish for bait resulted in a large, significant reduction in shark CPUE, while switching from Japan tuna and J hooks to circle hooks caused no change or a significant but small increase in shark CPUE.

SC3-EB-IP-19 Commonly captured sharks and rays for consideration of the Ecosystem and Bycatch Specialist Working Group

31. Brett Molony (SPC) presented a summary of shark species reported by observers based on longline and purse-seine vessels in the Convention Area, in order to develop a list of key shark species for consideration by the Commission. It was noted that the spatial distribution of observer data differs from the spatial distribution of fishing effort and coverage rates are low. At least 49 species and higher taxa have been reported, although not all species are reported from all areas of the Convention Area.

32. Sharks contribute approximately 25% of the total longline catch by weight, with blue sharks, silky sharks, and pelagic sting rays dominating the observer data. Longline shark fisheries also exist in the Convention Area. Sharks represent less than 1% (by weight) of the purse-seine fisheries in the area, dominated by silky sharks, oceanic whitetip sharks and manta rays (Mobulidae). However, this was significant in view of current total catch levels (1.5 million mt). In both fisheries, thresher sharks, mako sharks and hammerhead sharks are often reported at a range of taxonomic levels (species, genus or family) and unidentified sharks are also reported by observers.

33. When developing a list of shark species for the Commission, the following suggestions were highlighted.

- Annex 1 of UNCLOS lists a range of highly migratory species of and families of sharks that fall under the management auspices of regional fisheries management organizations (RFMOs), including the families Carcharhinidae, Alopiidae (threshers), Sphyrnidae (hammerheads), Isuridae (makos), which combined, represent a large number of species;

- The IUCN lists several shark species that interact with fisheries in the Convention Area, and is likely to list more species in the near future;

- The observer data is likely to reflect the productivity of various sharks species, with more reproductive species (e.g. blue sharks) being reported more frequently that less productive species (e.g. dogfish). Thus, frequency of reporting may not reflect the impacts of fishing on all species of sharks;

- If observers report sharks at the lowest possible taxonomic level, then it is relatively easy for all countries to report all species of sharks to the Commission;

34. Observer data will become more critical in the future in order to assess sharks in the Convention Area.

Discussion

35. Participants discussed the difficulties in identifying shark species. Some participants consider that it may be unrealistic to expect fishermen to identify and report all shark species and that maybe they would only report a few key species. Other participants were of the opinion that there was a need to identify sharks to the species level as there was often a price differential among those shark species that are retained. It was noted, however, that training could be made available to improve fishermen's ability to identify shark species. There was also some discussion about the reporting of shark disposition in observer reports, which included whether sharks were released dead or alive. Shark species identification resources included an identification sheet from Papua New Guinea for use in its directed shark longline fishery, and a US document on the WCPFC website with 50 pages of identification sheets on sharks.

Review of fin-to-body weight ratios

SC3-EB-WP-4 A Review of fin-weight ratios for pelagic sharks

36. Ilona Stobutzki from Australia presented a review of studies on the fin weight to carcass weight ratio of pelagic shark species. There was a wide range of reported ratios both within and between species. The ratio is influenced by the species studied and the size of shark; younger, smaller sharks tend to have relatively larger fins. The ratio varies with the number of fins used, how the fins have been cut and whether it is wet or dry weight. The form of carcass weight used, dressed weight or whole/round weight also influence the ratio. The origin of the 5% fin-weight ratio was a study by the US National Oceanic and Atmospheric Administration (NOAA) Fisheries (1993) where the ratio measured was the weight of the primary fin set (first dorsal fin, pectoral fins and lower lobe of the caudal fin) to dressed carcass weight (headed, gutted and all fins removed) and based on the value from 12 silky shark. In the current review, comparable studies which used the ratio of primary fin set to dressed carcass weight found ratios to between

2.9% and 5.07%. Ideally, species-specific and even fleet-specific ratios should be developed, as well as accepted criteria for calculating fin weight to carcass weight ratio. However, there are practical difficulties in implementing species- or fleet-specific ratios.

Discussion

37. Participants generally considered that the average 5% fin to carcass ratio was reasonable, given the variations in species composition, size and processing methods. However, there were issues concerning how much of the shark carcass was processed at sea prior to landing and whether undressed carcasses could be processed on landing. There was also discussion about the range of fisheries included in the review presented by Australia and if the fin-to-carcass ratio was influenced by the type of fishery catching sharks and the area of fishing (i.e. tropics versus sub tropics/temperate waters). There were also some comments on cultural issues surrounding shark finning and that the Commission should adopt a ratio which was suitable for this convention area and not just because it was used by other RFMOs.

38. Participants also discussed research programmes related to achieving full utilization, and whether tax incentives or marketing programmes could be used to achieve full utilization. It was noted that there were a range of countries such as Indonesia where full utilization occurs that might be models for achieving this. On the other hand, there may be economic constraints mitigating this in some markets. Some participants expressed concern about whether fins need to be landed attached to the sharks as this may not be practical. There was also discussion about the current shark finning restrictions being limited to vessels of over 24 m in length and that there appeared to be no scientific basis for this. Participants also discussed if the current conservation measure included shark catch limits. Currently, there were no limits on landings, although participants were supposed to attempt to release sharks alive if they were not retained. Discussions under this agenda item finished with comments on the regression analysis used to establish fin length to body length as the shark grew over time. It was noted that the studies cited in the review should be consulted with respect to this issue.

Review of conservation and management measures

SC3-EB-WP-5: Large-scale experiment shows that banning wire leaders helps pelagic sharks and longline fishers

39. Peter Ward presented the results of an Australian study to assess the performance of wire leaders, which some jurisdictions have banned in order to reduce shark mortality from pelagic longline fishing. Experiments were conducted on commercial vessels that deployed equal numbers of wire and nylon monofilament leaders randomly along their longlines. During this experiment observers monitored 177 longline operations consisting of 77,011 hooks (37,679 nylon leaders and 37,422 wire leaders). The longliners concentrated on a relatively small area of the western Coral Sea outside the Great Barrier Reef. Longline activity was uniformly distributed throughout the 15-month study period. Catch rates of several species, including sharks, were significantly lower on nylon than on wire leaders, probably because those animals often escape by severing the nylon leaders. High bite-off rates indicate that as many animals escape from nylon leaders as are caught on nylon leaders. The fate of escaped animals is not known, although large sharks are more likely to survive than are small animals. By contrast, catch rates of valuable bigeye tuna (*Thunnus obesus*) were higher on nylon than on wire leaders. Bigeye tuna are probably able to see wire leaders and avoid those hooks. The financial benefits of increased bigeye tuna catches outweigh the costs associated with banning wire leaders, such as increased

rates of gear loss. Thus, banning wire leaders is an effective way of reducing shark catches that fishers should be keen to adopt.

Discussion

40. Initial discussions on this issue suggested that deep-setting tuna fishing would likely catch few sharks, which tended to inhabit the upper surface layers of the water column. It was noted that the study was unable to analyze this effect. Deeper setting would likely cause a reduction in shark CPUE so the difference in CPUE between wire and nylon would be reduced. Differences in illumination soak time and hook type would also cause a difference in loss rates. Also, fishermen regularly reported sharks caught with several hooks in their jaws, which provides support for the assertion that sharks survive the interaction with longlines. However, it was not known whether gut-hooked sharks survived or whether other species survived.

41. It was also noted that not all longline vessels use wire leaders. Some vessels change their target species seasonally, and will change their leader type depending on the principal target species. In most fisheries, fishers want to catch more tuna and not sharks. It was also noted that fishermen may move to avoid unwanted species, but changes in gear can result in changes in catch rates of all species. Often, fishers want to avoid sharks, and so change their gear and habitat type to do this.

42. Participants asked about the bait type used in the study, which included mackerel and some squid but the mix was randomized, as was the use of lightsticks. There was a suggestion that sharks might be attracted to the wire because of the electrical current from the interaction of the wire with seawater, attracting sharks to the gear when wire is used. It was noted that research is underway in the USA to investigate certain metals from deterring sharks from ingesting baits.

43. Participants also discussed the use of hook timers to investigate bait loss, although this study was focused on hook loss by bite-offs rather than bait loss. There was some discussion about the assumption that bite-offs are from sharks and not other species such as marine mammals. Other possible issues included whether bite-offs were fish taking the baited hook or larger fish biting off fish which had been caught on the baited hook. There was also discussion about the survival of hooked and released sharks and the deployment of tags to investigate this by comparing mortality rates of sharks released with hooks still in place with sharks released with hooks removed.

Seabirds

44. WCPFC3 adopted Conservation and Management Measure 2006-02. This requires CCMs to ensure that their longline vessels use at least two of the mitigation measures in Table 1 (below), including at least one from Column A in areas south of 30°S and north of 23°N. The Commission also agreed that at its 2007 Annual Meeting it would adopt minimum technical specifications for the mitigation measures, based on the advice and recommendations of the SC and TCC3.

Review of WCPFC3 Resolution

45. No working papers were submitted in relation to agenda item 6(a). Discussion was held on the information paper submitted under this agenda item.

Table 1: Mitigation measures

Column A	Column B
Side setting with a bird curtain and weighted branch lines	Tori line
Night setting with minimum deck lighting	Weighted branch lines
Tori line	Blue-dyed bait
Weighted branch lines	Deep-setting line shooter
	Underwater setting chute
	Management of offal discharge

SC3-EB-IP-4: Quantifying the impact of longline fisheries on adult survival in the black-footed albatross

46. Industrial longline fishing has been suspected to impact on black-footed albatross (*Phoebastria nigripes*) populations by increasing mortality, but no precise estimates of bycatch mortality are available to ascertain this statement. A general framework was developed for quantifying the relationship between albatross populations and longline fishing in the absence of reliable estimates of bycatch rate. The framework analyzed capture–recapture data of a population of black-footed albatrosses in order to obtain estimates of survival probability for this population using several alternative models that adequately take into account heterogeneity in the recapture process. Instead of trying to estimate the number of birds killed by using various extrapolations and unchecked assumptions, the study investigated the potential relationship between annual adult survival and several measures of fishing effort. Although a large number of covariates were considered the principal component used was an analysis generating a few uncorrelated synthetic variables from the set, thus maintaining both power and robustness.

47. The average survival for black-footed albatrosses for 1997–2002 was 92%, a low value compared with estimates available for other albatross species. It was found that one of the synthetic variables used to summarize industrial longline fishing significantly explained more than 40% of the variation in adult survival over 11 years, suggesting an impact by longline fishing on albatross survival.

48. The analysis provides some evidence of non-linear variation in survival with fishing effort. This could indicate that below a certain level of fishing effort, deaths due to incidental catch can be partially or totally compensated for by a decrease in natural mortality. Another possible explanation is the existence of a strong interspecific competition for accessing the baits, reducing the risk of being accidentally hooked.

49. The suspicion of a significant impact of longline fishing on the black-footed albatross population was supported by the combination of a low estimate of adult survival for the study period, and a significant relationship between adult survival and a synthetic measure of fishing effort. This study highlights the sensitivity of the black-footed albatross to commercial longline fishing.

Discussion

50. Paul Dalzell reported on an analysis of a large banding database for black-footed albatross nesting on Hawaiian Islands. By using a PSA, the authors concluded that over 40% of the variation in population size was due to the swordfish fishery in the North Pacific Ocean. However, it was noted that estimates of survival for black-footed albatrosses were lower than for other albatross species and that consequently, the impact of fisheries could be dramatic. This paper and other population dynamic studies will be discussed at a workshop to be held in November this year.

Review of Research on Seabird Interactions and Mitigation Measures

51. CMM-2006-02 requires the SC and TCC to annually review any new information on new or existing mitigation measures or on seabird interactions from observer or other monitoring programmes. Where necessary an updated suite of mitigation measures, specifications for mitigation measures, or recommendations for areas of application will then be provided to the Commission for its consideration and review as appropriate. The Convenor recalled that the measure also requires CCMs to provide the Commission with all available information on interactions with seabirds, including by-catches and details of species, to enable the Scientific Committee to estimate seabird mortality in all fisheries to which the WCPF Convention applies. This was a task that needed to be added to the EB-SWG work programme.

SC3-EB-IP-17: Distribution of albatrosses and petrels in the WCPFC Convention Area and overlap with WCPFC longline fishing effort

52. Cleo Small (BirdLife International) provided an update on this paper, which was presented at last year's meeting. The paper provides an analysis of the distribution of albatrosses and petrels in the area under the jurisdiction of the WCPFC, using data from the BirdLife Global *Procellariiform* Tracking Database. It was noted that the WCPFC area includes 41% of the global breeding distribution of albatrosses and petrels and that albatross distribution is concentrated north of 20ºN and south of 30ºS. Previously, the tracking database contained little data on non-breeding birds, but since last year, a large amount of data had been received on non-breeding birds, particularly in the North Pacific. The overlap of fishing effort data against bird distribution still needs to be undertaken. Data were requested from SPC-OFP for fishing effort data in a 5 x 5 grid by year, quarter and fishery aggregation.

Discussion

53. Chinese Taipei requested that further information on seabird population sizes be provided to the meeting. The Agreement of the Conservation of Albatrosses and Petrels (ACAP) advised that it holds data on population status and trends for all species listed on Annex 1 of its Agreement. These data were in the process of being incorporated with breeding site data into a database for use in the development of comprehensive species assessments that could be provided to the next meeting, if required. The USA advised that it was currently reviewing the status of black-footed and Laysan albatross populations, which will also be available for next year's meeting. EB-SWG noted that this information would be considered further under Agenda Item 9.

SC3-EB-IP-7: Studies of distribution, population dynamics and bycatch rates of seabirds in the Atlantic

SC3-EB-IP-6: Assessment of the impact of ICCAT fisheries on seabirds: Proposed methodology and framework for discussion

54. Cleo Small reported that BirdLife International is collaborating with CSIRO on the preparation of a seabird assessment for ICCATT, based on ERA methodology, using PSA and Level 3 models. The results of this assessment will be available towards the end of 2008.

Review of Technical Specifications on Seabird Mitigation Measures

55. CMM-2006-02 requires the SC and TCC to annually review any new information on new or existing mitigation measures or on seabird interactions from observer or other monitoring programmes. Where necessary, an updated suite of mitigation measures, specifications for mitigation measures, or recommendations for areas of application will then be provided to the Commission for its consideration and review as appropriate.

SC3-EB-WP-13: Effective factors of tori-poles in reducing incidental catch of seabirds in the Japanese longline fishery

56. The paper summarizes an analysis undertaken to identify the effective factors of tori-poles in reducing the incidental catch of albatrosses. These factors were examined with data taken from the Japanese observer programme in the southern bluefin tuna fishery using large-sized vessels. A total of 727 observations were used in the analysis. The data in night settings were not used because observed numbers of albatrosses and other seabirds were not recorded correctly during night-setting. The tori-pole specifications were categorized as follows: 1) tori line material (Type I: multifilament twine, Type II: nylon code, and Type III: nylon monofilament), 2) streamer material (Type A: nylon code and urethane cube, Type B: polypropylene (PP) band, and Type C: combination of Type A and B), 3) tori line length (approx. 50 m, 100 m, 150 m, and 200 m), 4) pole height above sea surface (5–10 m, and 10–15 m). A catch model (generalized linear model) was constructed: catch number of albatrosses were treated as responsible variables with a negative binomial error structure distribution; the potential factors affecting albatross catches were incorporated as explanatory variables. The model was evaluated by model selection based on Akaike's Information Criterion (AIC). In the model, tori line length was selected as an explanatory variable, but such factors as tori line material, streamer material, and pole height were not. The model selected the number of albatross observed during line setting, and indicated that the catch increased with the observed number, as might be expected. Results in the model analysis suggest that: 1) the effectiveness of tori-pole in reducing incidental catch of albatross increased with longer tori line; 2) the effectiveness did not differ between Type I, II, and III in tori line material, and between Type A, B, and C in streamer material; 3) the effectiveness did not differ between 5–10 m and 10–15 m in pole height above the sea surface. Recommendations arising from this presentation are that tori lines should be over three times the total length of the vessel (30 m in this study), that the tori line should be constructed of a material that does not twist, and that the streamer line material should be lightweight (e.g. polypropylene band). The type and size of tori line to be used should vary depending on vessel size and oceanic conditions.

Discussion

57. ACAP commended the study, noting that tori lines were one of the mitigation devices that were considered to be a high priority for further research by its Seabird Bycatch Working Group. Japan noted that tori lines were initially developed by fishers to reduce the loss of baits to seabirds. The light tori line developed by Japan slightly modified the fishermen's original design.

It was noted that the optimum configuration of tori poles also depends on vessel size and favorable weather conditions and that the longer tori line had a higher potential for entanglement with fishing gear. Australia also welcomed the study, noting that information on optimum tori line length for vessel size and weather conditions would be very useful. Further information on the activities of small longliners was required so that appropriate mitigation measures could be developed for this component of the fishery.

SC3-EB-WP-8: TCC draft report and information paper of the voluntary small working group on seabird bycatch mitigation

58. The results for a small voluntary working group assessing seabird mitigation measures of various CCMs and other RFMOs were presented. Australia, the EC (Spain), New Zealand, and the United States of America (Hawaii and the US west coast) participated in the working group. The investigation noted that mitigation measures used are area specific, and that there are a number of broad similarities in the specifications for most mitigation measures employed by both the small working group participants and other RFMOs. In addition, the ACAP bycatch working group provided comment on the mitigation measures presented. The information and advice provided by ACAP supported the introduction of a system that prescribes the use of a range of specified mitigation devices. Therefore, the use of measures presented in CMM-2006-02, the technical specifications of which are based on the best available knowledge, represents an acceptable compromise of those measures currently employed and was though to be an appropriate way forward in the short term.

Discussion

59. The EB-SWG noted that some fishers have introduced different types of weights on branch lines and that some of these can present safety issues for the crew. Japan was investigating lead-core branchlines as a possible alternative to weighted swivels. The branchline sink rate is determined by the length of the lead-core branchline as well as its total weight. Smaller vessels have 25–30 m branchlines that are thought to sink very quickly.

60. Chinese Taipei recommended that practical advice from the fishers should be incorporated into future meetings on this issue, as they can often provide insights on bycatch mitigation, such as moving out of areas that have a high incidence of seabirds. Australia supported this approach, noting that observer programmes can also be very valuable in this regard.

SC3-EB-WP-14: Seabird bycatch mitigation: Minimum standards for pelagic longline fishing and priorities for further research

61. Warren Papworth presented a report from ACAP's Seabird Bycatch Working Group (SBWG), which had recently reviewed research on seabird bycatch mitigation measures for pelagic longline fishing to identify knowledge gaps and priorities for future research on pelagic mitigation technologies. Each mitigation measure was grouped as either "primary", "secondary", or "other". Primary measures were those considered likely to be effective without other mitigation measures, secondary measures were those considered useful for deployment with other measures, but may not significantly reduce bycatch if used in isolation. Side setting, blue-dyed fish and squid bait, and fish oil were regarded as possible candidates for primary mitigation but were considered separately due to their early stage of development and/or limited research results

to date. Acoustic alarms, water jets, time–area closures and artificial lures/baits were not considered. Each was assigned a priority ranking using the following criteria.

- Effectiveness on surface foraging seabirds
- Effectiveness on diving seabirds
- Practical use on vessel
- Safe use on vessel
- Capital cost – costs for purchase of a specific technology
- Operational cost – cost related to vessel operations (lost fishing time)
- Applicability to distant water fleets and domestic fleets
- Compliance – the ability to monitor use and performance

The results of this assessment were provided in Table 1 (attached). A second table (Table 2) details the scientific evidence for the effectiveness of these mitigation measures, provides caveats/notes regarding whether there is a need for them to be used in combination, as well as providing minimum technical standards for each mitigation measure, where this information is available. This information is of particular relevance to the work of this meeting.

62. CCMs were encouraged to work with ACAP to conduct research on these measures as a part of implementing Conservation and Management Measure 2006-02.

Discussion

63. Japan referred to protection of breeding colonies on Torishima Island (SC3-EB-IP-18), which showed that the population of short-tailed albatrosses is increasing while longline fishing levels have not changed appreciably. Japan concluded that a holistic approach should be adopted to address seabird conservation, including protection of breeding colonies. The ACAP Agreement has been developed on this premise, and those ACAP member countries that are located within the breeding ranges, have responsibility for ensuring that adequate conservation measures are put in place at these breeding sites. Information on action being taken in this regard will be available in species assessments that could be provided by ACAP to the next meeting. Incorporating the experience of fishers is also important. This experience has been incorporated into the assessments undertaken by ACAP. EB-SWG noted that the information provided by ACAP provides a good basis for refining the technical specifications in CMM-2006-06.

64. Participants queried the practicality of achieving the required standard for blue-dyed bait. ACAP advised that this was straightforward when using squid, but much more difficult for fish bait. The USA agreed that it was more difficult to dye fish, but noted it was still effective when used in combination with other measures.

Sea turtles

SC3-EB-WP-9 Bayesian hazard regression modeling of factors affecting post-release mortality of loggerhead sea turtles caught in pelagic longline fisheries

65. Yonat Swimmer described post-release mortality work being undertaken by NOAA Fisheries. There are few estimates of post-release mortality for sea turtles despite being essential for risk assessment and hazard mitigation. Pop-up satellite archival tag (PSAT) telemetry was deployed by two observer programmes to estimate post-release mortality of 29 loggerhead turtles caught in USA-based North Pacific pelagic longline fisheries between late 2002 and mid-2006. A

PSAT that reports prior to its scheduled report date is considered indicative of apparent turtle mortality. Time-to-report for each PSAT was modeled using an extended Cox-type semi-parametric hazard rate model to identify informative covariates affecting apparent post-release mortality. Covariates included observer programme, date and geolocation of PSAT deployment or retrieval, turtle size, hooking severity (i.e. shallow or deep) and whether the hook was removed before release. Nonlinear and time-varying covariate effects were modeled using Bayesian P-splines and varying-coefficient techniques. Spatial effects were treated as correlated random effects estimated using a two-dimensional P-spline surface smoother. Individual heterogeneity associated with each PSAT (or turtle) was treated as an unstructured random effect. The time-to-report data were also subject to censoring mechanisms including right censoring, left censoring and left truncation (or staggered entry) that were accounted for in the modeling framework. A range of models of increasing complexity were fitted using mixed-model estimation (empirical Bayes) with model selection based on the AIC. The best-fit model comprised a monotone increasing baseline hazard (PSAT "aging" effect) reflecting increasing probability of apparent post-release mortality, a declining hazard rate over the four-year study (perhaps reflecting improving PSAT technology or turtle handling procedures), a hazard rate that was a time-varying function of hooking severity and that was also spatially-dependent reflecting a westward movement of the longer surviving loggerhead turtles. The time–depth profiles recovered from the PSATs that reported prematurely (apparent mortality) were reviewed to determine if those turtles did in fact die and concluded that only 2 of the 29 loggerheads might have died subsequently from gear-induced injuries. This significant discrepancy between apparent and most-likely post-release mortality reflects PSAT equipment and/or attachment failures.

Discussion

66. Japan noted that safe handling of hooked seas turtles is effective in reducing mortality. Japan has conducted observations on captive hooked loggerheads. All turtles survived and hooks fell out or were discharged within a few months. The reports of this work are currently only available in Japanese and are as yet unpublished.

SC3-EB-WP-7 Developments (2006-2007) in scientific research on the use of modified fishing gear to reduce longline bycatch of sea turtles

67. Yonat Swimmer gave an overview of the ongoing sea turtle bycatch mitigation research, including recommendations of effective techniques that have also been shown to maintain viable catch rates of target species. Specifically, research to date includes results from experiments in different stages of development, all which suggest that the use of circle hooks reduces the severity of injuries to turtles, thereby increasing the chances of surviving the hooking event. Large circle hooks can effectively reduce the frequency of hookings by hard-shelled sea turtles that bite baited hooks, and can also reduce snagging and entanglements of turtles that rarely bite the gear (i.e. leatherbacks). Size of circle hooks is an important factor to consider, with increased size resulting in fewer hookings, but smaller sizes also being somewhat effective in fisheries with smaller turtles. The review included descriptions of research on circle hook experiments conducted in both shallow-set swordfish and deep-set tuna fisheries with collaborators in Italy, Brazil, Uruguay, Indonesia and the Philippines. Use of fish bait has also been shown to be an effective mitigation measure to reduce sea turtle bycatch, as proven by field experiments in a Spanish longline fishery in the Mediterranean Sea and in other fisheries. In addition, research in Costa Rica has shown the effectiveness of a hook with an added "appendage" in reducing sea turtle capture rates. This method, however, was not found to maintain acceptable levels of target species, such as mahimahi and sharks, and is therefore not likely to be accepted by that fishing industry. With regards to entanglement of sea turtles in shallow-set fisheries, experiments in the

EPO have shown that replacing a light-weight multifilament line with a stiffer monofilament line, either throughout the mainline or even for a portion of the line at the base of the float lines, can significantly reduce entanglement interactions.

Discussion

68. Circle hook use was being promoted by Chinese Taipei through a programme of hook exchanges with their fishing industry. However, it was noted that fishermen had complained that the circle hook increases the risk of injury. Fishermen in the US had noted that when fishermen are hooked with circle hooks they were harder to remove than J hooks.

69. Research results from Japan showed that smaller circle hooks were effective in reducing the proportion of deeply hooked turtles. However it was also noted that there may be resistance by fishermen to using a different hook, especially different type or size. There was also discussion about a holistic approach to address the conservation of turtle populations such as nesting beach protection, an activity in which several participant countries were engaged. It was also noted that the Commission needs to know catch rates of sensitive species through an observer programme in order to determine fisheries effects and enable an adaptive management approach. For example, if there were deep-set fisheries that did not catch turtles, then they may not be required to employ turtle avoidance methods. Participants also noted the differences in the various fisheries covered in this presentation and that fishery-specific solutions may be needed. A good example was the use of monofilament line versus highly flexible lightweight cord to reduce the potential for turtles to become entangled by longlines. It was noted that that there may be no longline fisheries using this type of highly flexible cord in the Convention area.

SC3-EB-WP-11 Comparison of circle hook and J hook catch rates for target and bycatch species taken in the Korean tuna longline fishery during 2005–2006

70. Korea's National Fisheries Research and Development Institute (NFRDI) conducted circle hook experiments to compare catch rates of target and bycatch species between J hook and circle hooks in the tuna longline fishery. Experiments were conducted in the EPO using the Korean commercial tuna longliners in 2005 with three hook types (J hook and two kinds of straight type or non-offset circle hook: C15 and C18) and in 2006 with four hook types (J hook and three kinds of 10^{o} offset type circle hook: C15, C16 and C18). The results from the two experiments in 2005 and 2006 showed differences in the catch rate of target and bycatch species by hook types and sea turtle catch rate. In the target species group, no significant differences between the four hook types were observed in 2006, but in 2005, the straight large circle hook (C18) had the lowest catch rate (i.e. lower than J4 by about 20% for tunas and for other fishes), and the small circle hook (C15) had lowest catch rate for billfish and sharks. The bycatch rate by species did not show the same trend between the two studies. Sea turtles were caught only by J hooks in 2005 but in 2006 they were caught by both J and circle hooks. It is clear that the use of offset circle hooks did not decrease sea turtle bycatch, but in general, increased the survival rate of sea turtles after they were caught. The inconsistencies between the results in 2005 and 2006 make it difficult to draw firm conclusions on the efficiency of circle hooks for sea turtle bycatch mitigation in tuna longline fishing. In 2007, NRFDI will continue conducting this type of research with a mixture of circle hooks (straight and offset types) during August–September in the WCPO and will present the results at SC4.

Discussion

71. There were supportive comments from participants for this type of experiment. It was noted that alternating the hooks along the mainline was the preferred experimental design to reduce sources of bias. As such, it was also noted that it may be possible to use more powerful statistical tests to analyze the data from this experiment.

72. Regional Observer Programme – Priorities for ecosystem and bycatch monitoring

SC3-EB-IP-17 Distribution of albatrosses and petrels in the WCPFC Convention Area and overlap with WCPFC longline fishing effort

73. BirdLife International provided an update on analysis of albatross and petrel distribution in the WCPFC area. Tracking data show the WCPFC area includes 41% of the global breeding distribution of albatrosses. New tracking data are available on non-breeding birds, collected by the Tagging of Pacific Pelagics Program and Hatfield Marine Science Center. ACAP has commissioned an updated analysis of spatial and temporal overlap between albatrosses and petrels and WCPFC longline fishing effort and this will be presented at next year's meeting.

SC3-EB-WP-6: Recording seabird bycatch in longline observer programmes

74. BirdLife International gave a presentation on best practice for recording seabird bycatch in longline observer programmes. A range of guidance on best practice exists, including information from WCPFC CMM observer programmes and the Observer Conference in 2004 (Dietrich et al. 2007). BirdLife has gathered experience through its collation of a global database on seabird bycatch data and through its Albatross Task Force, which works with fishermen in seabird bycatch hotspots worldwide. The Commission for the Conservation of Antarctic Marine Living Resources (CCAMLR) has had a regional observer programme since 1992, and this has been identified as a key factor in CCAMLR's success in reducing seabird bycatch by over 99%. Key issues are adequate observer coverage, the standardized collection of data, and observer training. Key data are number of hooks observed from hauling hatch, number and fate of seabirds caught, mitigation measures used, collection of data for seabird identification, trip and gear information, and feedback from observers on causes of seabird bycatch events and effectiveness/problems with use of mitigation measures.

Discussion

75. The work of observers can involve many tasks in WCPO tuna fisheries, with the need to balance work on bycatch monitoring with other responsibilities, such as collecting data on fishing gear and target catches. The EB-SWG noted that there is a need to prioritize the observer work when activities overlap, and that the observer effort (number of hooks observed) must be recorded appropriately to indicate the fraction of effort not observed (gaps in attention to the haulback).

76. EB-SWG noted that the EC fleets operating throughout the world will be required to have at least 10% observer coverage, with a priority on bycatch monitoring. The EC will be funding this observer coverage.

77. The meeting reiterated the need for observers to collect information from WCPFC fisheries that are essential to meeting the requirements of the Convention (e.g., assessment of

target species and the minimisation of bycatch). Such information included vessel and gear attributes to determine relative fishing power, spatial information, various effort parameters and detailed information on the catch and interactions, including species identification, size, condition, fate, post-release mortality, sex and issues with mitigation methods or new innovations.

Future research plans

Discussion

78. In considering last year's work programme, the Convenors noted that many of the tasks and projects were listed against "other" sources of funding. They stressed that the EB-SWG's endorsement of those projects, if warranted, can help proponents to secure funding from external sources. It also provided CCMs and the Commission with an indication of the extent to which Commission-related research may be cross-subsidized by external sources.

79. The EB-SWG noted the lack of research on shark biology. CMM-2006-05 paragraph 14 states that "CCMs are encouraged to cooperate in the development of stock assessments for key shark species within the Convention Area." Shark stock assessments should therefore be included in the research plan. A stock assessment of blue shark has been undertaken and EB-SWG requested that this work be presented at SC4. The feasibility of a regional shark tagging programme should also be investigated. Such a programme might provide information on the survival of released sharks as well as estimating key population parameters of common species.

80. Participants were reminded that their governments should develop and implement shark NPOAs, as CMM-2006-05 notes that "CCMs shall advise the Commission annually on their implementation of the IPOA Sharks, including, as appropriate, results of their assessment of the need for a National Plan of Action and/or the status of their National Plans of Action for the Conservation and Management of Sharks."

81. The conveners suggested that the next EB-SWG consider an investigation into the fishing activities and catch composition of longliners smaller than 24 m so that appropriate seabird and shark measures might be considered for these vessels.

82. CMM-2006-02 states that "CCMs shall provide the Commission with all available information on interactions with seabirds, including bycatches and details of species, to enable the Scientific Committee to estimate seabird mortality in all fisheries to which the WCPF Convention applies." Therefore, the estimation of seabird interactions and bycatch should be included in the work plan. ACAP is a useful source of advice on priorities for seabird research. The study that is investigating the overlap of fishing effort with seabird distribution is to be funded by ACAP.

83. Participants emphasized that research into bycatch mitigation measures needs to simultaneously compare catch rates of all gears tested, for target species as well as other non-target species. For example, some studies suggested that circle hooks may result in elevated catch rates of sharks, while others suggested that reduced shark catch rates may be associated with circle hooks.

84. A small drafting group will further develop the work programme during the SC so that EB-SWG research priorities can be aligned with other priority areas, such as assessments of target species. The small drafting group's recommendation will then be considered at plenary.

Other matters

Nomination of EB-SWG convenors

85. Paul Dalzell and Peter Ward were nominated to continue as Co-Convenors for the EB-SWG for the 2008 and 2009 meetings. There was no other nomination, and Paul and Peter accepted their nominations.

86. In closing the meeting, the Convenors noted that no new or existing research results were presented to the EB-SWG. It was therefore not necessary for the SC to review or suggest modifications to the mitigation measures listed in CMM-2006-02. The Conveners thanked presenters, participants and rapporteurs for their contributions to the session.

87. This report was cleared by the SC.

88. Close of meeting.

Attachment H, Appendix 1

The Commission for the Conservation and Management of Highly Migratory Fish Stocks in the Western and Central Pacific Ocean

Scientific Committee
Third Regular Session

Honolulu, HI, USA
13–24 August 2007

AGENDA FOR THE ECOSYSTEM AND BYCATCH SPECIALIST WORKING GROUP

1. **Opening of meeting**
2. **Selection of rapporteurs**
3. **Adoption of agenda**
4. **Ecosystem effects of fishing**
   a. Progress of productivity and susceptibility assessment (PSA)
   b. Biology of high risk species
   c. Ecosystem effects on fisheries
5. **Sharks**
   a. Identification of key shark species for annual reporting to the Commission
   b. Review of fin to body weight ratios
   c. Review of Conservation and Management Measures
   d. Stock assessment for key shark species
6. **Seabirds**
   a. Review of WCPFC3 resolution
   b. Review of research on seabird interactions and mitigation measures
   c. Review of technical specifications of seabird mitigation measures
7. **Sea Turtles**
   a. Review of Research Programme and WCPFC2 Resolution
   b. Review of research on sea turtle interactions and mitigation measures
8. **Regional Observer Programme**
   a. Priorities for ecosystem and bycatch monitoring
9. **Future research plan**
   a. Detailed operational research plan for 2007/08 with budget
   b. Work programme for 2009-2010 with indicative budget
10. **Other matters**
11. **Adoption of report** (including a one-page summary)
12. **Close of meeting**

Attachment I

The Commission for the Conservation and Management of Highly Migratory Fish Stocks in the Western and Central Pacific Ocean

Scientific Committee
Third Regular Session

Honolulu, HI, USA
13–24 August 2007

REPORT OF THE FISHING TECHNOLOGY SPECIALIST WORKING GROUP

Preliminaries

1. The meeting was opened by David Itano who convened the session. The agenda was adopted as set out in Appendix 1, with modification to include brief presentations of recently received SC3-FT-IP-10 and SC3-FT-WP-8, and session rapporteurs were identified.

Review of information and related studies

2. Eight working papers and 11 information papers were submitted to the Fishing Technology Specialist Working Group (FT-SWG) for consideration by the Third Session of the Scientific Committee (SC3). All papers were either presented or noted briefly during the session. These papers described research or descriptive materials on the biological, ecological or fishing efficiency influences of fish aggregation devices (FADs) and floating objects on target and non-target species; improvements in targeting and avoidance of small tuna; operational characterization of fleets, effort standardization and effective effort; and information requirements for port sampling and observer programmes.

Studies related to the influence of FADs and floating objects on target and non-target species

SC3-FT-WP-4: Preliminarily results of the relationship between catch ratio of bigeye tuna to total catch and length of underwater structures

3. Keisuke Satoh presented SC3-FT-WP-4, which described preliminary port sampling and logbook investigations of the tuna species composition of purse seine catches, and the depth of FADs, that were conducted from May to June 2007 in the western and central Pacific Ocean (WCPO). A total of 17 and 65 associated sets were investigated using port sampling and logbook investigations, respectively. No clear relationship was found between the presence or absence of bigeye tuna catches and the depth to which FADs hung down in the water. There was no effect of FAD depth on the ratio of bigeye tuna positive catches to total catch per set. The effects of the depth of FADs for the amount of skipjack and yellowfin tuna catch were also investigated and catches were also not significant with respect to the depth of FADs.

4. The analysis was considered preliminary because of small sample sizes for both data sets. These investigations involved collaboration between Japan Far Seas Purse Seine Fishing

Association, two fishing markets (Yaizu and Makurazaki ports), Japan Fisheries Resource Conservation Association, and the National Research Institute of Far Seas Fisheries, Fisheries Research Agency (NRIFSF, FRA) lead by Fishery Agency of Japan. This type of collaborative work is recommended in Conservation and Management Measure 2006-01 (WCPFC 2006).

Discussion

5. There was general recognition that the temporal and spatial nature of the fishing activities investigated in this study was restricted as the study began in May 2007 with only a small data set examined. The author and colleagues advised that similar investigations were planned up until March 2008 so that purse seine associated sets from other locations and seasons in the WCPO could be investigated. The utility of this extended work was supported by the FT-SWG. The importance of collecting supplementary data for these investigations, including how long the FAD had been deployed in the water and independent verification of the length of the underwater structure of the FAD, was also noted.

SC3-FT-WP-5: Fish behaviour from fishermen knowledge: The case study of tropical tuna around drifting fish aggregating devices

6. The Convenor presented SC3-FT-WP-5 that aimed to apply local ecological knowledge (LEK) to assist in the planning of future *in situ* studies of fish behaviour around drifting fish aggregating devices (DFADs) by prioritizing research topics, thereby reducing the number of potential hypotheses to explore. Interviews of fishing masters of the purse-seine fleets working in the Western Indian Ocean (WIO) provided an alternate, independent and previously unexplored source of behavioral information: specifically on the attraction, retention and departure behaviors of tuna schools in relation to DFADs.

7. Most fishing masters concurred that the maximum attraction distance of a DFAD is approximately 10 km, and generally agreed to the following statements: 1) Tuna form distinct schools under FADs, commonly segregated by species, size and aggregation history; and 2) The main reasons for the departure of tuna aggregations from FADs are changes in currents or FAD movements and location in relation to physical or oceanographic features. The number of actively monitored DFADs at sea in the WIO was estimated at approximately 2,100 drifting objects. The authors propose that incorporating fishermen into the planning and design stages of future research projects will facilitate collaborative and integrated approaches.

Discussion

8. The value of face-to-face interviews between scientists and fishing masters was noted, but it was suggested that statistical significance should be analysed before conclusions can be made. The Convenor advised that many of the informed opinions and observations of fishing masters were supported by recent conventional, archival and sonic tagging studies.

Improvements in targeting and avoidance of small tuna

SC3-FT-WP-2: Acoustic imaging, visual observations, and other information used for classification of tuna aggregations associated with floating objects in the Pacific Ocean

9. Kurt Schaefer presented SC3-FT-WP-2, which described the anatomical and behavioral differences of skipjack, yellowfin and bigeye tunas, their acoustic images, behaviour, and other relevant information used for estimating their presence, quantity and sizes when associated with

floating objects in the Pacific Ocean. Most captains of large-scale industrial purse-seine vessels operating in the Pacific Ocean have 10 or more years experience fishing for tunas in association with FADs. Through the use of echo-sounders and sonars on the bridges of these vessels, along with *a priori* knowledge of the acoustic signatures, depth distributions, and behavior — by geographical region and oceanographic conditions — of the various species, along with visual observations of the mixed-species aggregations, captains should have a fairly good idea of the quantities and sizes of each species before they set their nets. Each set provides an opportunity to verify their estimates and thus develop their expertise in determining the species and size compositions of the fish in the aggregations before they set their nets.

Discussion

10. The widespread benefits of scientists working closely with fishers to utilize their knowledge for the benefit of the resource and the industry were communicated by the Convenor. Recognizing the distinct acoustic "signatures" of different species of tuna — and their seemingly different preferred depth ranges by size at different times of the day while associated with FADs (presented in SC3-FT-WP-2) — could assist in avoiding purse-seine sets on aggregations with high concentrations of bigeye and yellowfin tuna.

11. Further discussion focused on the possibility of conducting purse-seine sets at times other than pre-dawn to avoid catching small bigeye and yellowfin tuna. It was noted that tuna can remain aggregated to floating objects after sunset, which may increase incentive for night sets while certain difficulties of night setting was recognized.

12. It was noted by some CCMs that this possible consequence of vessel day scheme (VDS) implementation may increase fishing pressure on tuna resources of concern to the Commission.

13. Queries were also raised as to concerns about the possibility that networks of drifting and anchored FADs may be affecting migration paths of tuna and acting as "ecological traps". SPC advised that recent data from the tagging exercise in PNG, combined with tagging data from the early 1990s prior to the large-scale deployment of FADs in the same area, should enable some comparative investigation of such hypotheses.

14. The dramatic changes in fishing technology utilized in tuna fisheries were acknowledged. The possibility of gaining information from fishers in regard to increases in fishing power over time was raised but it did not appear such quantitative information was able to be derived from this paper. The Convenor advised that crude but informative indicators of increases in fishing power could be acquired from examining total annual catches of tuna now taken from purse seiners compared with 20 years ago. In most cases the annual catches had increased several-fold. The concept of using the actual number of FADs monitored by fishing vessels or FAD density was also suggested as a crude measure of fishing power.

Operational characteristics of fleets, effort standardization and effective effort

SC3-FT-IP-3: Compilation of TDR longline studies and coverage in the WCPO region (brief overview)

15. The Convenor (and author) presented SC3-FT-IP-3. The paper focused on the requirement for improvements in the standardization of longline CPUE if longline data is to be used for abundance indices. Standardization efforts are confounded by numerous technical, environmental, oceanographic, economic and social factors. At issue is the fact that longlines

seldom fish to their predicted depth and the actual time and location of hooking by species and area are not well known. The fishing parameters of many longline fleets have also not been accurately characterized. Time–depth recorders (TDRs) and hook timers offer an empirical way to define these characteristics on a fleet-by-fleet basis. TDR and hook timer studies in the WCPO are summarized with suggestions to contact regional experts when designing TDR studies. Further use of TDRs and hook timers, especially in tropical areas less studied are encouraged. The paper summarizes TDR and hook timer studies that have been carried out in the WCPO. With few exceptions, most studies have taken place in higher latitudes close to countries with well developed domestic fisheries. Increased characterization of longline fisheries in the core equatorial region was encouraged.

Discussion

16. The utility and benefits of such work using TDRs was broadly agreed on, with tropical areas being a priority study area for such work. The scientific services provider (SPC-OFP) to the Commission advised that the combination of such studies with various observer programmes enabled more informed standardisation of longline CPUE. These needs were recognized during SC2 and the Commission has provided SPC-OFP with funding to support the purchase of TDRs for use by domestic observer programmes. Further funding support was encouraged.

SC3-FT-WP-6: Bait loss and its potential effects on fishing power in pelagic longline fisheries

17. Peter Ward presented SC3-FT-WP-6. Survey data from the 1950s were analyzed with generalized estimating equations (GEEs) to quantify factors that influence the rate that bait is lost from pelagic longlines. Hook depth, bait species, local tuna abundance, and the timing of longline operations strongly influenced loss rates. Loss rates increased with tuna abundance and soak time. They declined with hook depth and were low for firm-bodied bait, such as squid. Many longliners began targeting bigeye tuna with deep longlines in the mid 1970s and have used squid bait since the 1980s. This may have resulted in increased fishing power, with important implications for the estimation of abundance from catch and fishing effort data.

Discussion

18. Discussion initially focused on the predicted increase in fishing power over time, primarily as a result of fishing deeper and using squid bait, which remains on hooks longer than soft-bodied baits such as herring. Other factors that may also have effected or reduced bait loss rates included changes in hook design. Some queries were raised as to the effect of hauling speed being a critical factor in bait loss. The author advised that the study was a controlled scientific experiment where hauling speeds were constant. It was noted that detailed longline data sets, where the fate of each hook and bait is noted, are very rare. The practical difficulties in studying and monitoring bait loss in longline fisheries were discussed and acknowledged.

SC3-FT-WP-7: Observation of Chinese purse seine fishery in the WCPFC waters during 2006-2007

19. The Convenor presented SC3-FT-WP-7. The paper presented data collected by two scientific observers who worked onboard two Chinese tuna purse seiners in equatorial waters in 2006 and 2007. The paper reported fishing activities, catch composition and biological features of the catch. The two vessels undertook 96 sets during these trips, of which free school sets and associated school sets were 78 and 18, respectively. The vessels caught 2,107 mt of fish comprising 1,894 mt skipjack, 200 mt yellowfin tuna and 13 mt bigeye tuna.

Discussion

20. The importance of detailed documentation of observer trips was acknowledged. It was noted that small yellowfin and small skipjack have the same market value in this fleet and are normally not separated in logbook data. Discussion mainly focused on the importance of species identification with appreciation that catches of bigeye tuna and yellowfin tuna would likely be under estimated with skipjack over estimated without appropriate port sampling and observer programmes. Experience of the fishing captain was also noted as important as to whether the vessel could pursue unassociated schools with lesser experienced captains being dependent on floating objects and FADs. The importance of recording the fate of small tunas was also noted.

SC3-FT-IP-10: Recalculation of the Philippine tuna production from the WCPO

21. The Convenor presented SC3-FT-WP-10 on behalf of the author. Official records for the Philippines from the WCPFC indicate that the country's tuna fishing fleet contributed a total of 306,512 mt in 2004, roughly 15% of the total tuna production from the WCPO region. Recently, the Bureau of Agricultural Statistics (BAS) estimated the country's total annual tuna production in 2006 at approximately 560,000 mt, which includes neritic species. BAS's estimates apparently also show a progressively increasing annual production trend but with a sudden increase starting in 2002.

22. The main focus of this research is to recalculate historical tuna catch data (i.e. covering periods before 2000). The year 2000 is of special interest because according to the recent report by BAS, it marks the end of a production trend that seems distinct from the trend after this year. The overall estimates of tuna production by the Philippine tuna commercial and municipal fisheries sectors were presented. The results show a relatively stable production trend from the 1990s to the present, indicating the long tradition of tuna fishing in the Philippines. Variability in the tuna production is attributed to changing weather patterns associated with El Niño/La Niña events. The declining production trend reflects the reduction in the number of purse seiner vessels.

Discussion

23. There was no discussion of SC3-FT-IP-10, although it was noted that these revised catch figures represented a significant change to the Philippines' catch and that the paper and methodology would need to be reviewed before SC4.

Information requirements for port sampling and observer programmes

SC3-FT-WP-3: An examination of FAD-related gear and fishing strategies useful for data collection and FAD-based management

24. The convener (author) presented SC3-FT-WP-3. The paper examines different gear and operational aspects of purse-seine fishing on FADs from different perspectives: fishermen's viewpoints, fishermen's knowledge (in reference to SC3-FT-WP-5) and published studies. Important FAD-related gear and associated technology include FAD appendages, electronics (i.e. radio buoys, sonar, and sounders), auxiliary vessels, non-tuna FAD-associated fish, artificial light and chumming. Any influence on bigeye catches and small tuna catches in general were emphasized. It was pointed out that some purse-seine vessels in the EPO and WCPO within a seemingly homogenous fleet have been identified as having disproportionately high catch rates of

bigeye tuna on floating objects. However, attempts to analyze or examine possible reasons for higher bigeye catches by individual vessels have not been possible in the WCPO due to data limitations. It was suggested that FAD-related data should be collected by observers and recorded in a coded form to ease analysis. The IATTC collects detailed FAD and floating object related data on a specific form (Flotsam Information Record) that could be used as a guide if a similar form was considered for the WCPO. Currently, their recording system can track individual floating objects within a trip and classifies each floating object when it is first found and when it is left. For example, it may be found as a natural drifting log, but enhanced by the addition of netting, floats, or a radio buoy, and left as a drifting FAD. Currently, their data collection system does not allow the tracking of floating objects between trips, but the adoption of individual FAD identifiers is being considered.

Discussion

25. The importance of keeping well informed on new technology and fishing methods was noted. However, the difficulty of actually quantifying incremental increases in efficiency was well recognized, but further efforts to do so are necessary and should be encouraged. Discussion noted that current models of long range sonar are capable of detecting a 10 mt school of tuna at a range of 4 km. While precise quantification of increasing purse-seine efficiency was recognized as nearly impossible, it was noted that increasing annual landings of individual vessels was a simple and informative measure of increasing efficiency over time. An example was provided of an EC purse-seine vessel that has increased performance from 2,000 mt pa to around 15,000 mt pa over a 30-year period.

Production, publication and distribution costs for materials to assist species-specific reporting developed by the FT-SWG in languages useful for the Scientific Committee

a) SC3-FT-IP-4: A summary of operational, technical and fishery information on WCPO purse seine fisheries operating on floating objects

b) SC3-FT-IP-5: Handbooks for the identification of yellowfin and bigeye tunas in (a) fresh, (b) frozen and (c) fresh but Less than ideal condition

c) SC3-FT-IP-6: Photographic identification guide for billfish, sharks, rays, tuna-like and non-tuna finfish taken in WCPO pelagic longline fisheries (v1)

26. The convener drew attention to identification guides SC3-FT-IP-4, SC3-FT-IP-5 and FT-IP-6 that the FT-SWG produces to assist training of port sampling and observer programmes in species identification of target and non-target catches. It was noted that instructions to download the manuals are provided in these information papers. The USA was acknowledged for providing funds to the WCPFC in support of observer programmes that allowed printing of guides in support of a recently initiated port sampling programme for distribution to the observer coordinators of the Commission, FFA, SPC and Indonesia. This year, an additional translation into Bahasa Indonesian and Vietnamese languages were noted in recognition of the importance of improving species-specific reporting to regional stock assessments.

Other studies

SC3-FT-WP-8: Catch information from the FAD-based domestic tuna purse-seine fishery in Papua New Guinea

27. This paper presents information on species composition, size structure and sex ratios of fish from associated sets from the Papua New Guinea domestic tuna purse-seine fleet, which is dependent on FAD fishing. For species composition there was no difference in the composition of catch between an anchored fish aggregating device (AFAD) and a free floating object (FFO). The combined data show that skipjack is the main target species (62% by weight and 75% by number) of the catch, followed by yellowfin (35% by weight and 23% by number) and then bigeye (3% by weight and 2% by number). Bycatch accounts for less than 1% by both weight and number (0.44% by weight and 0.48% by number), with rainbow runner being the main bycatch species. A comparison of mean lengths between AFAD- and the FFO-caught fish, by species, shows no significant difference in the tuna species, indicating that the tuna in both set types were of the same size on average. Of the bycatch species, only two species (rainbow runner and silky sharks) showed differences in mean sizes, which for rainbow runner showed that the smaller ones were associated with FFOs and larger ones were associated with AFADs. For silky sharks, the smaller ones were also associated with FFOs and the larger ones with AFADs. Comparison of the means at the lower and upper quartile levels showed significant differences for most of the species including the tunas. For tunas, skipjack and yellowfin showed that the smallest ones were associated with FFOs and larger ones were associated with AFADs. For bigeye tuna, both the smallest and largest fish were found on FFOs. Sex ratio was variable by species by set types. There were significant deviations from the 1:1 male to female ratio overall for skipjack, bigeye tuna, mackerel scad, dolphinfish and barracuda. For AFADs, there was significant deviation for yellowfin tuna, bigeye tuna and mackerel scad. For FFOs, only skipjack tuna and mackerel scad showed significant deviation from the 1:1 male to female ratio. The differences in sex ratio by species by set types indicate that sex ratio may not necessarily be uniform by set association type even for the same species.

Discussion

28. The relatively low percentage of bigeye in the PNG domestic fishery was questioned in relation to perceived higher rates that have been reported in the past. It was clarified that some of those differences can be explained by regional differences in yellowfin and bigeye abundance toward the eastern part of the WCPO. The size of yellowfin and bigeye tunas that should be considered "small" and of concern to management was discussed. Based on an observation of length–frequency of catch, it was suggested that fish less than 60 cm be considered "small tuna" worthy of management attention. The sex ratio data for bigeye reported in the study was questioned as being unusually high for females. It was suggested that these findings may be caused by difficulty in identifying very immature male bigeye by visual means and the exclusion of fish of unknown sex in the study. The convener expressed some difficulty in interpreting the comparisons between anchored and drifting object tuna catch and suggested further development and analysis of this unique data set.

29. It was noted that an associated paper was submitted by PNG in conjunction with SC3-FT-WP-8 and included in the meeting documents. This paper was not formally presented but a short summary of this paper is provided below.

SC3-FT-IP-11. Koren. An assessment of independent fishery tuna data collected from tuna landings from purse seine vessels in Madang for the year 1999 and 2005.

30. This paper presents information on the species composition and size structure of tuna caught from associated sets from the PNG domestic tuna fishery by purse-seine vessels based on port sampling data. This work was carried out to determine the catch composition, the size distribution and likely trend by species and to provide a comparison between years (1999 and 2005). Using stratified random selections, fork length measurements from tuna landings were done in Madang on purse-seine vessels for nine months (January to September) in 1999 and three months (November to January) in 2005. The catch composition calculated indicated that skipjack landings were highest (46.1%), followed by yellowfin (44.9%) and bigeye (9%) in 1999. Port sampling during 2005 indicated a species composition of skipjack (64%), yellowfin (35%) and bigeye (1%). This represents an interesting decrease in the relative amount of yellowfin and bigeye in 2005 sampling with a subsequent increase in skipjack tuna. Comparisons of mean length by species between years showed no significant difference for all three tuna species.

Advice to the Scientific Committee

31. Encourage and support the use of TDRs and hook timers in conjunction with detailed setting information to improve estimates of actual fishing depths of longline gear useful for longline standardization and definition of habitat utilization. Efforts should be emphasized in the equatorial regions and longline fisheries that have not been well sampled with TDRs and hook timers.

32. Encourage and support the use of depth recording gear on purse seiners by observers in comparison with net measurements and set details to improve information on the actual fishing depth of purse seines. The work should be carried out on a fleet by fleet basis to better characterize fleet-specific fishing characteristics.

33. Review Babaran study (SC3-FT-IP-10) relating to Philippine tuna production and its application toward improvements in data collection efforts.

34. Encourage further analysis of FAD catches and landings in Papua New Guinea due to their large and comprehensive port sampling and observer programmes. Conduct comparative analyses of target and bycatch levels between drifting and anchored FADs and between eastern and western areas of the WCPO.

35. Consider a definition of what is a natural drifting object vs. a drifting FAD, as well as various configurations and specifications of deployed FADs. (Note: it was suggested to adopt terminology as detailed in SC3-FT-IP-4.)

RESEARCH PLANNING AND COORDINATION

OPERATIONAL RESEARCH PLAN FOR 2007/2008

36. Analyze increases in purse-seine efficiency and effective effort using simple proxies and other means as tangible indicators of increasing fishing power (i.e. individual or fleet landings in mt/pa), and estimates of the number of FADs deployed each year.

37. Design industry-associated studies related to selectivity and avoidance of small tuna and bycatch on floating objects.

38. Actively solicit collaboration with tuna industry to address important management issues (i.e. issues related to FADs and small tuna fishing mortality).

39. Utilize underwater video camera equipment and other potential complimentary tools to identify species, size composition and spatial distribution of tuna aggregated to floating objects, in conjunction with acoustic equipment.

40. Operational characterization of the major WCPO longline and purse-seine fleets and identification of important technical parameters for data collection.

41. Identification of operational level data useful for effort standardization and the evaluation of fishing efficiency, targeting and bycatch mitigation;

42. Studies related to the various specifications and use of FADs; the behaviour and distribution of target and non-target species; and the influence of purse-seine gear configurations to catchability of fish taken in association with FADs; with a view to identifying their impact in relation to mitigation measures to reduce catches of juvenile tuna and non-target species by purse-seine gear;

43. The production of material to facilitate the identification of target and non-target species by fishermen, observers, and port samplers with the objective of improving data quality.

Medium-term research plan

44. Characterization of the major WCPO fishing fleets. This information, including historical and current details of fishing gear and practices, will be used in standardizing catch rates, specifically to document changes in efficiency, primarily for longline and purse-seine gear.

45. In collaboration with the ME-SWG, promote, review and conduct effort standardization analyses using technical, biological and other data inputs;

46. Work to identify and refine the necessary technical data inputs for effort standardization;

47. Monitor and report on new developments in fishing gear and practices, fishing modes and related shore side developments as they relate to changes in fishing power;

48. Develop training materials to improve species-specific identification of target and non-target species to improve the quality of submitted data and data collection programmes;

49. Investigate and promote studies on socio-economic influences on fishing strategies, spatio-temporal fishing patterns and influences on effective fishing effort;

50. Examine and review the technical aspects of capacity measurement and monitoring of fisheries within the Convention Area.

OTHER MATTERS ARISING

Format, review and clearance procedures of the FT-SWG report

51. The Convener noted that the draft report of the report of the meeting of the FT-SWG will be provided to the Secretariat at 15:00 on Saturday, 18 August and available in hardcopy to delegations that afternoon.

Nomination and election of new Convener and co-Convener for FT SWG

52. David Itano was reappointed as Convener of the FT-SWG. No nominations were received for Co-Convenor and it is not a statutory requirement of the Commission. The Convenor accepted the reappointment.

Other matters

53. No other matters were raised

CLOSE OF MEETING

54. The meeting was adjourned at 12:15 on Friday, 17 August. The report was adopted by the SC.

Attachment I, Appendix 1

The Commission for the Conservation and Management of Highly Migratory Fish Stocks in the Western and Central Pacific Ocean

Scientific Committee
Third Regular Session

Honolulu, HI, USA
13–24 August 2007

AGENDA FOR THE FISHING TECHNOLOGY SPECIALIST WORKING GROUP

5. Opening of the meeting
6. Selection of rapporteurs
7. Adoption of agenda

   3.1 Description of session format and anticipated outcomes
8. Research directives and issues arising from WCPFC-3

   Review of progress and related studies

   a) Quantification and reporting on changes in effective effort due to changes in fishing gears and fish finding technologies.

      i. Use of Time/Depth Recorders (TDRs)

      ii. Recent advancements in gear technology

   b) Technical gear and operational data (longline and purse seine) necessary to monitor changes in effective effort and their impact on species or species groups of special concern, e.g. juvenile tuna, billfish, oceanic sharks, other non-target species. Specific consideration to the data needs for:

      i. Port sampling and observer programmes;

      ii. Effort standardisation;

      iii. The development of FAD Management Plans.

      iv. Information requirements for fisheries other than longline and purse seine.

   4.2. Advice to the Scientific Committee
9. Progress on SC2 Work Programme for 2007

   Review of information

   a) Studies related to the use of FADs and the behaviour of target and non-target species taken in association with FADs.

      i. Acoustic selectivity in relation to purse seine fisheries

      ii. Vertical behaviour and residence time of juvenile bigeye and yellowfin tuna on floating objects

b) Operational characterization of the major WCPO longline and purse seine fleets.

c) Studies related to vessel efficiency and capacity or total effective effort by regional fisheries.

d) Production, publication and distribution costs for materials to assist species-specific reporting developed by the FT-SWG in languages useful for the Scientific Committee

Advice to the Scientific Committee

10. Progress on additional FT-SWG Research Issues identified at SC2 (not covered by Agenda Items 2 and 3):

    Other issues.

11. Research planning and coordination

    Medium Term research priorities

    Detailed operational research plan for 2007/08 with budget

    Work programme for 2009-2010 with indicative budget

12. Other matters arising

    Format, review and clearance of the FT-SWG report

    Other matters

13. Adoption of Report (including a one-page summary)

14. Close of the meeting

Attachment J

The Commission for the Conservation and Management of Highly Migratory Fish Stocks in the Western and Central Pacific Ocean

Scientific Committee
Third Regular Session

Honolulu, HI, USA
13–24 August 2007

REPORT OF THE METHODS SPECIALIST WORKING GROUP

Introduction

1. The Methods Specialist Working Group (ME-SWG) met during the two morning sessions on Tuesday, 14 August and the later afternoon session on Wednesday, 15 August. Robert Campbell (Australia) served as the Convenor of the meeting with Ray Conser and Dale Kolody serving as rapporteurs.

2. Under its Terms of Reference, the ME-SWG will coordinate research and make recommendations to the Western and Central Pacific Fisheries Commission (WCPFC) Scientific Committee (SC) on technical questions relating to analytical methods used for fishery management.

3. For this meeting it had as specific tasks the review of research undertaken to address issues identified at the Third Session of the WCPFC (WCPFC3) and the Second Session of the SC (SC2) as relevant to the ME-SWG. In addition to reviewing the changes and enhancements made to the MULTIFAN-CL (MFCL) models used for assessing the principal target species in the WCPO, and research directed at improving the standardization of longline CPUE and the calculation of indices of stock abundance, this also included reviewing the report of the Expert Consultation on "Investigation of alternative stock status reference points to replace MSY and identification of limit and target reference points".

4. A provisional agenda was circulated for review prior to the meeting and adopted as attached in Appendix 1 to this report. Seven working papers were presented to and reviewed by the meeting while two additional information papers were also noted.

4 — ISSUES ARISING FROM WCPFC3

4.1 Review of information

A: Continued refinement of stock assessment models (including models to standardize CPUE)

SC3-ME-WP-1 — *Regional weighting factors for yellowfin tuna in Convention Area stock assessments*

Working paper SC3-ME-WP-1 was presented by Simon Hoyle. Regional weighting factors are influential components of stock assessments for yellowfin and bigeye tuna in the Convention

Area. They have been calculated for yellowfin assessments since 2005. Catch rate by region has changed through time, and in relation to season and hooks between floats (HBF). We therefore investigated the effect of including these factors in the regional weighting factor standardization for yellowfin tuna. Results of the analysis suggest that including these factors improved the model. The model that used data from 1966 and 1975–1986, and fitting to Region*Year, Region*Quarter and HBF, was selected as the best model based on having substantially the best Akaike's Information Criterion (AIC). However, altering the model did not substantially change the estimated weighting factors.

Discussion

5. In the discussion following the presentation of SC3-ME-WP-1, there was a question regarding the appropriateness of including sets with four HBF in the yellowfin CPUE standardization, as this is generally indicative of swordfish targeting. It was noted that anomalous behaviour of the HBF-catchability relationship (including 4 HBF) sometimes occurs in the tails of the polynomial functions, where there are few observations.

6. In response to a suggestion that HBF may be a poor approximation for set depth, it was explained that this was one of the reasons for restricting the analysis to the period before 1996 — when depth distributions likely changed considerably through the introduction of monofilament line. It was also recognized that a reliable statistical relationship between HBF and CPUE would be meaningful even if HBF is not a good proxy for depths fished.

7. It was noted that results of the area weighting scheme indicate strong differences in density among regions, and support the idea that there are substantial numbers of yellowfin tuna in the lower density regions, removed from the highly depleted equatorial region (particularly Region 3).

8. It was also noted that data from Area 6 in the analysis were very limited (predominantly from 1966 and post-1975). In response to a question as to whether it would be useful to consider mechanistic habitat-based models for estimating abundance in the unfished (or inconsistently fished) areas that are outside of the CPUE standardization region, it was noted that while this was considered possible, it was recognized that this would introduce a new set of uncertainties.

9. Given the shift in targeting from yellowfin tuna to bigeye tuna after the mid-1970s, it was questioned whether it might be more appropriate to subset the standardization data pre- and post-1975, to capture the species targeting effect. In response, Dr Hoyle considered that while this suggestion could be looked at, the model seemed to describe this transition period without obvious problems, suggesting that the HBF factor adequately describes most of the effects of the targeting change.

10. The ME-SWG noted that the new re-weighting scheme was not used in the 2007 assessment for yellowfin tuna but was expected to be applied next year. Furthermore, as it was expected that the HBF-catchability relationships would likely differ by species, the ME-SWG was informed that similar analyses for bigeye tuna would be undertaken during the next year.

11. SC3-ME-WP-2 — Reducing parameter complexity in Multifan-CL stock assessments: catch conditioning

Working Paper SC3-ME-WP-2 was presented by John Hampton. Standard MFCL stock assessments have a large number of estimated parameters, often >5,000, due to long time series of the models and the complexity of fishery definitions. Most of these parameters (~65%) are effort deviations, which model the random variation in the effort–fishing mortality relationship. In the catch-conditioned approach, we assume that the observed catch is known without error and "implicit catchability" parameters are solved analytically, thus removing effort deviations and

catchability deviations (cumulative changes in catchability over time) from the function minimization. The main computational issue to deal with is to maintain numerical stability of the analytical computations. Effort data may be used as in the standard approach and parameters equivalent to effort and catchability deviations computed. The approach has been tested on the 2007 yellowfin tuna assessment data, and very similar results obtained with the number of estimated parameters reduced from around 5,500 to 1,761. It is likely that the catch-conditioned approach will become the default for MFCL assessments in the future. Further work on reducing the parameter complexity is envisaged, particularly with respect to the other large source of model parameters, recruitment.

Discussion

12. The ME-SWG commented that model convergence reliability was listed as one of the main reasons for adopting catch conditioning; however, other model features (notably selectivity parameterization) were thought to be more problematic in this regard. In response, Dr Hampton explained that MFCL already included several selectivity options.

13. It was also noted that model results involving MFCL catch-conditioning and catch estimation were very similar to a comparative study between A-SCALA and SS2 in the EPO. In that comparison, it was also observed that the assessment models were much less sensitive to the differing methods of catch extraction compared with other arbitrary assumptions imposed by the analyst. In particular, removing CPUE (or effort) series (those that were not thought to be informative), resulted in substantially different inferences relative to the equivalent model that down-weighted the unreliable data. Dr Hampton explained that MFCL could achieve a similar effect to removing a CPUE series, by down-weighting the unreliable effort series by a large factor.

14. It was noted that changes in computational efficiency between the two versions of the model had not been quantified. However, while catch conditioning seemed to be about 20% slower for an individual function minimization, it was expected that fewer function evaluations would be required in the minimization resulting in an overall quicker model runtime.

15. The ME-SWG questioned whether there needed to be a process for comparing the sequential effects of the evolving assessment model so the implications of each change are clearly understood. Dr Hampton replied that catch conditioning implications were relatively minor compared with other generic modelling assumptions, but both versions would probably be presented in parallel for a few years.

16. The ME-SWG supported the modifications to the MFCL software that reduce parameter complexity. The reduced computation time is expected to allow a greater exploration of model structural uncertainty than has been undertaken to date.

B: Methods to estimate IUU catches in the WCPO (Topic 3)

17. The ME-SWG noted that no working paper directly addressed this topic and suggested that this issue would be best progressed by the ST-SWG.

C: Further review of 2006 swordfish assessment (Topic 19, CMM-2006-03).

18. The ME-SWG noted that no working paper directly addressed this topic but noted that a revised stock assessment for swordfish in the southwest Pacific is to be undertaken during 2008, the results of which will be presented to SC4. Working paper SA-WP-5 provides further details on this proposal.

D: Review research to reduce uncertainty for striped marlin assessment (Topic 20, CMM-2006-04)

19. The ME-SWG noted that no working paper directly addressed this topic, although it was informed that an updated assessment on striped marlin would likely be undertaken sometime within the next two years.

4.2. Advice and Recommendations to the SC

20. The ME-SWG accepted the changes to the methodology used to calculate the regional weighting factors used to calculate the indices of stock abundance in stock assessments, and recommended that this methodology be used in future assessments.

21. The ME-SWG also accepted the changes to the MFCL stock assessment model to reduce the number of parameters, and recommended that in order to better understand the implications of these changes, that both the original and the revised MFCL model be used in next year's assessments.

5 — PROGRESS ON SC2 WORK PROGRAMME FOR 2007

5.1 Review of information

A. Investigation of alternative stock status reference points to replace MSY and identification of limit and target reference points

22. The Convenor introduced this agenda item by noting that Annex II of the 1995 UN Fish Stocks Agreement and Article 6 of the WCPFC Convention provide the legal framework for the application of the precautionary approach and guidelines for its application to fisheries management of highly migratory species in the WCPO. Article 6 also requests that stock-specific reference points be determined together with the action to be taken if they are exceeded. Currently, the Commission has not formerly adopted any specific reference points but has largely used MSY-based biological reference points in its evaluation of stock conditions.

23. SC2 adopted a work programme for 2007 that included an investigation of alternative stock status reference points, including identification of appropriate target and limit reference points. This was endorsed by the Commission in December 2006. The Commission invited expressions of interest from suitably qualified experts to undertake a short-term consultancy to develop a discussion paper for consideration at SC3. This consultancy was awarded to Drs Campbell Davies and Tom Polacheck of CSIRO Australia and their report is given in SC3-ME-WP-3.

24. Working paper SC3-ME-WP-3 — A brief review of the use of the precautionary approach and the role of target and limit reference points and Management Strategy Evaluation in the management of highly migratory fish stocks — was presented by Campbell Davies. This review aimed to: 1) provide the background and rationale to the development of reference points and management strategy evaluation (MSE) as separate but related approaches to dealing with uncertainty and risk in the management of fisheries; 2) briefly outline the relevant sections of international law that enable and require the implementation of the precautionary approach in the management of highly migratory fish stocks; 3) review the current application of the precautionary approach across international tuna RFMOs; 4) provide a framework and examples of how high level policy and management goals can be logically distilled into specific operational objectives and related directly to reference points in the context of the WCPFC and the MSE

approach; and 5) provide guidance on the issues that will need to be considered in the development of a work programme for implementing the MSE approach in the WCPFC.

25. On the basis of this review, the authors of SC3-ME-WP-3 reached the following conclusions.

- Provisions of international law and WCPFC require the application of the precautionary approach, including the use of target and limit reference points and pre-agreed management measures (i.e. decision rules).
- There are two contexts for the use of reference points: 1) as a benchmark for interpreting results of stock assessments and providing advice on short-term management actions, and 2) informing the development of operational objectives and performance measures for management strategies as part of a management strategy evaluation process.
- MSE provides a formal approach for evaluating whether the performance of a management strategy is likely to be consistent with the precautionary approach and to compare relative performance among alternative strategies.
- Review of the current application of the precautionary approach in tuna RFMOS, including use of target and limit reference point and MSE, indicated that none appear to be currently applying the precautionary approach in practice as per WCPFC, UN Fish Stocks Agreement (UNFSA), and FAO Code of Conduct.
- The WCPFC Convention provides specific guidance and requirement for the development of formal management plans that meet the requirements of the precautionary approach.
- Operationalising the Commission's objectives along with defining appropriate performance measures and reference points is a key component of implementing the precautionary approach. This needs to be done based on a realistic expectation of what is possible and in light of the feasible management measures that the Commission may use.
- The Commission and SC should initiate a work programme for: 1) a consultative process to develop formal management strategies for a small number of case studies spanning the size and complexity of the WCPFC fisheries; and 2) a technical process to evaluate the robustness of the current and alternative assessment and reference points and determine the specific technical requirements and costs associated with undertaking a management strategy evaluation process for specific fisheries.
- Other key issues in the implementation of the precautionary approach that need to be addressed include the development of a programme for the reliable collection of fishery data with appropriate levels of independent verification and a research programme to address priority information gaps.
- Support for this process should be commensurate with the relative priority and likely impact of the outcomes on the decisions of the Commission. It is essential that the development of any future work programme for stock status reference points and MSE is done with full consideration of the priority of and resources available for other elements of the precautionary approach that will be central to its effective implementation.

Discussion

26. The ME-SWG noted the quality and utility of the report in providing guidance on the use of reference points and the use of the MSE approach for implementation of the precautionary approach in the management of the tuna fisheries within the WCPO.

27. The Convenor informed the ME-SWG that Small Working Group 1 had, todate, held two meetings to discuss SC3-ME-WP-3 in order to help inform discussions of this report by both the ME-SWG and the SC. However, the Convenor informed the meeting that he had not yet received the report from the Small Working Group 1, but that this report would be circulated to participants before the reconvening of the SC. The Convenor also informed the group that

discussion by the ME-SWG should be limited to methodological aspects related to issues covered by SC3-ME-WP-3 as further discussion of the report and its recommendations would be covered by Agenda Item 4.10 of the SC.

28. In the discussion of SC3-ME-WP-3, a number of technical issues related to Reference Points (RPs) were noted by the ME-SWG. These included: 1) identifying the assumptions underlying various RPs (e.g. estimation of MSY-related RPs requires an assumed stock-recruitment relationship, selectivity, etc); 2) the need for separate target and limit RPs; iii) the identification of alternative target and limit RPs (e.g. MSY-based, depletion-based, use of reference years, etc); 4) the level of risk to be placed on breaching a RP; and 5) what management issues may require the use of RPs (e.g. target species, bycatch, etc.).

29. The methodological steps involved in the development and evaluation of any harvest strategy incorporating RPs were also noted. These included 1) the identification of RPs, 2) the development of decision rules for updating management actions, and 3) the MSE approach taken to evaluate such a harvest strategy.

30. While some participants supported the concept of the MSE approach, other participants expressed uncertainty in relation to the adoption of an MSE and the process involved. It remained an open question as to whether it may be better to establish RPs first, then deal with decision rules and MSE later, or, whether all of these aspects should be handled simultaneously in a comprehensive MSE.

31. In light of these views and the uncertainty around identifying priority tasks, it was agreed that the organizational arrangements required for progressing the discussion with the Commission on RPs and the utility of undertaking an MSE needed to be clearly identified.

32. The inclusion of socioeconomic considerations in an MSE was also raised during the discussion. The ME-SWG agreed that economic considerations are important, and from a methodological view point are usually incorporated in such analyses through proxies such as annual catch levels and the stability in these levels between years. Indeed, when alternative management approaches are shown to give similar biological results, the economic factors may provide an objective means of choosing among them. However, the full incorporation of socioeconomic factors is generally considered too complex for explicit consideration within an MSE. The ME-SWG was informed, however, that if an MSE was undertaken for the WCPFC the Commission would have great influence in establishing the multiple objectives against which alternative management strategies would be assessed.

33. The ME-SWG was informed that harvest strategies based on simple rules and/or simple models can sometimes outperform complex rules and models. For example, at CCSBT, simple models are used for annual evaluations and decision rule implementation (although this deals with only a single species and two fisheries). Formal assessments are only carried out every three to five years. The CCSBT MSE process has been cited frequently because it is the only example to date of an MSE applied to a highly migratory species. However, not all of the "lessons learned" from CCSBT will carry over to a WCPFC MSE.

34. While the ME-SWG noted the large nature (including cost) and complexity of the task involved in undertaking an MSE within the WCPO, it was acknowledged that the strength of the MSE approach is that by its nature and design decision-making under uncertainty is fully addressed.

35. The discussion following the presentation of SC3-ME-WP-3 led to consensus on the following issues.

a) There are no perceived major methodological impediments to the identification of appropriate RPs and decision rules and the application of an MSE approach to the tuna fisheries within the WCPO.
b) Further work should be undertaken to help identify and assess the utility of various target and limit RPs applicable to the WCPFC. This includes interaction with the Commission on determining the acceptable levels of risk associated with the use of RPs and the identification of those management issues requiring RPs.
c) In order to inform the SC and the Commission about the feasibility of implementing an MSE within the WCPO, further work is required on scoping the methodological and technical issues related to this task (e.g. the nature and scope of an operational model).
d) As a means of progressing a future work programme on these issues, the SC recommend to the Commission that a scoping paper, and draft work plan, should be developed over the next year to help inform the SC and the Commission on the potential costs, benefits and difficulties of alternative approaches to identifying appropriate RPs and the implementation of an MSE within the WCPO.
e) Technical and organizational issues to be clarified and addressed by the scoping paper would be based on those issues identified by Small Working Group 1 and the SC under Agenda Item 4.1 (Note: the report of Small Working Group 1 is attached as Appendix 2).

36. The ME-SWG recommended that the SC consider that a presentation of SC3-ME-WP-3 be made to the upcoming Commission meeting to inform the Commission about the utility of the MSE approach.

B. Development of methods used to evaluate potential management strategies including MSE development and uncertainty

37. In introducing this agenda item, the Convenor noted that the following two working papers provided an example of the development of both a harvest strategy and an MSE approach discussed more generally under the previous agenda item. As the two working papers under this agenda item were seen as companion papers, they were presented together followed by a single discussion session.

SC3-ME-WP-4 Development of an empirical-indicator based harvest strategy for the Australian Eastern Tuna and Billfish Fishery

38. Working Paper SC3-ME-WP-4 was presented by Robert Campbell. The paper summarizes the development of a harvest strategy for the Australian Eastern Tuna and Billfish Fishery (ETBF). Although the tuna and billfish resources fished by the Australian longline fleets are part of larger stocks found throughout the WCPO, given the absence of local model-based stock assessments for target species in the ETBF, from which local performance indicators of exploitation (F) and biomass levels (B) can be inferred, it was seen as best to develop harvest strategies for the ETBF that are based on "local" empirical (data)-based depletion indicators of stock status. In particular, the harvest strategy uses a range of empirical size- and CPUE-based performance indicators to infer biomass levels for different size-classes ("recruitment", "prime-sized" and "old" fish) in the exploited fish populations These relative biomass indicators are then compared to pre-agreed target values to ascertain the levels of exploitation for each size-class and with accompanying decision-rules can be used to adjust the total allowable catch (TAC)/total allowable effort (TAE) in the fishery. The overall "assessment" combines these individual assessments and decision-rules in a staged decision tree process with the possible adjustment of the TAC/TAE at each stage.

SC3-ME-WP-5 Application of a harvest strategy evaluation approach to the Australian swordfish fishery

39. Working Paper SC3-ME-WP-5, presented by Dale Kolody, and describes progress on the MSE of the harvest strategy as described in SC3-ME-WP-4. The paper illustrates preliminary results and the anticipated process to develop and reach agreement on decision rules. Swordfish were selected as the highest priority for examination because this species is perceived to be the most vulnerable of the target species in this fishery. The swordfish stock assessment (and most others) includes a large degree of uncertainty, such that the stock status is only approximately known, and it is always difficult to know how productive the stock will be in the future. The decision rule uses data-based indicators to reset the TAC in relation to changes in CPUE and with an operational objective of maintaining CPUE near a biologically safe and economically profitable level. This example illustrates how the same rule will gradually reduce catches if the stock is at risk biologically or economically, while maintaining or increasing catches if the stock turns out to be resilient.

40. As tested, the CPUE level fluctuates around the target level and the TAC needs to be frequently readjusted to account for recruitment variability and imperfect data. However, the rule seems to be reasonably robust to the range of uncertainty expressed in the swordfish assessment. The simulations quantify a number of trade-offs with respect to management outcomes, and we illustrate some of the interactions expected among scientists, managers and industry that will be required to complete the selection process. This preliminary work represents the initial phase of a two-year project. Future work will involve refining the swordfish operating models, parameterizing and testing decision rules for other target species, and eventually developing a multi-species framework.

Discussion

41. Discussion of SC3-ME-WP-4 and SC3-ME-WP-5 mainly entailed clarification of the presentations and related material in the working papers. In regards to the swordfish stock structure used in SC3-ME-WP-5, it was explained that this remains somewhat uncertain — particularly with regard to the eastern stock boundary of any southwest Pacific stock structure hypothesis — although this issue will be revisited as part of the swordfish stock assessment to be undertaken over the next year. It was also explained that the selectivity was assumed to be same for the ETBF and non-ETBF fisheries.

42. In regards to the availability of size data used for calculation of the size-based CPUE indices used in the decision rules for the Australian fishery, it was explained that individual weight data, covering around 70–80% for each of the principal target fish landed, had been collected from the major east coast processors since 1997. It was also noted that observers have been used in the Australian fishery for approximately five years (5–10% coverage) to collect length–frequency data.

43. The ME-SWG noted the stages involved in the development and evaluation of any harvest strategy, in particular, the identification of the RPs, the development of decision rules for updating management actions, and the MSE approach taken to evaluate such a harvest strategy. It remains an open question as to whether it may be better to establish RPs first, and then deal with decision rules and MSE later, or, whether all of these aspects should be handled simultaneously in a comprehensive MSE.

5.2 Advice and recommendations to the SC

44. The ME-SWG recommended SC3-ME-WP-3 to the SC in providing guidance on the use of reference points and the use of the MSE approach on implementation of the precautionary approach in the management of the tuna fisheries within the WCPO.

45. The ME-SWG also recommended that the SC consider a presentation of SC3-ME-WP-3 to be made to the upcoming Commission meeting to inform the Commission about the utility of the MSE approach.

46. The ME-SWG also recommended that as a means of progressing a future work programme on this issue, the SC recommend to the Commission that a Scoping Paper, and draft Work Plan, should be developed over the next year to inform both the SC and the Commission on the potential costs, benefits and difficulties of alternative approaches for identification of appropriate reference points and implementation of an MSE within the WCPO.

47. Technical and organizational issues to be clarified and addressed by the Scoping Paper should be based on those issues identified by Small Working Group 1 and the SC under Agenda Item 4.1 and should include identifying the use of interim management strategies (including reference points and decision rules) while a full MSE is underway.

6 — PROGRESS ON ADDITIONAL ME-SWG RESEARCH ISSUES IDENTIFIED AT SC2

6.1 Review of information

A. Exploration of sensitivity to structural assumptions in stock assessment models

SC3-ME-WP-6 Comparison of South Pacific albacore stock assessments using Multifan-CL and Stock Synthesis 2

48. Working Paper SC3-ME-WP-6 was presented by Simon Hoyle. The Multifan-CL (MFCL) stock assessment of South Pacific albacore was compared with a new assessment using the same data, but carried out using Stock Synthesis 2 (SS2). We describe differences between the two software applications and discuss their relative merits for carrying out stock assessments in the Convention Area. The comparison did not involve improving the existing MFCL assessment, but areas for potential improvement were explored. Results confirm that there is a strong need to re-analyse the data used in the South Pacific albacore assessment and to reconfigure the model, to resolve a number of problems with the assessment. In general, very similar dynamics could be obtained from both MFCL and SS2, but subtle differences in some of the parameterizations and defaults also had significant effects. Small changes in assumptions about selectivity parameterization, both within and between models, substantially changed results. This was largely because of data problems and mis-specification of both models. Care is required in assessing what parameterization to use, and the sensitivity to assumptions. Stock assessment software requires continual validation. This could be done by regularly running parallel assessments in MFCL and another analysis package such as SS2. SS2 needs more features, including the ability to fit to tagging data and weight–frequency data, to be usable for the full yellowfin and bigeye assessments. Some of these features are planned, and a scaled-down version of the data would be usable with the current version of SS2.

Discussion

49. During the discussion of SC3-ME-WP-6 it was noted that SS2 had similar limitations to MFCL and A-SCALA in not being able to estimate the variance of the effort deviations (CPUE observation error in SS2) as a free parameter. However, it was explained that sensitivity to alternative variance specifications could easily be compared. It was noted that albacore tuna might not have represented the best candidate stock for comparing the two assessment models,

because it represents a difficult situation with inconsistencies in the size data over time, suspicious CPUE trends that probably reflect catchability changes, and limited contrast in the catch series. It was suggested that a comparison of stock assessments for yellowfin tuna might have been more informative.

50. It was suggested that even simpler models (e.g. production models) would also be worth comparing to MFCL. Simulations were also suggested as a better way of evaluating the models with respect to the performance at estimating known parameters. However, this was recognized as a very time consuming process.

51. The ME-SWG inquired about the large differences in the biomass estimates between MFCL and SS2 model results, and what the assessment implications would be. Dr Hoyle indicated that the assessment was sensitive to the assumed selectivity, with the SS2 length-based function greatly inflating the absolute biomass. Dr Hoyle also indicated that the purpose of the study was not to redo the assessment, but rather to compare the model features. At this time, the MFCL assessment would still be preferable, because it was tailored specifically as an assessment, and included the tagging data (which SS2 cannot currently do).

52. Even though the paper was intended as a comparison of modelling software, it was suggested that some issues should be followed up with respect to the next albacore assessment. The apparent pessimism in some of the models was recognized as a possible indication of decreasing abundance that might explain the movement of the Taiwanese fleet from the EEZs of Pacific Island nations in recent years. Additional logbook data from the Taiwanese fleet in Pago Pago, American Samoa might be accessed to improve the size data. There was some concern that the north–south seasonal movements of albacore might not be described properly by the seasonal catchability currently used in the spatially aggregated models.

B. Investigation of the sensitivity of model outcomes to hypotheses concerning changes in fishing power not adequately accounted for in the standardizations

SC3-ME-WP-7 Preliminary estimates of historical variations in the fishing power and catchability of pelagic longline fishing gear

53. Working Paper SC3-ME-WP-7 was presented by Peter Ward. The effects of 11 variables on the catchability of pelagic longlines were quantified. Extension of the depth range and the duration of longline operations have reduced the catchability of several epipelagic species, such as mako sharks (*Isurus* spp.), since industrial longlining commenced in the tropical Pacific Ocean in the early 1950s. Reductions in the body size of many species also resulted in reduced searching for food and fewer encounters with longline hooks. By contrast, the catchability of commercially valuable species, such as bigeye tuna (*Thunnus obesus*), increased substantially as a result of the extension of the depth range of longlines and the longer duration of fishing operations. Stronger and less visible line materials, new bait species, and skipper experience also contributed to increased catchability. It was recommended that dedicated surveys should be used to obtain fishery independent estimates of abundance. Another option is to use surveys to measure variations in the relationship between longline catch rates and animal abundance.

Discussion

54. In the discussion of SC3-ME-WP-7, it was suggested that some of the basic assumptions about gear configuration used in these types of studies may not be correct and can exaggerate differences in catchability. Dr Ward acknowledged the uncertainties in this regard and emphasized that one should not focus on the actual numerical results, but rather on the general approach. A number of others factors not used in the current CPUE standardizations influence

catchability. SC3-ME-WP-7 was intended to provide an illustration of methods that may be used to assist in understanding the nature of these changes.

55. It was noted that some of the assumptions about temporal trends in the adoption of different gear configuration (specifically the use of nylon versus wire leaders) might not be valid, as the rate of technological change differs dramatically within and among fleets. It was also noted that skipper experience can sometimes have a greater effect on fishing power than technological innovations. This was recognized as further emphasis for the need to obtain accurate data on changes within fisheries.

56. The ME-SWG noted that the presence of marine mammals and sharks can also have important implications for catch rate interpretation, but this was not considered to be directly related to fishing power.

6.2. Advice and recommendations to the SC

57. The ME-SWG strongly endorsed the comparative approach taken in Working Paper SC3-ME-WP-6 in helping to elucidate the assumptions underlying the various stock assessment models and the sensitivity of model outcomes to these assumptions. It recommended the continue use of this approach in future research, especially its application to yellowfin and bigeye tuna assessments in the WCPO.

58. The ME-SWG also endorsed the research described in Working Paper SC3-ME-WP-7 in helping to understand and possibly quantify the influence of changes in fishing practices and fishing conditions on the longline catchability. The ME-SWG considered that trends in fishing power are almost certainly occurring for target species in general, and encouraged further research on this issue.

59. The ME-SWG also recognized that traditional generalized linear model (GLM)-type CPUE standardization analyses probably could not adequately incorporate many of the effects described in SC3-ME-WP-7, and that fishing power trends would probably have to be incorporated externally to these analyses. Guided by the results of such research, the ME-SWG therefore recommended that alternative scenarios of catchability trends for the longline fleets should be routinely employed in the stock assessment models.

7 — RESEARCH PLANNING

60. The meeting reviewed the tasks identified by the ME-SWG at SC2. These are listed in Appendix 3. It was noted that a significant amount of work had been undertaken since SC2 and that aspects of all short-term tasks had been addressed, although it was also noted that further analyses were needed on many of these tasks.

61. Taking into account the work completed over the past year, and the recommendations for additional research stemming from this work, the ME-SWG noted the following tasks that should be addressed over the next year and reported to SC4 in 2008.

a) Continued refinement of stock assessment models (including designing a more efficient recruitment parameterization with MFCL).

b) Continued development of models used to standardize CPUE and the abundance indices used within the stock assessments (including the continued identification of factors which influence CPUE, understanding and quantification of the changes in catchability over time not included in the CPUE standardization models, and identification of alternative catchability trends for inclusion in stock assessment models).

c) Continued exploration of sensitivity of stock assessment models to model assumptions and data issues (including a comparison of MFCL, SS2 and other stock assessments for yellowfin or bigeye tuna).

d) Development of recruitment indices for incorporation into stock assessment models (especially for yellowfin tuna based on further investigation of the relationship between oceanography and recruitment estimates from MFCL).

62. It was noted that other SWGs can also direct tasks to the ME-SWG. As was the case in past years, it was suggested that some of the above tasks may be facilitated via an intersessional working group meeting.

63. The ME-SWG also noted the following additional tasks that should be addressed on a medium-term basis:

f) Further development of the methods used to evaluate potential management strategies (including exploration of uncertainty).

g) Further consideration of how to reflect uncertainty in projections.

h) Development/review of models for evaluation of impacts on ecosystem, and the development of reference points for ecosystem-based management.

i) Development of new stock assessment models and associated software.

64. The ME-SWG recommends that the SC take note of the above research tasks and priorities when formulating an overall research plan for the Commission.

8 — ADMINISTRATIVE MATTERS

65. The Convenor informed the meeting that his two-year appointment for the ME-SWG expired at the end of the present meeting. He called for nominations from the floor to fill this position for the next two-year term (2008–2009).

66. The USA nominated Robert Campbell to continue as the Convenor for the next two years. This nominated was seconded by Papua New Guinea and also supported by Chinese Taipei. With no other nominations being received, Robert Campbell agreed to the nomination and was duly elected.

67. There were no other administrative matters to consider.

9 — ADOPTION OF REPORT

68. The ME-SWG was informed that a draft report of the meeting would be made available to participants on Saturday, 18 August and would be cleared by the SC on the following Monday.

69. The report of the ME-SWG was cleared and adopted by consensus by the SC on Monday, 20 August.

10 — CLOSE OF MEETING

71. The Convenor thanked all presenters and rapporteurs together with all participants of the ME-SWG.

Attachment J, Appendix 1

The Commission for the Conservation and Management of Highly Migratory Fish Stocks in the Western and Central Pacific Ocean

Scientific Committee
Third Regular Session

Honolulu, HI, USA
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AGENDA FOR THE METHODS SPECIALIST WORKING GROUP

1. **Opening of Meeting**

2. **Selection of Rapporteurs**

3. **Adoption of Agenda**

4. **Issues Arising from WCPFC-3**

   4.1. Review of information

   a) Continued refinement of stock assessment models (incl. models to standardize CPUE) (Topic 2).

      ME-WP-1: Hoyle, S. and A. Langley. "Regional weighting factors for yellowfin tuna in WCP-CA stock assessments"

      ME-WP-2: Hampton, J., P. Kleiber and D. Fournier. "Reducing parameter complexity in Multifan-CL stock assessments: catch conditioning"

      ME-IP-1: Hoyle, S. et al. "Proceedings of the pelagic longline catch rate standardization meeting"

   b) Methods to estimate IUU catches in the WCPO (Topic 3)

   c) Further review of 2006 swordfish assessment (Topic 19, CMM-2006-03).

   d) Review research to reduce uncertainty for striped marlin assessment(Topic 20, , CMM-2006-04)

   4.2. Advice to the Scientific Committee

5. **Progress on SC2 Work Programme for 2007**

   5.1. Review of information

   c) Investigation of alternative stock status reference points to replace MSY and identification of limit and target reference points.

      ME-WP-3: Davies, C. and T. Polacheck. "A brief review of the use of the precautionary approach and the role of target and limit reference points and Management Strategy Evaluation in the management of highly migratory fish stocks"

d) Development of methods used to evaluate potential management strategies including MSE development and uncertainty.

ME-WP-4: Campbell, R. et al. "Development of an empirical-indicator based harvest strategy for the Australian Eastern Tuna and Billfish Fishery"

ME-WP-5: Kolody, et al "Application of a harvest strategy evaluation approach to the Australian swordfish fishery."

5.2. Advice to the Scientific Committee

6. Progress on additional ME-SWG Research Issues identified at SC2 (not covered by Agenda Items 2 and 3):

6.1. Review of information

a) Exploration of sensitivity to structural assumptions in stock assessment models

ME-WP-6: Hoyle, S. and A. Langley. "Comparison of South Pacific albacore stock assessments using Multifan-CL and Stock Synthesis 2"

b) Investigation of the sensitivity of model outcomes to hypotheses concerning changes in fishing power not adequately accounted for in the standardisations.

ME-WP-7: Ward, P. "Preliminary estimates of historical variations in the fishing power and catchability of pelagic longline fishing gear"

ME-IP-2: Ward, P. "Preliminary estimates of historical variations in the fishing power and catchability of pelagic longline fishing gear – Description of methods"

6.2. Advice to the Scientific Committee

7. Research Planning

7.1. Operational Research Plan for 2008

7.2. Medium-term work programme for 2009–2010

8. Administrative Matters

8.1. Election of Convenor for 2008–2009

8.2. Other matters

9. Adoption of Report

10. Close of Meeting

Attachment J, Appendix 2

The Commission for the Conservation and Management of Highly Migratory Fish Stocks in the Western and Central Pacific Ocean

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SUMMARY OF DISCUSSION POINTS IDENTIFIED BY INFORMAL SMALL GROUP 1 FOR CONSIDERATION BY THE SCIENTIFIC COMMITTEE ON THE REPORT OF THE EXPERT CONSULTANCY ON REFERENCE POINTS

Introduction

Following the success of the small group discussions at the Second Session of the Scientific Committee SC2 (Manila), the Chair of the SC proposed that several informal small groups (ISGs) be established in conjunction with the SC3 meeting. An SC3 discussion group on biological reference points (BRPs) was established with Ray Conser (USA) serving as convener. The group held two one-hour meetings: one on 12 August 2007 (prior to the start of the formal SC3 meeting), and the other on 13 August 2007 (during the SC3 session lunch break). Both meetings were well attended with most of the most of the WCPFC members represented.

The BRP ISG (the Group) recognized that the breadth of the subject matter — including a vast literature and numerous worldwide case studies — could not be adequately addressed in two brief discussion periods on the periphery of the formal SC3 meeting. Further, the Group acknowledged that the BRP topic would be taken up by both the Methods Specialist Working Group (ME-SWG) and the SC3 plenary (Agenda Item 4.10).

The Group focused primarily on SC3 Working Paper ME-WP-3 entitled, "A brief review of the use of the precautionary approach and the role of target and limit reference points and Management Strategy Evaluation in the management of highly migratory fish stocks", by Campbell Davies and Tom Polacheck (CSIRO). The SC2 adopted a work programme for 2007 to investigate alternative stock status reference points, including the identification of appropriate target and limit reference points. Consistent with the 2007 work programme, the WCPFC Secretariat commissioned a review of BRPs and related issues. ME-WP-3 is a product of the resulting consultancy.

The Group approached the discussion of ME-WP-3 at three levels.

A. General introduction to BRPs (a brief presentation by Campbell Davies) to assist those without expertise on these issues to more fully benefit from the discussions.
B. Questions of clarification and more detailed explanation of points raised and conclusions reached in ME-WP-3.
C. General discussion of BRP issues with particular emphasis on identifying key points that would benefit most from indepth discussion during the ME-SWG and the SC3 plenary.

It was agreed that the product of this Group would be a list of the discussion points identified in Level C above.

Discussion points

1. ME-WP-3 concludes that the WCPFC management cannot be considered precautionary at least until both BRPs and the concomitant decision rule(s) are agreed on and implemented. The SC has been using been suggesting F_{MSY} and SSB_{MSY} as BRPs but no clear decision rule has been put forth.
    a. Does the SC agree with the ME-WP-3 conclusion regarding WCPFC and the precautionary principle?
    b. Recognizing that full development of decision rule(s) may take considerable time (perhaps three to five years), can interim decision rule(s) be put forth by the SC to satisfy the precautionary principle?

2. ME-WP-3 suggests that a full management strategy evaluation (MSE) is needed to integrate the best choices of stock assessment methods, appropriate BRPs, decision rules, and higher level management objectives. An MSE for WCPFC stocks would be a time- and resource-consuming endeavor. Does the SC agree that a full MSE is necessary, or are there other objective means of establishing the best BRPs and control rules?

3. The ME-SWG concluded that there were no perceived major methodological impediments to the application of an MSE approach to the tuna fisheries within the WCPO. Does the SC agree with this conclusion? Furthermore, if an MSE is needed, what does the SC see as the major technical issues (e.g. feasible range of sensitivity cases, conditioning the currently-used assessment methods, robustness tests, etc) and institutional impediments that need to be resolved to make this feasible?

4. The ME-SWG agreed that economic considerations are important and are usually incorporated in MSE analyses through proxies such as annual catch levels and the stability in these levels between years. Indeed, when alternative management approaches are shown to give similar biological results, the economic factors may provide an objective means of choosing among them. However, the ME-SWG concluded that the full incorporation of socioeconomic factors is generally too complex for explicit consideration in an MSE, although in the development of an MSE for the WCPFC, the Commission would have great influence in establishing the multiple objectives against which alternative management strategies will be assessed under an MSE. Does the SC agree?

5. ME-WP-3 suggests that a proper MSE cannot be done by the SC alone. Rather, the full involvement and continuing feedback from fishery managers, stakeholders, and other interested parties are essential.
    a. What is the best process for involving non-scientists in the MSE?
    b. What are the responsibilities of the various groups? For example, fishery managers will need to establish the acceptable level of risk for the MSE. What else is needed from fishery managers?
    c. What institutional arrangements are needed? For example, the Commission meeting is the only place where the broad scope (suggested above) can be fully considered. How should the SC and the Commission interact regarding MSE planning?

6. Given that the scientific contribution to an WCPFC MSE process would be costly (both in monetary terms and the time of the individuals involved), what is the best mix of involvement of national scientists and Secretariat-contracted services?

7. The SC has been considering MSY-based BRPs to be limit reference points but no target reference points have been put forth. The precautionary principle requires both. Does the SC agree that MSY-based BRPs will be used as interim limit BRPs and other BRPs be established as target reference points?

8. Associated with the adoption of any RP, there will always be a non-zero probability that the "current" value of the associated performance indicator will fall below the reference level. As such, the use of BRP is often accompanied by the adoption of a probability that maximizes the acceptable level of allowing this to occur. Does the SC agree that the use of such defined probabilities (or levels of associated risk) should also be adopted with the use of BRPs?

9. The current mix of fisheries and their relative catches implies an aggregate selectivity that greatly influences BRP estimates (e.g. F_{MSY} and SSB_{MSY}). Does the SC recommend that the scope of an MSE undertaken by the SC should allow for changes to the aggregate selectivity to better meet the pre-established management objectives (e.g. to maximize long-term yield)?

10. The highly migratory species identified in Annex 1 form a diverse and lengthy list, including many species considered to be bycatch in the tuna-targeted fisheries. Should bycatch issues and BRPs for bycatch species be considered in initial MSE planning?

11. If an MSE is to be undertaken, it will not be practical to initially specify all of the details needed to model the complex multi-national, multi-species WCPFC fisheries; and the current process for assessing them and providing management advice. Does the SC agree with the recommendation of the ME-SWG that as a means of progressing a future work programme, the SC recommend to the Commission that a Scoping Paper, and draft Work Plan, should be developed over the next year to inform both the SC and the Commission on the potential costs and benefits of alternative approaches for identification of appropriate reference points and implementation of an MSE within the WCPF and that this Paper should include identifying the:
    a) components of the MSE model (e.g. the regional scope of operational model, what species of species mix it should encompass, etc.);
    b) management objectives (e.g. conservation and economic objectives) against which the harvest strategies will be evaluated, and the operationalization of these objectives for modelling purposes;
    c) classes or categories of harvest strategies/decision rules to be evaluated;
    d) organizational arrangements required to engage all parties in the MSE process; and
    e) use of interim management strategies (including reference points and decision rules) while full MSE is underway.

Attachment J, Appendix 3

The Commission for the Conservation and Management of Highly Migratory Fish Stocks in the Western and Central Pacific Ocean

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RESEARCH TASKS FOR THE METHODS SPECIALIST WORKING GROUP IDENTIFIED AT SC-2 AND ASSOCIATED DOCUMENTS REVIEWED AT SC-3

1. Work Programme for 2007 identified at the Second Regular Session of the Scientific Committee (SC2) and applicable working papers reviewed by the ME-SWG.

a. Continued refinement of stock assessment models. This includes further reduction in the number of parameters to speed up convergence times in order to facilitate investigation of the sensitivity to model assumptions.

ME-WP-2

b. Exploration of sensitivity to structural assumptions. It was considered that the approach outlined in ME-WP-3 provided a good framework for conducting such analyses. While acknowledging the time constraints on such analyses due to the run-time for the main tuna species, it was suggested that sensitivity analyses could be undertaken using previous assessments, thus allowing considerable more time than if the analyses had to wait until the latest data for the updated assessments was available. This work would also include the development of better diagnostics to more objectively determine plausible model structure.

ME-WP-6

c. Given the critical role played by standardised longline CPUE as relative abundance indices in the assessment models, there is a high priority to assess the sensitivity of model outcomes to various hypotheses concerning possible changes in fishing power not adequately accounted for in the standardizations. Analytical methods of defending these series would be preferable, one possibility being a study of the impact of historical variations in bait loss.

ME-WP-1, ME-IP-1, ME-WP-7, ME-IP-2

d. Investigation of alternative stock status reference points to replace MSY, for example, elaboration of fishery impact, B/B (not-fished), reference points used by other RFMOs, etc.

ME-WP-3

2. Medium-term Research Tasks identified at SC2 and applicable working papers reviewed by the ME-SWG.

a. Continued refinement of stock assessment models (including models to standardize CPUE)

ME-WP-1, ME-WP-2

b. Exploration of sensitivity to model uncertainty.

ME-WP-6

c. Identification of limit and target reference points.

ME-WP-3

d. Further development of the methods used to evaluate potential management strategies (including exploration of uncertainty).

ME-WP-4, ME-WP-5

e. Further consideration of how to reflect uncertainty in projections.

f. Development of recruitment indices independent of the MFCL model.

SA-WP-5

g. Development/review of models for evaluation of impacts on ecosystem, and the development of reference points for ecosystem-based management.

Attachment K

The Commission for the Conservation and Management of Highly Migratory Fish Stocks in the Western and Central Pacific Ocean

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REPORT OF THE STATISTICS SPECIALIST WORKING GROUP

INTRODUCTION

1. The Statistics Specialist Working Group (ST-SWG) was held on the afternoons of Monday, 13 August and Friday, 17 August. Kim Duckworth was appointed Convener. Samasoni Sauni, Robert Skillman, Les Clark and Campbell Davies were appointed as rapporteurs.

2. The agenda was adopted and is attached as Appendix I to this report. Discussion of the procedures for the provision of annual catch estimates, catch and effort and size data was brought forward in the agenda. It was agreed that a discussion of SC3-ST-IP-7 (species composition) would occur under "Other Matters" if time permitted.

OVERVIEW OF GAPS/ISSUES WITH DATA

3. Peter Williams (Secretariat of the Pacific Community, Oceanic Fisheries Programme, SPC-OFP) reported on recent developments in regard to data gaps, referring to SC3-ST-IP-3 (Scientific Data Available to the Commission). The major developments concerning the resolution of data gaps over the past year included:

a) Catches stratified by gear type, species, year/month and geographic area, covering the domestic fisheries of the Philippines have been refined by using survey sampling data from key tuna landing centers and tuna catches broken down by region provided by the Bureau of Agricultural Statistics (BAS) and port sampling data collected through the National Stock Assessment Project (NSAP) of the Bureau of Fisheries and Aquatic Resources.
b) The Eastern Indonesia Tuna Fishery Data Collection Workshop, held in Jakarta, Indonesia (30–31 January 2007) reviewed information obtained from recent reviews of key tuna unloading ports in eastern Indonesia, and came up with a set of recommendations, primarily focused on establishing a port sampling programme in key eastern Indonesian ports. It is hoped that port sampling activities can start in 2008, dependent on funding and once preliminary work scoping out the requirements have been undertaken in late 2007.
c) Continuing on from 2004 data provided prior to SC2, aggregated catch and effort data for the Chinese Taipei domestic longline fleet, covering 2005, were provided by Chinese Taipei.
d) Comprehensive operational (logsheet) catch and effort data for the Vanuatu distant-water longline fleet for 2005 were provided by Vanuatu. These data have been used

to distinguish logsheet data from vessels that were thought to be reporting under other flags (e.g. Chinese Taipei and Belize).

4. With regard to outstanding data gaps, it was noted that there are several categories of data gaps, including instances where data were:

a) not collected
b) collected, but some attributes were not collected
c) collected but not provided
d) provided but the coverage of data is less than required
e) not provided in a timely manner.

5. Other than the lack of data from the Indonesian and Philippines domestic fisheries, data gaps from the distant-water longline fishery were considered to be the most important, specifically:

a) The late provision of annual catch estimates and aggregate data means that recent trends in the fishery may not be taken account of in stock assessments;
b) Operational catch and effort data are required for certain studies related to stock assessments but the coverage of operational catch/effort data for activities on the high seas is lacking;
c) Distant-water longline fleets account for 56%, 36% and 56% of the Convention Area longline catch of albacore, bigeye and yellowfin for 1992–2006, respectively. Observer data are required for the estimation of catches of non-target species. The coverage of observer data is less than 0.05% for distant-water longline fleets, so the estimation of the non-target species taken from a substantial amount of longline fishing effort is highly uncertain.

6. The ST-SWG noted that the timely provision of data was a very important issue for the work of the SC, and in particular for the stock assessments. A number of potential explanations for different data gaps were identified, including the time and resources required to access and collate historical records, the long voyage times for some distant-water longline fleets and the large and dispersed nature of small boat fleets in Indonesia and the Philippines. It was also noted that in the some cases, in-zone catches can be reported by both the coastal state and the flag state of the vessel, creating the potential for double counting. It was noted, however, that in such cases, only the catch data reported by the flag state is accounted for, avoiding the potential for double counting. A number of members cited specific issues with the summary of data gaps presented in the paper and SPC undertook to revise the information accordingly in consultation with the relevant members.

7. The ST-SWG recommended that such data gaps (including late and/or absent data) are impacting on the ability to provide the best available scientific advice, particularly for the assessment of stocks, and that the SC should note this issue.

8. The ST-SWG recommended that within the next 12 months the Secretariat deploys on the WCPFC website a prototype computer programme that would allow data gaps to be easily identified, and a study be undertaken to identify the causes of data gaps from a holistic perspective, paying particular attention to those instances where data were not collected.

REGIONAL OBSERVER PROGRAMME

9. Tim Lawson (SPC-OFP) presented SC3-ST-WP2 (Objectives and Priorities for Data to be Collected by Observers for Fisheries other than Purse Seine and Longline). The discussion that

followed focused on scientific objectives and priorities for Regional Observer Programme (ROP) coverage on vessels using the pole-and-line, handline and troll fishing methods. For details on the ROP see Article 28 of the Convention and CMM-2006-07.

10. The ST-SWG recommended that the scientific objectives and priorities for data to be collected by the ROP be those documented in Appendix II.

11. Tim Lawson also presented SC3-GN-WP-6 (Data Standards for the Regional Observer Programme).

12. The discussion that followed was extensive and a wide range of views were expressed. The suggestions that were made included adding fields (e.g. the characteristics of FADs used by purse seiners, longline vessel speed when setting, longline line shooter speed, the number of years experience of the fishing master) and deleting fields. Delegation Papers were submitted by:

- Japan in SC3-DP-02;
- United States of America in Informal Small Group working Paper, SC3-ISG-WP-4;
- China, Chinese Taipei, Japan and Korea in SC3-DP-04.

In the ST-SWG, a consensus agreement was reached on slightly over 100 data fields (those not square bracketed in Appendix III) that should be collected by the ROP, but consensus was not reached with regard to other fields.

13. The ST-SWG recommended that Appendix III be used as the starting point for future discussions on the minimum fields of scientific data to be collected by the ROP. In making this recommendation the ST-SWG noted that:

- This list is provisional and requires substantially more consideration and refinement (by other subsidiary bodies of the Commission and subsequent sessions of the ST-SWG); and
- The ST-SWG only considered scientific needs for the fields of data to be collected by the ROP.

PROCEDURES FOR THE PROVISION OF ANNUAL CATCH ESTIMATES, CATCH AND EFFORT AND SIZE DATA

14. Tim Lawson also presented SC3-ST-WP-3 (Proposed Revisions to the Procedures for the Provision of Data). Based on experience gained in implementing procedures for the provision of scientific data to the Commission, and changes implemented by the Commission since the procedures were adopted in 2005, the Commission's science services provider proposed a number of revisions. A number of editorial changes were approved by the ST-SWG. These included the common names for fish species and logical regrouping of some fish species as well as the rearrangement or rewording of text in the interest of consistency. The paper proposed four substantive changes:

a) in section 2: *Number of vessels active*: the inclusion of a requirement for the provision of data on trollers for the calendar year as well as the fishing seasons.
b) in section 4. *Catch and effort data aggregated by time period and geographic area*: the inclusion of a requirement for the provision of catch and effort data by school association for purse-seine and ringnet fisheries targeting tuna.
c) in section 5. *Size composition data*: the inclusion of a minimum standard for size composition data to be provided at least as fine as periods of quarter and areas of 20° longitude and 10° latitude.

d) in section 4. *Catch and effort data aggregated by time period and geographic area*: the inclusion of a requirement for the provision of aggregated catch and effort data covering distant-water longliners fishing to the east of the eastern boundary of the WCPFC Statistical Area. It was explained that this proposal arose because of difficulties in the timeliness and effectiveness of acquiring these data from the IATTC, and that there were other precedents for CCMs to be required to be provide data on fishing activities outside the Convention Area. Chinese Taipei noted its difficulty with the legal or mandatory proposal, stating that such a proposal should be considered in other Commission bodies. The ST-SWG agreed to square bracket the proposed wording on this issue in the text and find a mechanism to receive advice on it from the Commission.

15. The ST-SWG recommended that the scientific data to be provided to the Commission be that documented in Appendix IV, noting the need for further consideration of the wording related to provision of data on fishing activities outside the Convention Area.

DATA CONFIDENTIALITY, SECURITY, AND DISSEMINATION

16. Andrew Wright (Secretariat of the Western and Central Pacific Fisheries Commission) presented SC3-ST-WP-1 (Framework for Access to Different Types of Non-Public Domain Data, and Draft Data Request Form and Draft Confidentiality Agreement). There was support for the draft framework, draft data request form, and draft data confidentiality agreement. Japan noted its concern that the draft confidentiality agreement did not address issues such as responsibility and the consequences if confidentiality of the non-public domain data was not maintained. It was suggested that expert opinions should be sought to strengthen and complete the text of agreements.

17. Kim Duckworth (New Zealand Ministry of Fisheries) presented SC3-ST-WP-4 (Proposed Revisions to the Rules and procedure for the access to and dissemination of data compiled by the Commission). In 2005 the Commission formed an *ad hoc* task group to develop rules and procedures to govern the security and confidentiality of data collected and held by the Commission. The task group drafted the rules and procedures in August 2006. The Commission adopted these rules and procedures in December 2006 as "a living document", and noted reservations tabled by Japan. SC3-ST-WP-4 was the result of comments received from CCMs and made at WCPFC3.

18 The ST-SWG agreed that the text of SC3-ST-WP-4 was an improvement on that adopted by the Commission at WCPFC3, and agreed to use SC3-ST-WP-4 as a basis for further discussions.

19. After discussing various considerations regarding paragraph 19(e), including the origin of the scientific activity collecting the data (e.g. the regional observer programme, contracted science providers, etc.), participants agreed to include a phrase to the effect that access by CCMs to non-public domain data for scientific purposes should require consent by the data source.

20. The ST-SWG concluded that deliberation on 19(d) would be more appropriately taken up by the TCC.

21. With regard to whether a mention of CCMs' domestic laws (on data confidentiality and privacy) should be incorporated into the proposed revisions, the ST-SWG concluded that this was a legal matter and would be more appropriately addressed by the Commission.

22. The ST-SWG considered the suggestion to broaden the scope of section 4.6 from exchange of data only with regional fisheries management organizations to regional fisheries organizations not involved in management (principally regional science organizations). The ST-SWG noted that the Commission had already developed MOUs (including the exchange of data) with ISC and SPC and that these organizations should be included in section 4.6. While discussions are currently being held with several other organizations regarding the exchange of data, the ST-SWG concluded that it was unnecessary to include these organizations at this time.

23. The ST-SWG recommended that Kim Duckworth amend the "Rules and procedures for the access to and dissemination of data compiled by the Commission" (as contained in SC3-ST-WP-4) to reflect the decisions of the ST-SWG and the editorial changes that had been proposed over the proceeding few days, and present an updated version of the rules and procedures for consideration by the SC plenary.

24. Andrew Wright presented SC3-ST-IP1 (The Commission's Information Security Policy), and indicated that the Secretariat contracted an expert to develop an information security policy (ISP) based on the international standard ISO 17799. The draft policy described in SC3-ST-IP-1 consists of a priorities document (which is intended for a small, evolving commission), an information security document (which describes the Secretariat's direction and support for information security), and a draft framework for a full set of operational security standards. The ST-SWG noted that this was a highly technical and legal document.

25. The ST-SWG recommended that:
    a) the Secretariat proceed immediately with the implementation of the information security policy; and
    b) if CCMs wish to provide comments on the ISP they do so within the next 90 days (before 16 November 2007), and noted that it was highly desirable that such comments were received before TCC3.

UNLOADINGS DATA AND CONSIDERATION OF THE ESTABLISHMENT OF A CATCH DOCUMENTATION SCHEME

26. In response to a request from the Marshall Islands that the SC provide guidance on the scientific value of unloading data and catch documentation data, the SPC scientific services provider to the Commission noted the following. The main scientific utility of such data is the estimation of total catch and estimates of logsheet coverage rates. These estimates are essential for stock assessment. Also, there is scientific interest in the estimation of the error rate of data recorded on logsheets. The data from unloadings, catch documentation schemes, and logsheets can be used for quality control and used for cross validation and verification purposes. Several participants noted the value of unloadings and catch documentation scheme data for scientific purposes. China noted that some unloadings and transshipment monitoring data are recorded in some national fisheries reports provided to the Commission, so more investigation is required before establishing a catch documentation scheme.

27. Japan lodged a reservation with regard to these agenda items. The reservation read: "Japan reserved its position on these matters because of its recognition that these measures are still under consideration in the TCC, and the Commission's clear guidance in this regard has not been given".

28. The ST-SWG recommended that:

- The SC draw the attention of the TCC to the value of unloadings and catch documentation scheme data for scientific purposes; and
- The current unloadings data forms used in the region, and the proposed WCPFC transshipment reporting form, be reviewed by the Commission's scientific services provider to determine their adequacy for scientific purposes, especially for obtaining size frequency information and species identification. It was noted that obtaining such data from this source can be even more effective than observer programmes.

FUTURE RESEARCH PLAN

29. The ST-SWG recommended, resources permitting, the following items for incorporation into the future work plan.

- That within the next 12 months the Secretariat deploys on the WCPFC website a prototype computer programme that would allow data gaps to be easily identified (see earlier recommendation in paragraph 8);
- The current unloadings data forms used in the region, and the proposed WCPFC transshipment reporting form, be reviewed by the Commission's scientific services provider to determine their adequacy for scientific purposes (see earlier recommendation in paragraph 28);
- The draft list of minimum data fields for the ROP be annotated with explanations of what each field is and why it is needed;
- The draft list of minimum data fields for the regional observer programme be annotated with details describing the format (units of measure, codes etc) to be used when collecting each field (completing the work that was started in SC3-GN-WP-6); and
- CCMs need to work with the Secretariat over the next 12 months to identify and address data gaps; a progress report should be submitted for next year's meeting.

OTHER MATTERS

30. Because there was insufficient time to discuss paper SC3-ST-IP-7 (species composition), it was recommended that this paper be raised at the SC or scheduled on the provisional agenda for the 2008 ST-SWG meeting.

31. The ST-SWG recommended that the review of the scientific structure and its efficacy that is to be conducted in the future include a review of the time scheduled for the ST-SWG to complete its agenda, and the current "2 hours early on, then 4 hours later" timing of the ST-SWG.

32. The ST-SWG reconfirmed Kim Duckworth as the Convenor (for 2008 and 2009), and accepted an offer from the USA to provide a Vice-Convenor.

33. The ST-SWG adopted this report by consensus.

Attachment K, Appendix I

The Commission for the Conservation and Management of Highly Migratory Fish Stocks in the Western and Central Pacific Ocean

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AGENDA FOR THE STATISTICS SPECIALIST WORKING GROUP

1. Opening of meeting

2. Selection of rapporteurs

3. Adoption of agenda

4. Overview of gaps/Issues with data
    a. Achievements toward filling gaps
    b. Status of data from Indonesia and the Philippines
    c. Data gaps remaining

5. Regional Observer Programme

6. Procedures for the provision of data to the Commission - Revision of procedures for the provision of annual catch estimates, catch and effort and size data

7. Data confidentiality, security and dissemination
    a. Consideration of Executive Director's draft framework for access to non-public domain data by CCMs, data request form and confidentiality agreement
    b. Refinement of the rules and procedures for access to and dissemination of data be submitted to the Commission
    c. Consideration of the draft Information Security Plan

8. Procedures for the provision of data to the Commission - proposed procedures for the provision of unloadings data; and consideration of the establishment of a Catch Documentation Scheme

9. Future research plan

10. Other matters

11. Adoption of Report

12. Close of the meeting

Attachment K, Appendix II

The Commission for the Conservation and Management of Highly Migratory Fish Stocks in the Western and Central Pacific Ocean

Scientific Committee
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SCIENTIFIC OBJECTIVES AND PRIORITIES FOR REGIONAL OBSERVER PROGRAMME

There are six scientific objectives that should be considered in the development of the Regional Observer Programme, all of which are high priority:

a. To record the species, fate (retained or discarded) and condition at capture and release (e.g. alive, barely alive, dead, etc.) of the catch of target and non-target species; depredation effects; and interactions with other non-target species, including species of special interest (i.e. sharks, marine reptiles, marine mammals and sea birds);

b. To collect data to allow the standardization of fishing effort, such as gear and vessel attributes, and fishing strategies. etc;

c. To sample the length and other relevant measurements of target and non-target species;

d. To sample other biological parameters, such as gender, stomach contents, hard parts (e.g. otoliths, first dorsal bone), tissue samples, and collect data to determine relationships between length and weight, and processed weight and whole weight;

e. To record information on mitigation measures utilized and their effectiveness; and

f. To record information on the catch and fishing effort during baitfishing, when baitfishing is undertaken by the tuna fishing vessel.

Attachment K, Appendix III

The Commission for the Conservation and Management of Highly Migratory Fish Stocks in the Western and Central Pacific Ocean

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PROVISIONAL MINIMUM LIST OF FIELDS OF SCIENTIFIC DATA TO BE COLLECTED BY THE REGIONAL OBSERVER PROGRAMME

Text in square brackets indicates data fields for which consensus was not achieved.

Table 1. Vessel and trip information

VESSEL IDENTIFICATION
Name of vessel
Flag
Flag state registration number
International radio call sign
TRIP INFORMATION
Date and time of departure from port
Port of departure
Date and time of return to port
Port of return
OBSERVER INFORMATION
Observer name
Observer's ROP certification number
Date, time and location of embarkation
Date, time and location of disembarkation
CREW INFORMATION
Name of captain
Nationality of captain
Name of fishing master
Nationality of fishing master

Other crew
VESSEL ATTRIBUTES
To be determined
VESSEL ELECTRONICS
Radars
Depth sounder
Global positioning system (GPS)
Track plotter
Weather facsimile
Sea surface temperature (SST) gauge
Sonar
Radio/ Satellite buoys
Doppler current meter
Expendable bathythermograph (XBT)
Satellite communications services
[Fishery information services]
Vessel monitoring system

Table 2. Longline information and data

VESSEL ATTRIBUTES
Refrigeration method
GENERAL GEAR ATTRIBUTES
Mainline material
Mainline length
Mainline diameter
Branchline material(s)
SPECIAL GEAR ATTRIBUTES
[Wire trace]
[Mainline hauler]
[Branchline hauler]
[Line shooter]
[Automatic bait thrower]
[Automatic branch line attacher]

[Hook type]
[Hook size]
[Tori pole]
[Bird curtain]
[Weighted branchlines]
[Blue-dyed bait]
[Underwater setting shoot]
[Disposal method for offal management]
SET AND HAUL INFORMATION
Date and time of start of set
Latitude and longitude of start of set
Date and time of end of set
Latitude and longitude of end of set
[Total number of baskets or floats]
[Number of hooks per basket or number of hooks between floats]
Total number of hooks used in a set
[Length of floatline]
[Distance between branchlines]
[Length of branchlines]
[Time-depth recorders (TDRs)]
[Number of light-sticks]
Target species
Bait species
Date and time of start of haul
Date and time of end of haul
[Total number of baskets or floats observed]
INFORMATION ON CATCH FOR EACH SET
[Hook number between floats]
Species code
Length of fish
Length measurement code
Gender [of fish sampled]
Condition when caught

Fate
Condition when discarded
Tag recovery information

Table 3. Pole-and-line information and data

VESSEL ATTRIBUTES
To be determined
GEAR ATTRIBUTES
Automatic poling devices
INFORMATION ON DAILY ACTIVITIES
Date and time of start of daily activities
Time of activity
Latitude and longitude of activity
Type of activity
Numbers of school sighted per day
BAITFISHING INFORMATION
Bait species caught
[Number of buckets of bait caught]
SCHOOL INFORMATION
Method of detection of school
Type of school association
INFORMATION ON CATCH PER SCHOOL FISHED
Number of crew poling
Time of start of spraying, chumming and poling
Time of end of spraying, chumming and poling
Retained catch, by species
Discards, by species
Tag recovery information
Species code
Length measurement code
Length

Table 4. Purse seine information and data

VESSEL AND RELATED ATTRIBUTES
Vessel cruising speed
Helicopter and/or tender vessel
GEAR ATTRIBUTES
Maximum depth of net
Maximum length of net
Net mesh size
INFORMATION ON DAILY ACTIVITIES
Date and time of start of daily activities
Time of activity
Latitude and longitude of activity
Numbers of school sighted per day
SCHOOL INFORMATION
Method of detection of school
Type of school association
SET INFORMATION
Observer’s record of date and time of start of set
Observer's record of date and time of end of set
Vessel's record of date and time of start of set
Retained catch, by species
Discards, by species
Tag recovery information
INFORMATION ON CATCH FOR EACH SET
Species code
Length measurement code
Length

Table 5. Troll or other fishing information and data

VESSEL ATTRIBUTES
To be determined
GEAR ATTRIBUTES
To be determined
INFORMATION ON DAILY ACTIVITIES
To be determined
INFORMATION ON CATCH FOR EACH OPRATION
To be determined

Table 6. Species of special interest

GENERAL INFORMATION
Type of interaction
Date and time of interaction
Latitude and longitude of interaction
Species code of marine reptile, marine mammal or seabird
LANDED ON DECK
Length
Length measurement code
Gender
Condition when landed on deck
Condition when released
Tag recovery information
Tag release information
INTERACTION WITH VESSEL OR GEAR ONLY
Vessel's activity during interaction
Condition observed at start of interaction
Condition observed at end of interaction
Description of interaction
Number of animals sighted

Attachment K, Appendix IV

The Commission for the Conservation and Management of Highly Migratory Fish Stocks in the Western and Central Pacific Ocean

Scientific Committee
Third Regular Session

Honolulu, HI, USA
13–24 August 2007

SCIENTIFIC DATA TO BE PROVIDED TO THE COMMISSION

1. Estimates of annual catches

The following estimates of catches during each calendar year shall be provided to the Commission for each gear type:

- catches of bigeye tuna (*Thunnus obesus*), skipjack tuna (*Katsuwonus pelamis*), yellowfin tuna (*Thunnus albacares*), blue marlin (*Makaira mazara*) and black marlin (*Makaira indica*) in: 1) the WCPFC Statistical Area (see paragraph #8), and 2) the portion of the WCPFC Statistical Area east of the 150° meridian of west longitude; and
- catches of albacore (*Thunnus alalunga*), striped marlin (*Tetrapturus audax*), swordfish (*Xiphias gladius*) and Pacific bluefin tuna (*Thunnus orientalis*) in: 1) the Pacific Ocean south of the Equator, 2) the Pacific Ocean north of the Equator, 3) the WCPFC Statistical Area north of the Equator, 4) the WCPFC Statistical Area south of the Equator, and 5) the portion of the WCPFC Statistical Area east of the 150° meridian of west longitude.

For trollers targeting albacore in the Pacific Ocean south of the Equator, the following catch estimates during the fishing season (July to June) should also be provided:

- catches of albacore in the Pacific Ocean south of the Equator

Catch estimates shall also be provided for other species as determined by the Commission.

Estimates of discards should also be provided.

Longline catch estimates shall be for whole weight, rather than processed weight.
All catch estimates shall be reported in metric tonnes.

The statistical methods used to estimate the annual and seasonal catches shall be reported to the Commission, with reference to the coverage rates for each type of data (e.g. operational catch and effort data, records of unloadings, species composition sampling data) that is used to estimate the catches and to the conversion factors that are used to convert the processed weight of longline-caught fish to whole weight.

2. Number of vessels active

The number of vessels active[1] in the WCPFC Statistical Area during each calendar year shall be provided to the Commission for each gear type.

For longliners, pole-and-line vessels, and purse seiners, the number of vessels active shall be provided by gross registered tonnage (GRT) class. The GRT classes are defined as follows:

- Longline: 0–50, 51–200, 201–500, 500+
- Pole-and-line: 0–50, 51–150, 150+
- Purse seine: 0–500, 501–1000, 1001–1500, 1500+

For trollers targeting albacore, the number of vessels active during each calendar year shall be provided for 1) the WCPFC Statistical Area south of the Equator and 2) the WCPFC Statistical Area north of the Equator. For trollers targeting albacore in the Pacific Ocean south of the Equator, the number of vessels active during the fishing season (July to June) shall be provided for 1) the WCPFC Statistical Area south of the Equator and 2) the Pacific Ocean south of the Equator.

3. Operational level catch and effort data

Operational level catch and effort data (e.g. individual sets by longliners and purse seiners, and individual days fished by pole-and-line vessels and trollers) shall be provided to the Commission, in accordance with the standards adopted by Commission at its Second Regular Session. These are listed in Annex 1.

It is recognized that certain members and cooperating non-members of the Commission may be subject to domestic legal constraints, such that they may not be able to provide operational data to the Commission until such constraints are overcome. Until such constraints are overcome, aggregated catch and effort data and size composition data, as described in (4) and (5) below, shall be provided.

It is also recognized that certain members and cooperating non-members of the Commission may have practical difficulties in compiling operational data for fleets comprised of small vessels, such as certain sectors of the fisheries of Indonesia, the Philippines and small island developing states.

4. Catch and effort data aggregated by time period and geographic area

If the coverage rate of the operational catch and effort data that are provided to the Commission is less than 100%, then catch and effort data aggregated by time period and geographic area that have been raised to represent the total catch and effort shall be provided. Longline catch and effort data shall be aggregated by periods of month and areas of 5° longitude and 5° latitude. Purse-seine and ringnet catch and effort data shall be aggregated by periods of month, areas of 1° longitude and 1° latitude, and type of school association. Catch and effort data for other surface

[1] A vessel is considered to be "active" if it fished (targeting highly migratory fish stocks) at least one day during the year.

fisheries targeting tuna shall be aggregated by periods of month and areas of 1° longitude and 1° latitude.

If the coverage rate of the operational catch and effort data that are provided to the Commission is less than 100%, then unraised longline catch and effort data stratified by the number of hooks between floats and the finest possible resolution of time period and geographic area shall also be provided.

If the coverage rate of the operational catch and effort data that are provided to the Commission is less than 100%, then catch and effort data that have been raised to represent the total catch and effort shall also be aggregated by periods of year and areas of national jurisdiction and high seas within the WCPFC Statistical Area.

[Catch and effort data aggregated by periods of month and areas of 5° longitude and 5° latitude that have been raised to represent the total catch and effort, and unraised longline catch and effort data stratified by the number of hooks between floats and the finest possible resolution of time period and geographic area, covering distant-water longliners may also be provided for the Pacific Ocean east of the eastern boundary of the WCPFC Statistical Area.]

The statistical methods that are used to derive the aggregated catch and effort data shall be reported to the Commission, with reference to the coverage rates of the operational catch and effort data, and the types of data and method used to raise the catch and effort data.

5. Size composition data

Length and/or weight composition data that are representative of catches by the fisheries shall be provided to the Commission at the finest possible resolution of time period and geographic area and at least as fine as periods of quarter and areas of 20° longitude and 10° latitude.

6. The roles of flag states and coastal states

Flag states or entities shall be responsible for providing to the Commission scientific data covering vessels they have flagged, except for vessels operating under joint-venture or charter arrangements with another state such that the vessels operate, for all intents and purposes, as local vessels of the other state, in which case the other state shall be responsible for the provision of data to the Commission.

It is recognized that the ability of flag States or entities to provide scientific data to the Commission may be constrained by the terms of bilateral or regional arrangements, such as the Treaty on Fisheries Between the Governments of Certain Pacific Island States and the Government of the United States of America.

Scientific data compiled by coastal states shall also be provided to the Commission.

7. Time periods covered and schedule for the provision of data

Estimates of annual or seasonal catches should be provided to the Commission from 1950 onwards or, if the fleet began operating after 1950, from the year in which the fleet began operating.

Operational catch and effort data, and size composition data, should be provided for all years, starting with the first year for which the data are available.

For all gear types, except trollers targeting albacore in the Pacific Ocean south of the Equator, estimates of annual catches, the number of vessels active, catch and effort data, and size composition data, covering a calendar year should be provided by April 30 of the year following the calendar year (e.g. data covering calendar year "x" should be provided by 30 April of year "x+1").

For trollers targeting albacore in the Pacific Ocean south of the Equator, estimates of annual catches, the number of vessels active, catch and effort data, and size composition data, covering a fishing season (July to June) should be provided by April 30 of the year following the year in which the season ends (e.g. data covering the season from July of year "x" to June of year "x+1" should be provided by 30 April of year "x+2").

Estimates of annual catches, the number of vessels active, catch and effort data, and size composition data should be revised, and the revisions provided to the Commission, as additional data become available.

8. Definition of the WCPFC Statistical Area

The WCPFC Statistical Area is defined as follows: from the south coast of Australia due south along the 141° meridian of east longitude to its intersection with the 55° parallel of south latitude; thence, due east along the 55° parallel of south latitude to its intersection with the 150° meridian of east longitude; thence, due south along the 150° meridian of east longitude to its intersection with the 60° parallel of south latitude; thence, due east along the 60° parallel of south latitude to its intersection with the 130° meridian of west longitude; thence, due north along the 130° meridian of west longitude to its intersection with the 4° parallel of south latitude; thence, due west along the 4° parallel of south latitude to its intersection with the 150° meridian of west longitude; thence, due north along the 150° meridian of west longitude; and from the north coast of Australia due north along the 129° meridian of east longitude to its intersection with the 8° parallel of south latitude, thence due west along the 8° parallel of south latitude to the Indonesian archipelago; and from the Indonesian peninsula due east along the 2°30′ parallel of north latitude to the Malaysian peninsula.

9. Periodic reviews of the requirements for scientific data

The Commission, through its Scientific Committee, shall periodically review the requirements for scientific data and shall provide the Commission with revised versions of this recommendation, as appropriate.

Attachment K, Annex 1. Standards for the Provision of Operational Level Catch and Effort Data

1. Data items that shall be reported to the Commission

1.1 Vessel identifiers, for all gear types

Name of the vessel, country of registration, registration number, and international radio call sign: The registration number is the number assigned to the vessel by the state that has flagged the vessel. A code may be used as a vessel identifier instead of the name of the vessel, registration number and call sign for vessels that have fished and that intend to fish only in the waters of national jurisdiction of the State that has flagged the vessel.

1.2 Trip information, for all gear types

The start of a trip is defined to occur when a vessel (a) leaves port after unloading part or all of the catch to transit to a fishing area or (b) recommences fishing operations or transits to a fishing area after transshipping part or all of the catch at sea (when this occurs in accordance with the terms and conditions of article 4 of Annex III of the Convention, subject to specific exemptions as per article 29 of the Convention).

Port of departure, date of departure, port of unloading, date of arrival in port of unloading: If the start of a trip coincides with recommencing fishing operations or transiting to a fishing area after transshipping part or all of the catch at sea, then "Transshipment at sea" shall be reported in lieu of the port of departure, and if the end of a trip coincides with transshipping part or all of the catch at sea, then "Transshipment at sea" shall be reported in lieu of the port of unloading.

1.3 Information on operations by longliners

Activity: This item should be reported for each set and for days on which no sets were made, from the start of the trip to the end of the trip. Activities should include "a set"; "no fishing — in transit"; "no fishing — gear breakdown"; "no fishing — bad weather"; and "no fishing — in port".

Date of start of set and time of start of set: The date and start of set time should be GMT/UTC. If no sets are made, the date and main activity should be reported.

Position of start of set: The position of start of set should be reported in units of at least minutes of latitude and longitude. If no sets are made, the noon position should be reported.

Number of hooks per set

Number of branch lines between floats. The number of branch lines between floats should be reported for each set.
Number of fish caught per set, for the following species: albacore (*Thunnus alalunga*), bigeye (*Thunnus obesus*), skipjack (*Katsuwonus pelamis*), yellowfin (*Thunnus albacares*), striped marlin (*Tetrapturus audax*), blue marlin (*Makaira mazara*), black marlin (*Makaira indica*) and swordfish (*Xiphias gladius*), and other species as determined by the Commission.

If the total weight or average weight of fish caught per set has been recorded, then the total weight or average weight of fish caught per set, by species, should also be reported. If the total

weight or average weight of fish caught per set has not been recorded, then the total weight or average weight of fish caught per set, by species, should be estimated and the estimates reported. The total weight or average weight shall refer to whole weights, rather than processed weights.

1.4 Information on operations by pole-and-line vessels and related gear types

Activity: This item shall be reported for each day, from the start of the trip to the end of the trip. Activities should include "a day fishing or searching with bait onboard"; "no fishing — collecting bait"; "no fishing — in transit"; "no fishing — gear breakdown"; "no fishing — bad weather"; and "no fishing — in port".

Date: The date should be GMT/UTC.

Noon position: The noon position should be reported in units of at least minutes of latitude and longitude.

Weight of fish caught per day, for the following species: albacore, bigeye, skipjack, yellowfin, and other species as determined by the Commission.

1.5 Information on operations by purse seiners and related gear types

Activity: This item shall be reported for each set and for days on which no sets were made, from the start of the trip to the end of the trip. Activities should include "a set"; "a day searched, but no sets made"; "no fishing — in transit"; "no fishing — gear breakdown"; "no fishing — bad weather"; and "no fishing — in port".

Date of start of set, time of start of set and time of end of set: The date and time of the start of set and the time of end of set should be GMT/UTC. If no sets are made, the date and main activity should be reported.

Position of set or noon position: If a set is made, then the position of the set shall be reported. If searching occurs, but no sets are made, then the noon position shall be reported. The position should be reported in units of at least minutes of latitude and longitude.

School association: All common types of school association should be reported, while uncommon types of associations should be reported as "other". Common types of school association are "free-swimming" or "unassociated"; "feeding on baitfish"; "drifting log, debris or dead animal"; "drifting raft, FAD or payao"; "anchored raft, FAD or payao"; "live whale"; and "live whale shark".

Weight of fish caught per set, for the following species: albacore, bigeye, skipjack, yellowfin, and other species as determined by the Commission.

1.6 Information on operations by trollers and related gear types

Activity: This item shall be reported for each day, from the start of the trip to the end of the trip. Activities should include "a day fished"; "no fishing — in transit"; "no fishing — gear breakdown"; "no fishing — bad weather"; and "no fishing — in port".
Date: The date should be GMT/UTC.

Noon position: The noon position should be reported in units of at least minutes of latitude and longitude.

Number of fish caught per day, for the following species: albacore, bigeye, skipjack, yellowfin, and other species as determined by the Commission.

If the total weight or average weight of fish caught per day has been recorded, then the total weight or average weight of fish caught per day, by species, should also be reported. If the total weight or average weight of fish caught per day has not been recorded, then the total weight or average weight of fish caught per day, by species, should be estimated and the estimates reported. The total weight or average weight shall refer to whole weights, rather than processed weights.

2. Geographic area to be covered by operational catch and effort data to be provided to the Commission

The geographic area to be covered by operational catch and effort data to be provided to the Commission shall be the WCPFC Statistical Area, except for fisheries targeting albacore in the Pacific Ocean south of the Equator, for which the geographic area should be the Pacific Ocean south of the Equator.

3. Target coverage rate for operational catch and effort data to be provided to the Commission

The target coverage rate for operational catch and effort data to be provided to the Commission is 100%.

4. Procedures for the verification of operational catch and effort data

Operational catch and effort data should be verified as follows:

a) The amount of the retained catch should be verified with records of unloading obtained from a source other than the crew or owner or operator of the fishing vessel, such as an agent of the company responsible for unloading or onward shipping or purchasing of the catch.

b) Positions of latitude and longitude should be verified with information obtained from vessel monitoring systems.

c) The species composition of the catch should be verified with sampling conducted by observers during fishing operations or by port samplers during unloading.

Attachment L

The Commission for the Conservation and Management of Highly Migratory Fish Stocks in the Western and Central Pacific Ocean

Scientific Committee
Third Regular Session

Honolulu, HI, USA
13–24 August 2007

REPORT OF THE STOCK ASSESSMENT SPECIALIST WORKING GROUP

INTRODUCTION

1. The meeting of the Stock Assessment Specialist Working Group (SA-SWG) took place from 14–15 August 2007 at the Convention Center in Honolulu, Hawaii, United States of America. Max Stocker (Canada) and Naozumi Miyabe (Japan) served as Convenors of the meeting, with Brett Molony, Simon Hoyle, Don Bromhead, Dale Kolody and Sean Sloan serving as rapporteurs.

2. A provisional agenda was circulated for review prior to the meeting and adopted (Appendix I to this report). Five working papers were presented to the SA-SWG, including the yellowfin tuna stock assessment, yellowfin and bigeye logsheet data analysis, multi-fishery management options, yellowfin recruitment-environment modeling, and bigeye and yellowfin area closure options. The yellowfin assessment represents an update of the assessment undertaken in 2006. Three information papers were also presented. A complete listing of documents presented to the SA-SWG is included in Attachment F of the main report.

3. In 2007, no assessments were undertaken for bigeye tuna, skipjack tuna, South Pacific albacore, southwest Pacific swordfish, and striped marlin in the southwestern Pacific. Assessments for northern stocks were presented in the Scientific Committee plenary.

4. The SA-SWG discussed responses to the Commission's requests (Agenda item 5), and addressed administrative matters.

5. The SA-SWG also discussed and identified short- to medium-term research items to advance stock assessments and these items are included in the emerging WCPFC research plan (see Agenda Item 9 — Future work programme). It should be noted that many of the research items identified by the SA-SWG are consistent with those identified by the other Specialist Working Groups (i.e. the integration of diverse datasets to produce a comprehensive and reliable results).

6. On the basis of the presentation of the stock assessment working paper and the discussions of the SA-SWG, stock status descriptions were formulated for yellowfin tuna. Summaries of each working paper, including relevant status descriptions and SA-SWG discussions, and proposed short- to medium-term research items follow.

YELLOWFIN TUNA STOCK ASSESSMENT

Summary of SC3-SA-WP-1

7. Adam Langley presented Working Paper SC3-SA-WP-1, "Stock assessment of yellowfin tuna in the WCPO".

8. Yellowfin tuna, an important component of tuna fisheries throughout the WCPO, are harvested with a diverse variety of gear types, from small-scale artisanal fisheries in Pacific Island and Southeast Asian waters to large, distant-water longliners and purse seiners that operate widely in equatorial and tropical waters. Purse seiners catch a wide size range of yellowfin tuna, whereas the longline fishery takes mostly adult fish.

9. Since 1997, the total yellowfin tuna catch in the WCPO has varied between 350,000 mt and 450,000 mt. Purse seiners harvest the majority of the yellowfin tuna catch (54% by weight in 2005), with the longline and pole-and-line fisheries comprising 15% and 3% of the total catch, respectively. Yellowfin tuna usually represent in approximately 20–25% of the overall purse-seine catch and may contribute higher percentages of the catch in individual sets. Yellowfin tuna are often directly targeted by purse seiners, especially as unassociated schools, which accounted for 56% of recent (2000–2005) yellowfin purse-seine catch (by weight).

10. Longline catches in recent years (60,000–80,000 mt) are well below catches in the late 1970s to early 1980s (which peaked at about 110,000 mt), presumably related to changes in targeting practices by some of the larger fleets. The domestic fisheries of the Philippines and eastern Indonesia catch yellowfin using a variety of gear types (e.g. pole-and-line, ringnet, gillnet, handline and seine net). Catches from these fisheries have increased over the past decade and are estimated to represent approximately 30% of total WCPO yellowfin tuna catches.

11. Most of the catch is taken in western equatorial areas, with declines in both purse-seine and longline catch towards the east of the WCPO (Fig. Y1). The east–west distribution of catch is strongly influenced by ENSO events, with larger catches taken east of 160°E during El Niño episodes. Catches from outside the equatorial region are relatively minor (5%) and are dominated by longline catches south of the equator and purse-seine and pole-and-line catches in the northwestern area of the WCPO.

12. The 2007 stock assessment for yellowfin tuna in the WCPO was implemented in MULTIFAN-CL (MFCL). The yellowfin tuna model is age- and spatially structured (28 age-classes, 6 regions) and the catch, effort, and size composition data used in the model are classified into 19 fisheries and quarterly time periods from 1952 through 2006. Tagging data were also used in the assessment model. The following substantive changes were introduced this year:

a. The inclusion of three new fisheries (an equatorial pole-and-line fishery, Japanese coastal pole-and-line, and purse-seine fisheries);

b. The separation of the Philippines and Indonesian domestic fisheries;

c. The subdivision of the principal longline fishery in Region 3 (LL ALL 3);

d. The treatment of the length- and weight-frequency data collected from the main longline and purse-seine fisheries;

e. The new CPUE weighting scheme among regions; and

f. The inclusion of additional recent fishery data (2005 for longline, 2005 for Philippines and Indonesia, and 2006 for purse seine).

13. The current assessment included a range of sensitivity analyses, mainly assessing the implications of the assumed level of catch from the Indonesian fishery, the potential for spatial heterogeneity in growth, and the effect of various changes in the model data structure. The sensitivity of the model to assumptions regarding the steepness parameter of the stock recruitment relationship (SRR) was also investigated. In addition, a separate model was constructed based on a single-region encompassing the western equatorial region (MFCL Region 3) — the core region of the fishery.

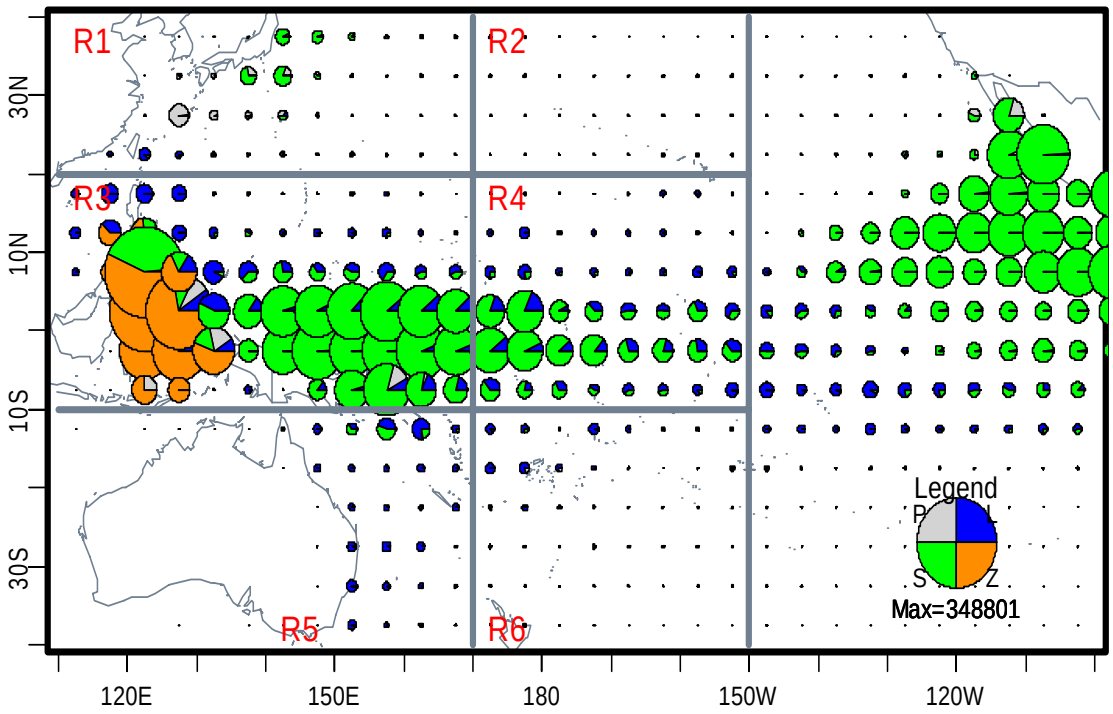

Figure Y1. Distribution of cumulative yellowfin tuna catch from 1990–2005 by 5 degree squares of latitude and longitude and fishing gear: longline (L, blue), purse-seine (S, green), pole-and-line (P, grey) and other (Z, dark orange). The grey lines indicate the spatial stratification. (The color figure is attached at the end of the report.)

14. From the five scenarios analyzed, biomass is estimated to have declined to 0.51–0.60 of unfished levels (a fishery impact of 40–49%), with exploitation rates rising steeply in the last decade. This represents a moderate level of stock-wide depletion that is approaching the equivalent equilibrium-based limit reference point ($\widetilde{B}_{MSY}/\widetilde{B}_0$ = 0.41). Further, fishery impact is somewhat greater for some individual model regions, notably in equatorial Region 3 where recent depletion levels are approximately 0.40 (a 60% reduction from the unexploited level). Other regions are less depleted, with indices of 0.80 or greater for all other regions except for Region 4 (0.65).

Discussion

Between-year variability in assessment inferences

15. There was some perception within the SA-SWG that the yellowfin tuna stock status estimates from the 2007 assessment were slightly more optimistic than 2006 when only the base case point estimates were examined. It was emphasized that point estimates (including biomass, fishing mortality and target and limit reference points) can be expected to fluctuate from year to year due to minor data revisions, model modifications, and the additional information in an extra year of data. These changes should be distinguished from real changes in stock biomass and condition between years. The importance of minor point estimate movements can be over-emphasized if the stock status jumps around either side of a particular reference point. It is much more important to recognize the general stock size trends and the uncertainty encompassed by confidence intervals. With this broader perspective, it is evident that the stock status estimates are actually very similar between the 2006 and 2007 assessments.

16. Two optimistic differences were observed in the 2007 assessment. The first was the good recruitment estimated for the most recent year, which was supported by both a conspicuous mode of small fish in longline fishery data and a corresponding mode in purse-seine data. However, estimates of the strength of recent recruitments are very uncertain. The second is the change in the recent biomass trend in response to higher recent recruitment, although estimates of the most recent trends are also very uncertain.

Implications of Indonesia and the Philippines fisheries

17. The SA-SWG indicated that the treatment of the Indonesian fishery merits further attention in the assessment. The base case assumed that catch levels in the last few years were drastically reduced (~50%) compared with previous catch estimates. This was a result of recent changes in the reported level of catch by Indonesia. The stock assessment is relatively insensitive to catch levels for the Indonesian fishery. It was again noted that these fisheries, which take small tuna, are unique in size composition among world tuna fisheries. Important life history parameters (particularly natural mortality and migration) are poorly quantified for such small, young fish. These fisheries were noted to have an estimated impact on adjacent regions (particularly area 5), and while the movement estimates are supported by some tagging studies, the migration estimates may not be expected to be very reliable (e.g. inter-annual variability is not estimated and migration rates are assumed constant by age). Direct estimates of fishing mortality (from tagging) in this region were considered to be among the most informative data that could be collected to improve the assessment.

Selectivity estimates

18. It was noted that the assessment model shares principal longline fleet catchability among regions, but that the same selectivity is shared between Regions 1 and 2, whereas the same selectivity was shared between Regions 3–6. The variable selectivity was adopted for the model to fit the size frequency data in all regions. However, this was recognized as a potential inconsistency that may undermine the intended regional abundance scaling among areas (imposed by the CPUE area weightings).

19. The selectivity estimates of the Japanese pole-and-line fishery (area 1) resembled those expected for longline fleets, in that the oldest individuals were highly selected, but not observed in the catches. This was explained as the result of the confounding of fine-scale vulnerability at

age and large-scale availability within area 1. The relatively high selectivity estimated for older fish is required to estimate a catch of adults that matches the observed catch of large fish in the fishery, because adults are estimated to be relatively less abundant in this region.

Recommendations for future assessments

20. The SA-SWG requested additional model runs in future to illustrate the assessment uncertainty with respect to natural mortality assumptions, alternative catch histories for Indonesia (and the Philippines), and changes in longline catchability time trends.

21. It was recognized that modeling of selectivity changes over time might be appropriate to describe some longline setting practices (e.g. day vs. night sets). This might account for the changing size composition observed in some longline fisheries that is not evident in concurrent purse seine fisheries.

22. It was suggested that figures would be easier to interpret if data and inferences were presented annually rather than quarterly, but it was recognized that such plots could be misleading because of strong seasonal patterns. Temporal trends in the catch size composition would be informative.

23. The merits of a Pacific-wide yellowfin tuna assessment were discussed, but not recommended because there seems to be a discontinuity between the WCPO and EPO populations. While a few tagged fish have crossed between regions, this is thought to represent a very small proportion.

24. It was recommended that previous year's base-case model be run in order to better understand the sensitivity of model results to changes in the model each year.

25. It was suggested that SA-SWG develop a procedure for interpreting stock assessment results to help in the formulation of stock status and management recommendations.

Stock description for yellowfin tuna

26. On the basis of the assessment, the SA-SWG developed the following stock status description for yellowfin tuna.

Key attributes

27. 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 (approximately 20–25% since 1990) of the total annual catch of the four main target tuna species in the WCPO. For stock assessment purposes, yellowfin tuna are assumed to constitute a single stock in the WCPO.

Trends: catch and effort

28. Longline fisheries developed in the early 1950s, with yellowfin tuna being the principal target species. A major change took place after the mid-1970s though, 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 (Fig. Y2). This development, together with increased catches by Indonesia and the Philippines, resulted in the yellowfin catches in the WCPO doubling from 200,000–400,000 mt between 1980 and 1990. Over the past decade, 40–60% of the total yellowfin catch each year has come from the purse-seine fishery.

29. With the introduction of FADs in the purse-seine fishery in the late 1990s, came a considerable catch of juvenile yellowfin. Since 1997, the total yellowfin tuna catch in the WCPO has varied between 350,000 mt and 450,000 mt. Purse seiners harvest the majority of the yellowfin tuna catch (54% by weight in 2005), with the longline and pole-and-line fisheries comprising 15% and 3% of the total catch, respectively. Yellowfin tuna usually represent approximately 20–25% of the overall purse-seine catch and may contribute higher percentages of the catch in individual sets. Yellowfin tuna is often directly targeted by purse seiners, especially as unassociated schools, which accounted for 56% of recent (2000–2005) yellowfin purse-seine catch (by weight).

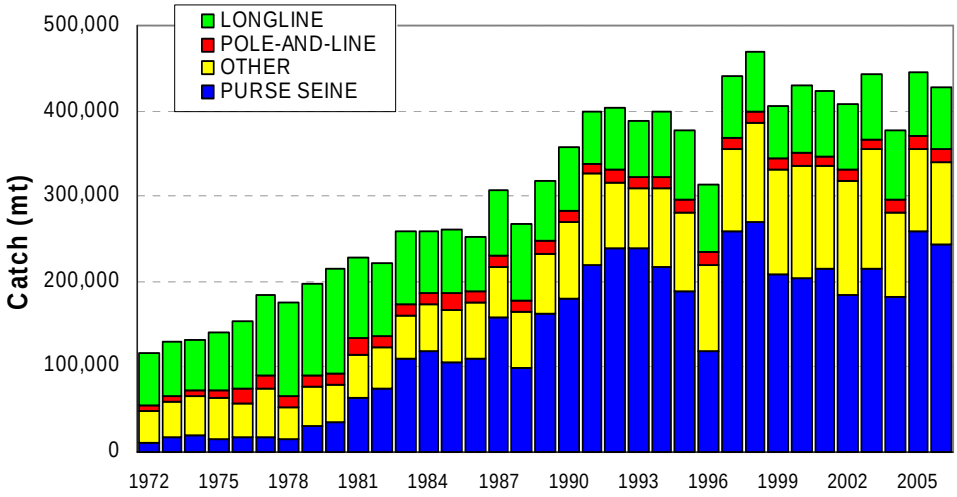

Figure Y2. Yellowfin catch (mt) in the Convention Area by longline, pole-and-line, purse seine and other gear types.

30. The total 2006 Convention Area yellowfin tuna catch (provisional) was 426,726 mt and is around the average level for the last 10 years. The purse-seine catch (243,620 mt), accounting for 57% of the total Convention Area yellowfin catch, was lower than the 2005 level, but still one of the highest catches over the past 10 years. In recent years, the yellowfin longline catch has ranged 75,000–82,000 mt, which is well below catches taken in the late 1970s to early 1980s (90,000–120,000 mt), presumably related to changes in targeting practices by some of the large fleets and the gradual reduction in the number of vessels. The Convention Area longline catch for 2006 was 71,021 mt (17% of the total Convention Area yellowfin catch), the lowest catch since 1999.

31. The CPUE indices derived from the Japanese longline fleet represent the principal index of longline exploitable biomass in each of the model regions. 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 more variable trends and smaller declines in more temperate regions. The generalized linear model (GLM) based index

displays similar (if sometimes smaller) trends to the nominal catch rates (Figure Y3) from the late 1970s to the 1990s.

Size of fish caught

32. The domestic surface fisheries of the Philippines and Indonesia take considerable quantities of small yellowfin in the range 20–50 cm (Fig. Y4). In the purse-seine fishery, smaller yellowfin are caught in log and FAD sets than in unassociated sets. A major portion of the purse-seine catch in weight is adult (>100 cm) yellowfin tuna, to the extent that the purse-seine catch of adult yellowfin tuna is usually higher than the longline catch. Inter-annual variability in the size of yellowfin taken exists in all fisheries. Note the strong mode of large (130–150cm) yellowfin from (purse-seine) unassociated-sets in 2002. There is an historical trend of declining fish size from the 1970s to the present.

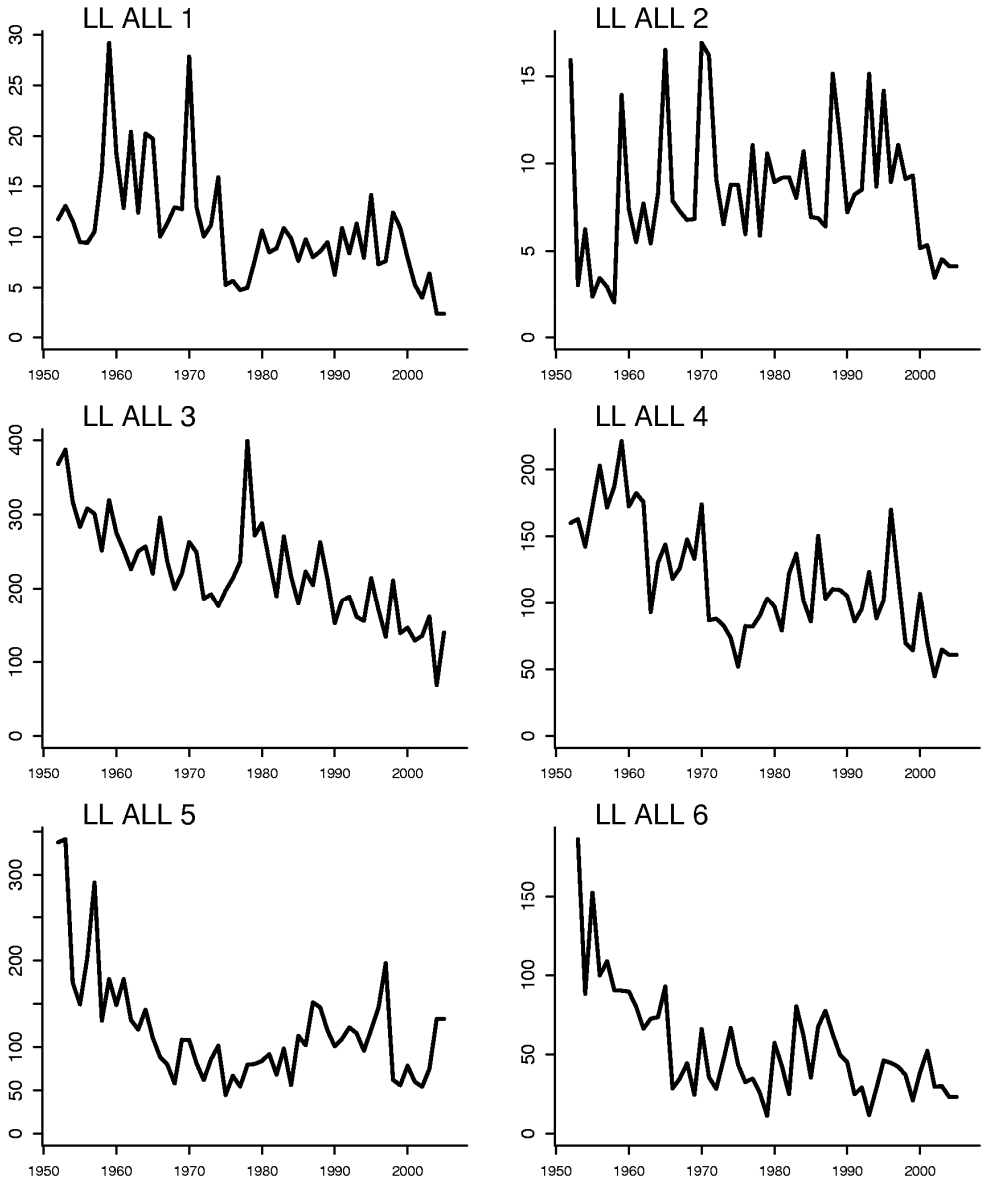

Figure Y3. GLM standardized catch per unit of effort (CPUE) for the principal longline fisheries (LL ALL 1–6) scaled by the respective region scalars. Areas correspond to Figure Y1.

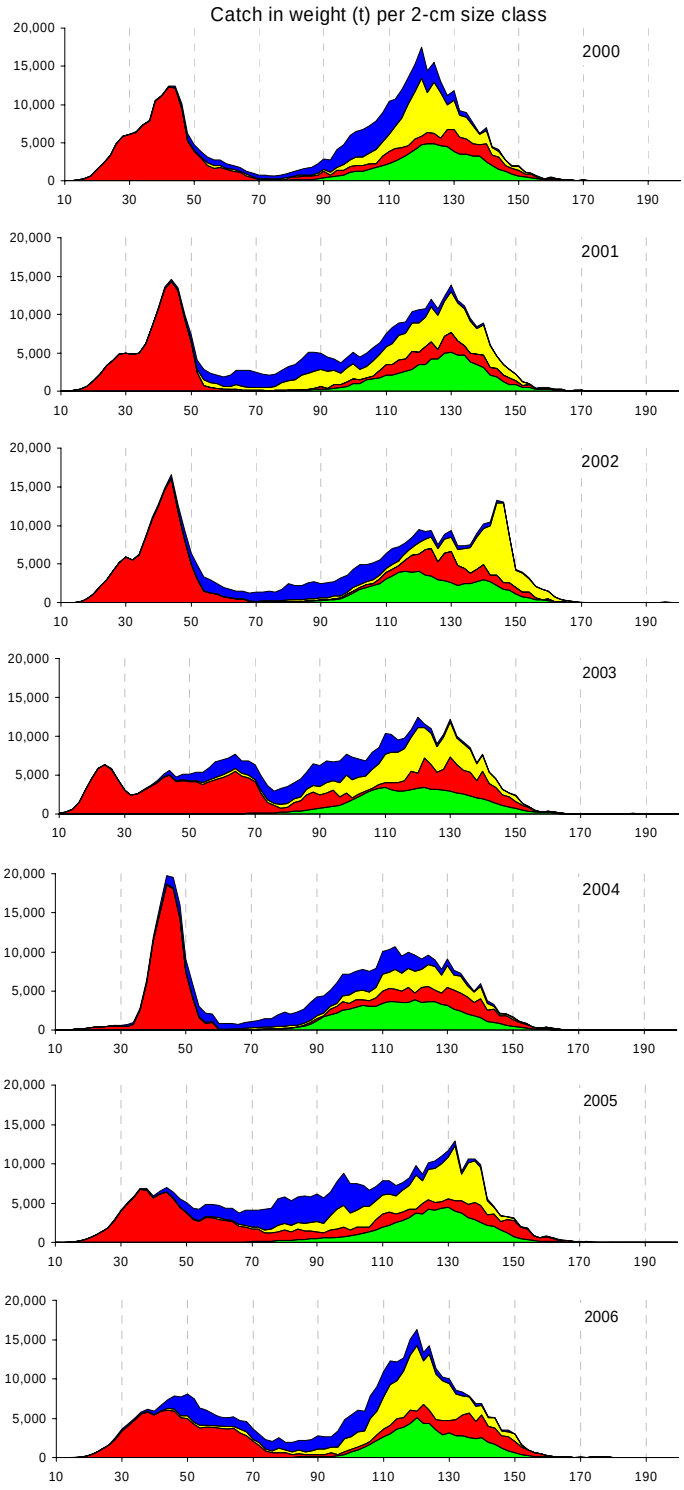

Figure Y4. Annual catches (mt) of yellowfin tuna in the WCPO by size and gear type, 2000–2006: longline, green; Phil-Indo fisheries, red; purse seine associated, blue; purse seine unassociated, yellow. (The color figure is attached at the end of the report.)

Recruitment

33. Initial recruitment in the base-case assessment was relatively high, declining to a lower level during the late 1950s (Fig. Y5). Recruitment subsequently has been relatively stable with moderate fluctuations through to 2005. For the most recent years, recruitment is estimated to have increased, although recent recruitment estimates are poorly determined. Nevertheless, the estimates of stronger recruitment in recent years are generally consistent with recruitment estimates derived from a model relating yellowfin recruitment to the oceanographic conditions of the WCPO.

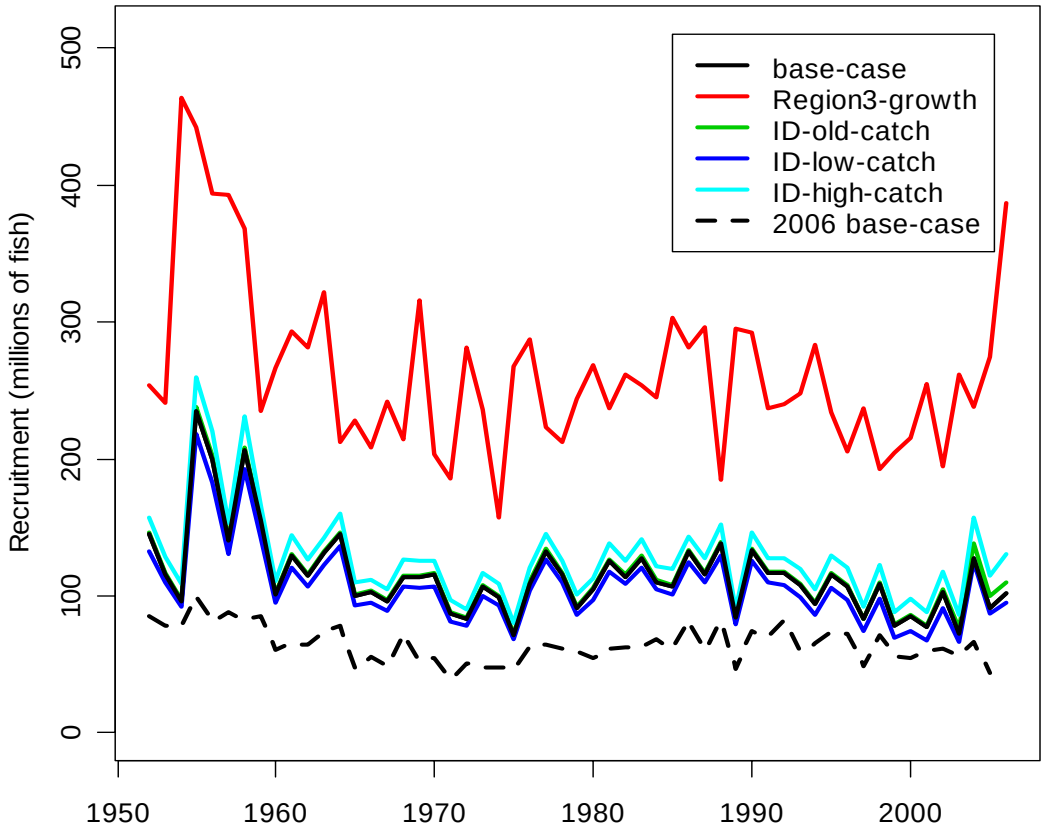

Figure Y5. Estimated annual recruitment (millions of fish) for the WCPO obtained from the different model options and the 2006 base-case model. (The color figure is attached at the end of the report.)

Biomass

34. For all analyses, the trends in biomass are generally comparable prior to the mid-1980s and were consistent with the underlying trends in recruitment, with biomass declining during the initial period to a low level in the early–mid 1970s, before increasing slightly in the mid-1970s

(Fig. Y6). Biomass levels remained relatively stable during the 1980s. For all model options, biomass is estimated to have declined steadily during the 1990s, largely due to the decline in the biomass within Region 3 but also evident in most other regions. The recent estimates of strong recruitment result in a predicted increase in total biomass during the most recent years in the model; again, there is considerable uncertainty associated with the recent recruitment estimates and, therefore, recent trends in total biomass.

35. Overall, the impact of fishing has reduced the WCPO total biomass to about 40% of unexploited levels. Depletion varies among regions, with high levels of depletion estimated for the equatorial regions; biomass in Region 3 is estimated to be at 35% of the unfished level. By comparison, fishery impacts are relatively low in Regions 1, 2, 5 and 6; less than about 20% for most of the time period (i.e. total biomass maintained at above 80% of unexploited levels).

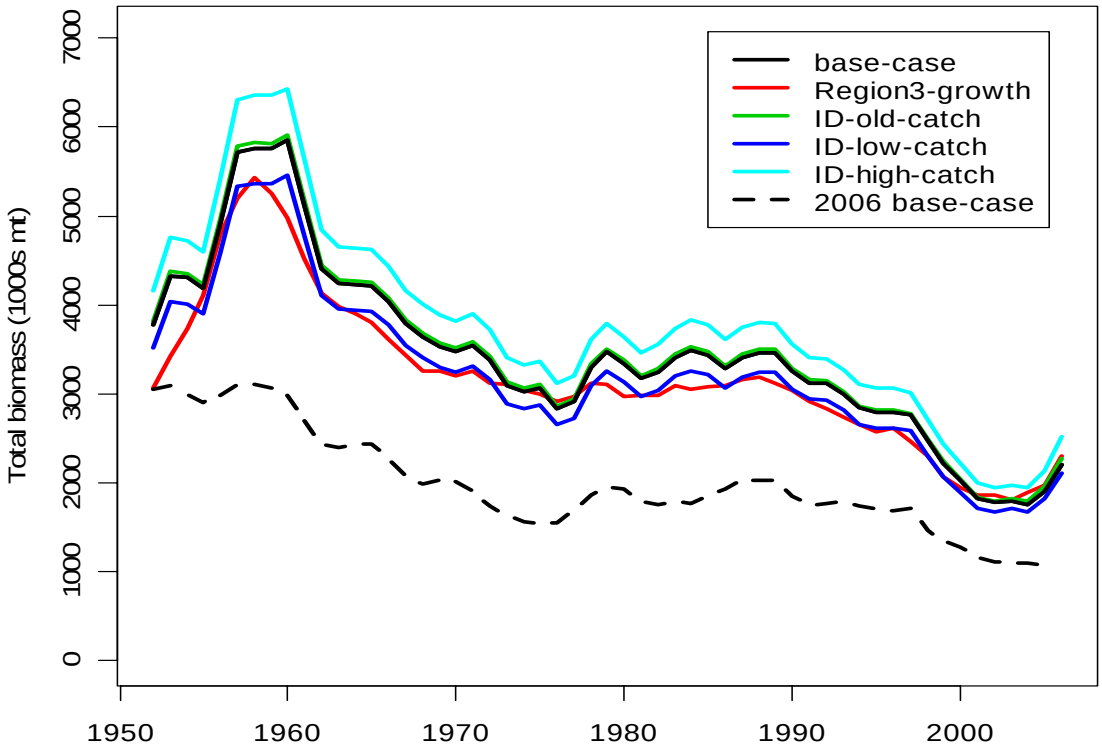

Figure Y6. Estimated annual average total biomass (thousands of mt) for the WCPO obtained from a range of different model options. (The color figure is attached at the end of the report.)

Fishing mortality

36. 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 (Fig. Y7). Fishing mortality is poorly determined for the last few years included in the model. These increases are attributable to increased catches in purse-seine fisheries and catches of juveniles in particular in the domestic Indonesian and Philippine fisheries,

causing the declines in overall biomass over the past decade. Fishery impact analysis shows that the highest impacts on the yellowfin stock occur in tropical Regions 3 and 4 (Fig. Y8), and to a lesser extent the northern region 1 (which has a low level of biomass relative to the equatorial regions). The longline fishery has relatively low impact on the stock, but the surface fisheries, particularly the Indonesian and Philippines domestic fisheries and the purse-seine fisheries, have a high impact.

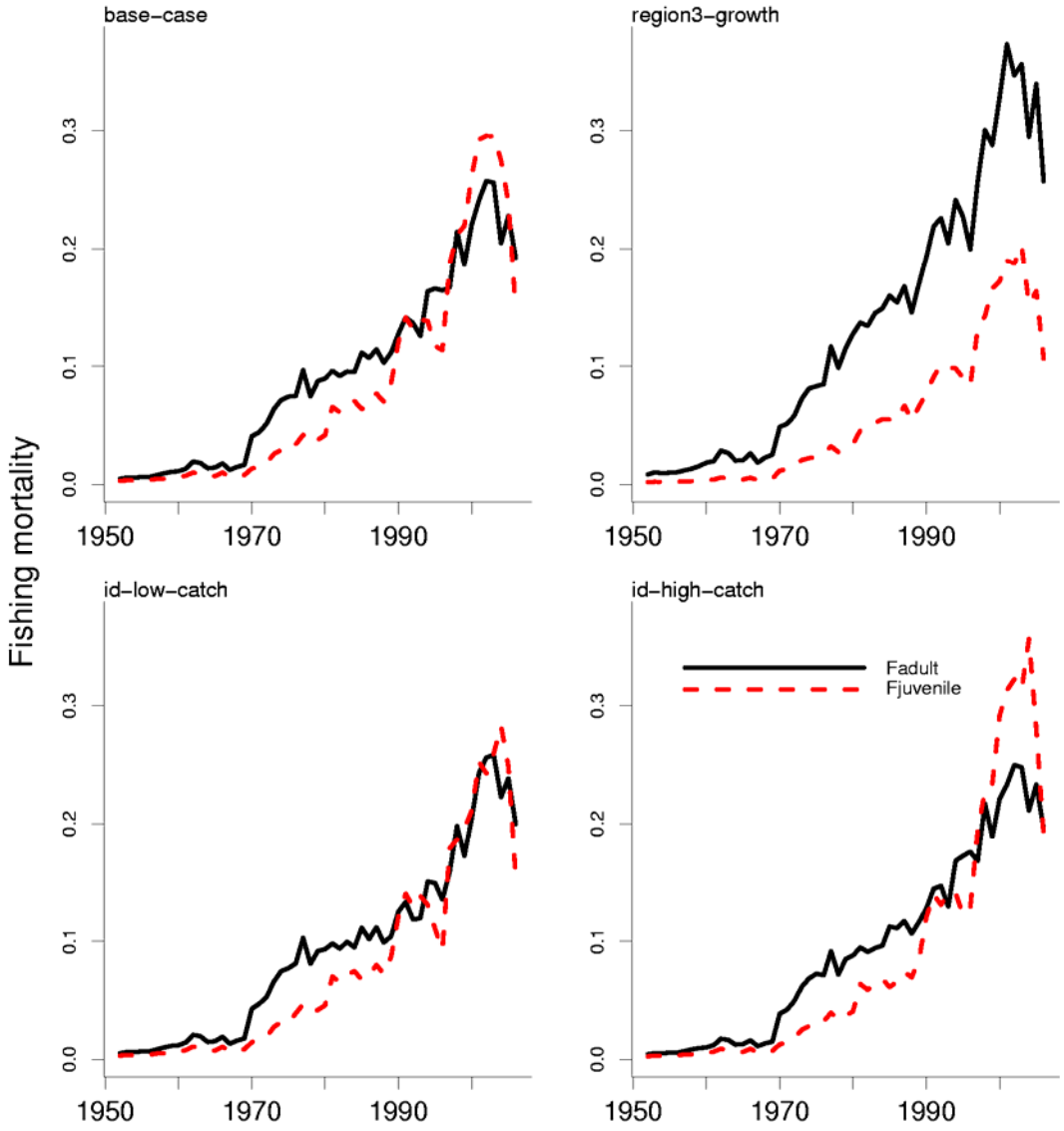

Figure Y7. Estimated annual average juvenile and adult fishing mortality for the WCPO obtained from the separate model options.

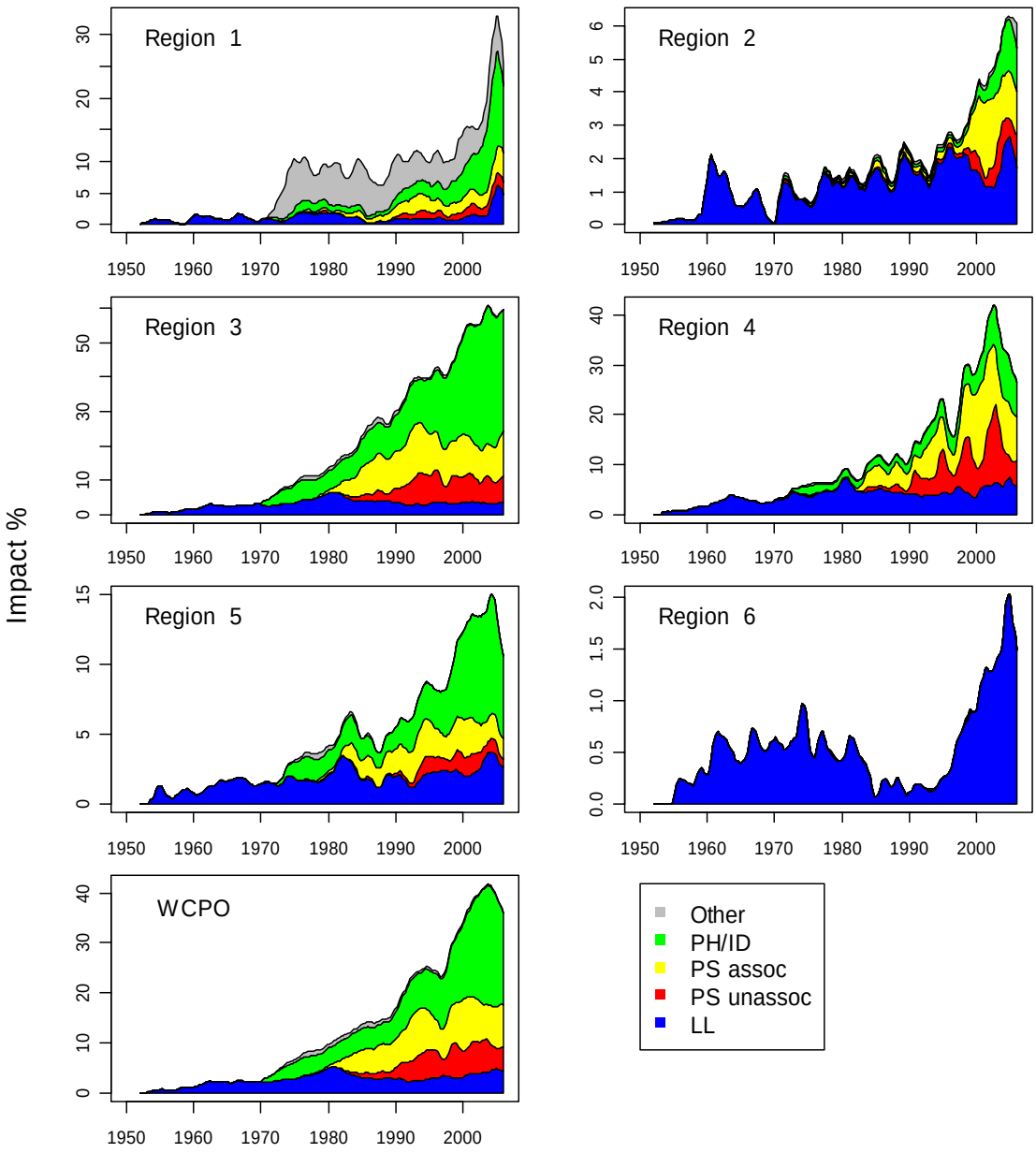

Figure Y8. Estimates of reduction in total biomass due to fishing (fishery impact = $1\text{-}B_t/B_{0,t}$) by region and for the WCPO attributed to various fishery groups. LL = all longline fisheries; PH/ID = Philippines and Indonesian domestic fisheries; PS associated = purse seine FAD and log sets; PS unassociated = purse seine school sets; Other = JP coastal PL & PS and equatorial PL. (The color figure is attached at the end of the report.)

Stock status for yellowfin tuna

37. The stock assessment conclusions differ slightly from the 2006 assessment, particularly in relation to the $F_{current}/\widetilde{F}_{MSY}$ threshold with the current assessment being slightly more optimistic than the 2006 assessment (Table Y1) when only the base-case point estimates are

examined. This change is largely due to the changes in the configuration of the fisheries and their associated size data in the model, as well as the refinements to the stock assessment models. However, the stock assessment conclusions are highly sensitive to the assumptions relating to the steepness of the SRR.

38. The reference points that predict the status of the stock under equilibrium conditions are $\widetilde{B}_{F_{current}} / \widetilde{B}_{MSY}$ (1.10) and $S\widetilde{B}_{F_{current}} / S\widetilde{B}_{MSY}$ (1.12), which indicate that the long-term average biomass would remain slightly above the level capable of producing *MSY* at 2002–2005 average fishing mortality (Table Y1). Overall, current biomass exceeds the estimated biomass at *MSY* ($B_{current} / \widetilde{B}_{MSY}$ >1.0) (i.e. the yellowfin stock in the WCPO is not in an overfished state, although there is a small probability (6.2%) that it is in an overfished state) (Figs. Y9 and Y10).

39. While the point estimate of $F_{current} / \widetilde{F}_{MSY}$ remains slightly less than 1 (0.95), the probability distribution associated with fishing mortality based reference point indicates that there is almost an equal probability that the value of $F_{current} / \widetilde{F}_{MSY}$ is less than or greater than the reference point (Figs.Y9 and Y11). Therefore, the possibility of overfishing is still relatively high (47%).

40. Current exploitation rates are likely to be, at least, approaching the F_{MSY} level and any further increase in exploitation rates will not result in an increase in equilibrium yields from the stock under the current age specific pattern of exploitation (i.e. $\widetilde{Y}_{F_{current}}$ is approximately equal to *MSY)*. On that basis, the WCPO yellowfin tuna stock can be considered to be fully exploited. The assessment indicates that sustainable yields from the fishery could be increase considerably by a relatively small increase in average age of the catch.

41. The attribution of depletion to various fisheries or groups of fisheries indicates that the Indonesian and Philippines domestic fisheries have the greatest impact, particularly in their home region (Region 3) and is contributing significantly to the impact in adjacent Regions 1, 4 and 5 through fish movement. The purse-seine fishery also has a high impact in Regions 3 and 4 and accounts for a significant component of the recent impacts in all other regions, except Region 6. It is notable that the composite longline fishery is responsible for biomass depletion of about 10% in the WCPO during recent years and generally catches larger, older size classes.

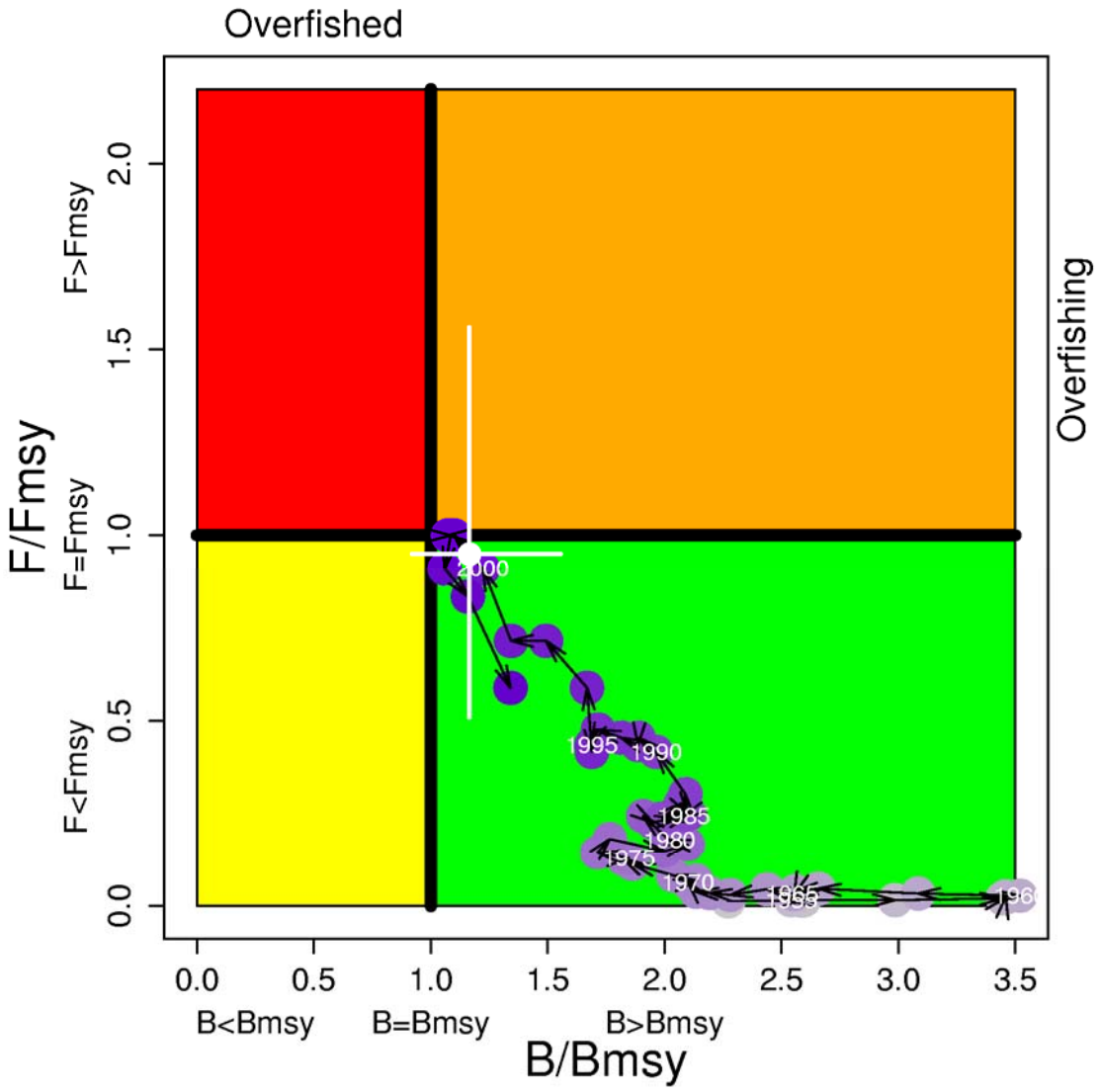

Figure Y9. Temporal trend in annual stock status, relative to B_{MSY} (x-axis) and F_{MSY} (y-axis) reference points, for the model period (1952–2006). The colour of the points is graduated from mauve (1952) to dark purple (2006) and the points are labelled at 5-year intervals. The white point represents the reference points computed for the "current" period (2002–2005) and the white lines represent the associated 95% confidence interval. (The color figure is attached at the end of the report.)

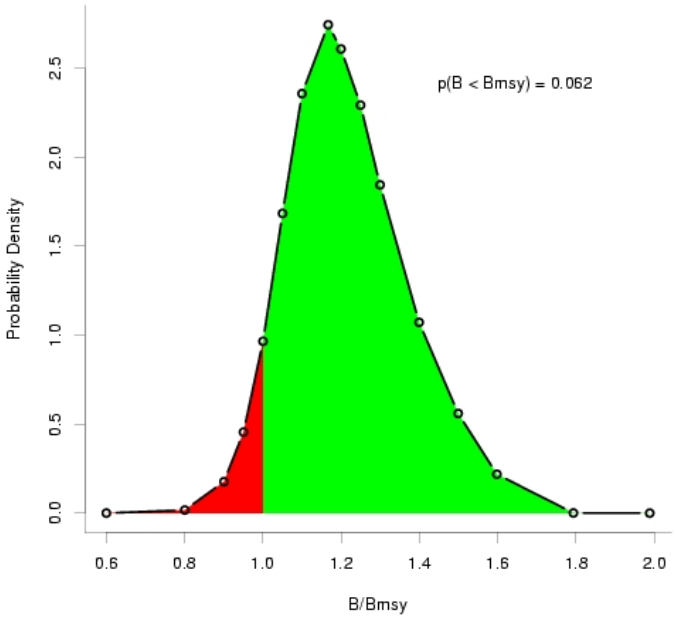

Figure Y10. Likelihood profile for $B_{current}/\widetilde{B}_{MSY}$ from the base-case model. The probability of $B_{current}/\widetilde{B}_{MSY}$ <1 (red region) is approximately 6.2%.

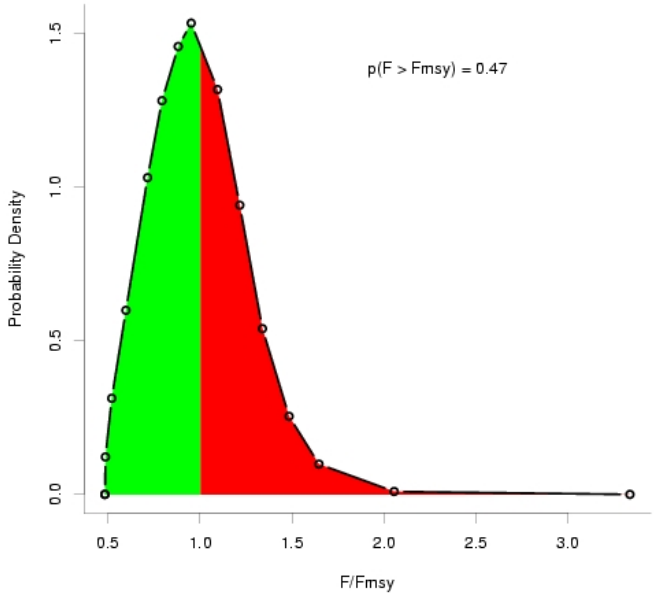

Figure Y11. Likelihood profile for $F_{current}/F_{MSY}$ from the base-case model. The probability of $F_{current}/F_{MSY}$ >1 (red region) is approximately 47%.

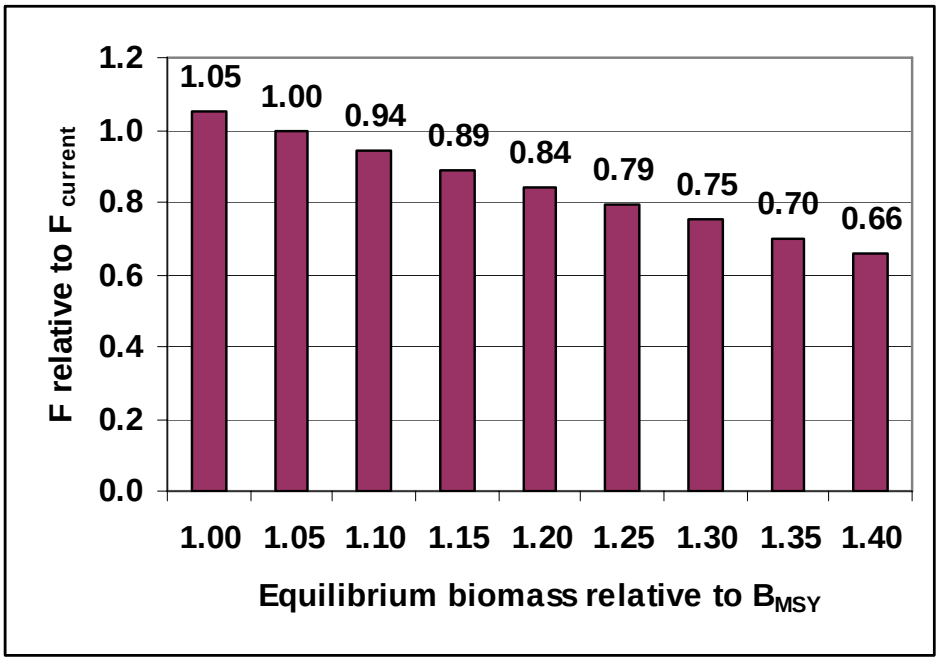

Figure Y12. Estimates of the equilibrium level of fishing mortality (relative to current levels) required to sustain biomass at the indicated levels (relative to B_{MSY}).

Table Y1. Estimates of reference points from the 2007 and 2006 yellowfin tuna stock assessments. The ranges shown in the table provide the minimum and maximum values of each reference point across the range of sensitivity scenarios considered within each assessment. However, as the range of scenarios considered within each assessment are not consistent across years, the ranges shown for each reference point should not be compared across years. They should not be considered as confidence intervals.

Management Quantity	2007 Assessment	2006 Assessment
Most Recent Catch	426,726 mt (2006[1])	445,109 (2005[2])
MSY	Base-case: 400,000 mt Range: 344,520 ~ 549,200 mt	Base-case: 329,680 mt Range: 329,680 ~ 330,040 mt
$\mathbf{Y_{Fcurrent}/MSY}$	Base-case: 1.0 Range: 0.88 ~ 1.0	Base-case: 1.0 Range: 1.0 ~ 1.0
$\mathbf{B_{current}/B_{current,\ F=0}}$	Base-case: 0.51 Range: 0.51 ~ 0.58	Base-case: 0.51 Range: 0.51 ~ 0.56
$\mathbf{F_{current}/F_{MSY}}$	Base-case: 0.95 Range: 0.56 ~ 1.0	Base-case: 1.11 Range: 1.0 ~ 1.11
$\mathbf{B_{current}/B_{MSY}}$	Base-case: 1.17 Range: 1.17 ~ 1.42	Base-case: 1.17 Range: 1.17 ~ 1.27

[1] Provisional; [2] Provisional in 2006 was 423,468 mt

Management recommendations

42. The point estimate of the $F_{current}/F_{MSY}$ ratio (0.95) in the 2007 assessment was lower than the point estimate (1.11) in the 2006 assessment. This change is largely due to the new configuration of the fisheries, their updated size data, and the modeling improvements. However, the possibility of overfishing is still relatively high (47%).

43. The WCPO yellowfin tuna fishery can be considered to be fully exploited. Both the 2006 and 2007 assessments indicate that there is a high probability that overfishing is occurring (73% for the base-case 2006 assessment and 47% for the base-case 2007 assessment). In order to reduce the likelihood of overfishing, and if the Commission wishes to maintain equilibrium average biomass at levels above B_{MSY}, reductions in the fishing mortality rate would be required.

44. The various levels of fishing mortality reduction required to maintain the biomass at specified levels above B_{MSY} (relative to the average levels for 2002–2005) are given in Figure Y13. As noted in 2006, fishing impacts in the western equatorial WCPO have been increasing over recent years and more urgent management actions may be required for this area.

45. Stock projections for 2007–2011 — which attempt to simulate the conservation and management measures adopted at WCPFC2 and WCPFC3 — indicate that the point estimate of $B_t / \widetilde{B}_{MSY}$ remains above 1.0 throughout the projection period. However, the increasing uncertainty in the future projections is likely to result in a greater probability of the biomass declining below $\widetilde{B}_{MSY}$ by the end of the projection period.

Summary of SC3-SA-WP-6

46. Adam Langley presented Working Paper SC3-SA-WP-6, "Analysis of yellowfin and bigeye catch and effort data from Japanese and Korean longline fleet collected from regional logsheet data collected from foreign fishing vessels operating within the equatorial region of the WCPO". The data are collected by the coastal states from vessels operating in their national waters, principally from the Chinese, Japanese and Taiwanese locally based fleets and the Japanese distant-water fleet operating in Micronesia, and the Korean distant-water fleet in the eastern equatorial WCPO. Trends in nominal and standardized yellowfin CPUE from the Micronesian fleets were similar among fleets and comparable to the standardized CPUE included in the yellowfin stock assessment. In contrast, there was considerable variation in the bigeye CPUE nominal and standardized trends among fleets, particularly in Micronesia, although longline CPUE trends from the Korean and Japanese distant-water fleets were comparable in the eastern WCPO.

47. The logsheet data from the Japanese distant-water fleet was analyzed in more detail to investigate trends in the operation of the fleet. The analysis revealed that since 1995 there has been an increased interdependence of fishing activity within a fishing trip and among trips. The analysis indicates that longline vessels are more successful at locating areas of higher bigeye catch rate and this is likely to result in hyperstability of the bigeye CPUE, and is likely to be introducing a positive bias in the CPUE indices for bigeye tuna.

48. Overall, the analysis highlighted the importance of the collection and provision to the Commission of fine-scale operational data from the longline fleet. These data augment the aggregated catch and effort data provided by distant-water fleets and provide the opportunity to understand the behavior of the fleets and, thereby, examine the utility of CPUE data as an index of relative abundance for tuna species.

Discussion

49. The SA-SWG noted that the analysis of operational data is a very informative new field of analysis, particularly given the importance of vessel behaviour. Caution was expressed that the spatial coverage of the analysis might not be representative of the larger WCPO longline fleet behavior.

50. Explanations for the cause of the change in fleet behavior were discussed. It was noted that the recent fuel cost rises occurred after the behavioral change, and that the timing seems to correspond with the introduction of improved satellite information.

51. The SA-SWG sought further elaboration on the effects of oceanographic variability on catch rates. The author noted that oceanographic variables are highly correlated such that the effects of individual factors are difficult to disentangle and mechanisms are only speculative. It was expected that the oceanographic effects are probably most relevant at a fine-scale (e.g. frontal systems), such that coarse scale averages might not be informative, and not show up as significant in typical GLM analyses. The interaction between gear configuration and local oceanography could also have an important effect. The author noted that many possible analyses were not explored, including gear saturation effects and the negative impact of gear competition among vessels.

52. Participants noted that skippers make a lot of decisions about where and when to set on the basis of observations obtained while steaming between fishing sites. These decisions are based on fine-scale observations that would not be captured in a 5x5 resolution CPUE analysis. These decisions are not recorded in logbooks, and efforts should be made to understand these processes. In some cases, areas of high target species density may not be fished to avoid bycatch issues.

Summary of SC3-SA-WP-5

53. Adam Langley made presented Working Paper SC3-SA-WP-5, "Influence of oceanographic variability on recruitment of yellowfin tuna *Thunnus albacares* in the western and central Pacific Ocean". Recruitment estimates for yellowfin tuna in the WCPO, derived from a stock assessment model, are highly variable seasonally, inter-annually and over decadal periods. A GLM was developed that predicts the variation in yellowfin recruitment in response to a range of oceanographic variables, computed from different areas and both spatial and temporal scales. The final model accounted for 68% of observed variation in quarterly recruitment for the period 1980–2003, with the inclusion of 10 different oceanographic variables derived from two zones within the equatorial region of the WCPO. The robustness of the recruitment model was investigated by cross-validation.

54. The model was then applied to hindcast recruitment for the period 1952–1979. Recruitment predictions from the GLM closely followed trends in recruitment estimates from the assessment model through most of this period. The long-term trend in predicted recruitment was largely driven by sea surface temperature in the northwestern area of the equatorial region. This work has direct application to stock assessment for yellowfin tuna in the WCPO. Principally, the GLM enables recent (last one to two years) recruitment to be estimated more precisely, thereby increasing the precision of estimates of current biomass and exploitation rates. Increased precision of the current age structure of the population also improves the accuracy of short-term (next one to two years) stock projections from the assessment model. In a broader context, the

recruitment model provides a tool to investigate how yellowfin recruitment may change in response to short- and long-term variation in the oceanographic conditions of the WCPO.

Discussion

55. Participants commented that these results are very interesting and very important. However, caution may be warranted given the history of estimated recruitment-environment relationships for other species, in which correlations observed with historical data have failed to predict future recruitments. Other concerns include the potential role of short- and long-term processes, such as regime shifts and seasonality, and their temporal autocorrelation in influencing these results. Nonetheless, it was noted that the successful cross-validation and prediction of recruitments before 1980 lend support to the method, as does its ability to predict anomalous recruitments, and the application of the technique to EPO yellowfin with similar success. Further validation work is warranted, as well as statistical analysis of potential effects of autocorrelation. Validation work might include randomly generating recruitment series and going through the same correlation process. This would be a simple test of how informative the recruitment series are.

56. It was noted that the areas for which the oceanographic data were found to be important are quite distant from the main juvenile areas in the Philippines, which suggests that the data from the selected areas are indicative of a broader environmental state. Recruitment may be continuous but oceanography in these areas indicates the size of the core area. These data may be indicators of expansion of the area of the warm pool.

57. It was noted that the relationship is also relevant to climate change. It is interesting in what it may say about the biological factors driving recruitment.

Summary of SC3-SA-WP-3

58. John Hampton presented Working Paper SA-WP-3, "Multi-fishery management options analyses for bigeye and yellowfin tuna". SC2 made recommendations for fishing mortality reductions for both bigeye (25%) and yellowfin tuna (10%), but did not make recommendations or provide information regarding how such recommendations might be implemented. Subsequent to SC2, the SPC-OFP undertook a range of analyses for the FFA Management Options Workshop, and used the same analytical approach to evaluate the four management scenarios presented in WCPFC3-2006-16 ("the closures paper"). The multi-fishery approach defines four fishery groupings: purse seine associated sets (FADs, logs), purse seine unassociated sets, longline, and domestic fisheries in Philippines/Indonesia. Relative effort for each category may be varied from baseline levels during a projection period (typically 5 or 10 years) and the resulting management quantities (F/F_{MSY}, B/B_{MSY}, MSY) and catches compared to those obtained from the baseline levels of effort. A large matrix of effort combinations (>3,000) has been evaluated and is available to members on request. The four scenarios presented in WCPFC3-2006-16 involved various spatial/temporal closures of the fishery groupings defined above. To evaluate these, we first had to estimate the levels of effort reduction implied, noting that the spatial resolution of the stock assessment models cannot directly reference fine-scale spatial measures (e.g. high-seas enclaves). Assumptions were also required regarding the spatial redistribution of effort and transfer of effort from associated to unassociated sets. The evaluations indicated that only scenario 4 of WCPFC3-2006-16 would meet F/F_{MSY} and B/B_{MSY} objectives. Further work is required to evaluate the multi-species impacts of management options.

Discussion

59. The Commission had called for further analyses to help inform it about available management options. Participants suggested that additional scenarios could be analyzed, such as scenarios of redistribution of fishing effort and movement of species. Total effort was suggested to be more important than effort distribution. MULTIFAN-CL (MFCL) can only consider movement at the regional level. SEAPODYM is resolved on a finer scale and may provide more highly resolved information.

60. The comment was made that the effects of management options are uncertain. For example, closing high seas areas will affect other areas due to the movement of fish and redistribution of fishing effort. It is difficult to predict fleet behavior but fleet behavior is very important. Preliminary work with SEPODYM, which is likely to be a useful tool in future to model fish movement at a finer scale than is possible with MFCL, suggests that the effects of closing high seas areas depend on whether fishing effort is redistributed and the extent of movement between areas. It suggests that if effort is redistributed, closing areas may have few benefits for target species. It was noted that the vessel day scheme would restrict the movement of fishing effort from high seas areas to EEZs.

61. The observation that the management options analyses do not explicitly include economic analyses or other social science was made. It was suggested that such analyses are needed, because they might help island nations to understand the implications of management scenarios, and additional management options such as increasing licensing fees. Such analyses should be conducted in parallel with other studies. This is relevant to the performance indicator aspects of management strategy evaluation, because different management strategies impact different areas, and different parties with interests in the fishery, in different ways.

BIGEYE TUNA STOCK ASSESSMENT

62. No stock assessment for bigeye tuna was undertaken in 2007. The latest stock assessment for bigeye tuna is presented in SC2-SA-WP-2.

SKIPJACK TUNA STOCK ASSESSMENT

63. No stock assessment for skipjack was undertaken in 2007. The latest stock assessment for skipjack tuna is presented in SC1-SA-WP-4.

SOUTH PACIFIC ALBACORE STOCK ASSESSMENT

64. No stock assessment for South Pacific albacore was undertaken in 2007. The latest stock assessment for South Pacific albacore is presented in SC1-SA-WP-3.

SOUTHWESTERN PACIFIC SWORDFISH STOCK ASSESSMENT

65. No stock assessment for southwest swordfish was undertaken in 2007. The latest stock assessment for southwest swordfish is presented in SC2-SA-WP-7.

SOUTHWESTERN PACIFIC STRIPED MARLIN STOCK ASSESSMENT

66. No stock assessment for striped marlin was undertaken in the southwestern Pacific Ocean in 2007. The latest stock assessment for striped marlin is presented in SC2-SA-WP-6.

RESPONSES TO COMMISSION REQUESTS

a) Refine stock assessment and scientific recommendations particularly for southwest Pacific swordfish, south Pacific albacore, yellowfin tuna and southwest Pacific striped marlin.

67. Work on a new stock assessment for South Pacific swordfish is in progress (see SC3-SA-IP-2). Specifically, there is a workshop planned in Noumea in April 2008 to progress the assessment. A request was raised to the EC to supply 2005 and 2006 swordfish data from the South Pacific, particularly as the catch rates are high and catches are significant.

68. Methods for improving the southern albacore assessment were investigated by ME-SWG WP-6 and reviewed by the ME-SWG, while the SA-SWG noted and encouraged a proposed study into the stock structure, and life history characteristics of the same species will feed into future albacore assessments, the next planned for 2008. Problems around the need for provision of timely data to feed into assessments was again noted and emphasized, in particular recent catches (2005 and 2006) of swordfish by EC vessels in the south Pacific.

69. Discussions noted that biological studies on striped marlin in the southwest Pacific are not due for completion until late 2008 and subsequently an assessment has been scheduled for 2009.

b) Mitigate the catches of small bigeye and yellowfin tunas caught by purse seine: "Review spatio-temporal aspects of such catches and refine analyses of potential management options that the Commission might adopt in order to reduce such catches."

70. Adam Langley presented the results of an analysis of recent catch and effort data from the industrial purse seiners operating in the equatorial WCPO (SC3-SA-WP-4). The objective of the analysis was to identify areas that have yielded a high catches of bigeye tuna, both in absolute terms and as a ratio of the catch of skipjack tuna and yellowfin tuna from unassociated sets. The analysis identified that high catches of bigeye tuna (in absolute and relative terms) were consistently taken within Papua New Guinea and Solomon Islands archipelagic waters — areas where purse-seine fishing effort is concentrated on anchored FADs. In addition, high catches of bigeye tuna have also been taken in the far eastern area of the equatorial WCPO in the last two quarters of the year. These catches have largely been taken from purse-seine fishing associated with drifting FADs, largely by vessels based in the eastern Pacific Ocean.

Discussion

71. Subsequent discussion noted a number of relevant issues. First, estimates of bigeye in purse-seine catches are generated from observer data, which are currently limited. It was suggested that more extensive port sampling could assist in increasing the information available for similar analyses in the future for some fleets. Concern was raised regarding the inability of such analyses (such as presented by SA WP-4) to investigate and account for catches of small bigeye tuna that are being taken in the Indonesian and Philippine fisheries, possibly limiting the utility of such analyses. It was also noted that while area closures should be investigated as

management measures, their effectiveness has been mixed. In some cases they have been effective, while in other situations their effectiveness has been shown to be limited due to effort transfer, changes in oceanographic conditions and shifts in the distribution of the stock. Concern was raised regarding the transfer of effort (by vessels not registered in the Commission) from the EPO into the eastern area of the WCPO, most likely as a result of IATTC area closures in the EPO in the third and fourth quarters.

72. It was also noted that if FAD-based controls aimed at reducing the catch of small bigeye and yellowfin tuna were to be attempted, the Commission would first require a better understanding of the type, structural and technological characteristics, location and frequency of FAD use across the Convention Area. Management options regarding gear characteristics (such as net depths and dimensions) should also be considered. It was also noted that phase 1 of the recent regional tagging programme focused on anchored FADs in the Bismarck Sea to allow investigation of the impacts of FADs on tuna stocks in PNG EEZ. The proposed phase 2 tagging project would be focussed more on drifting FADs and their impacts on tuna stocks generally in the WCPO.

c) Consider any need for more specific information on other commercial fisheries catching bigeye and yellowfin in formulating advice on specific management measures for those fisheries.

73. No information was presented that specifically addressed this request in the SA-SWG.

RESEARCH PLANNING

b) Short- and Medium-term Research Plan

74. Following consideration of the stock assessment papers presented to the SA-SWG, a number of suggestions were made in relation to future research priorities. The following areas of further research were suggested for incorporation in the research plan:

- Research to support improvements to the yellowfin tuna stock assessment, including:
  - Integrate environmental data on recruitment patterns into the stock assessment;
  - Further investigate the regional weighting factors, in particular more investigation into the standard deviation factors;
  - Determine appropriate sample sizes for length frequency sampling strategies; and
  - Further investigate length based selectivity.
- Inclusion of the proposed swordfish research plan.
- Research to address the known data/information gaps in the current stock assessment, particularly in relation to operational level CPUE data and CPUE standardization procedures. There is a need to ensure that operational level CPUE data is provided to the Commission by all CCMs.
- Further development work on the abundance indexes used in models.
- Development and reporting of stock indicators for those species not formally assessed.
- Develop procedures for interpreting stock assessment results.

b) Work programme for 2008–2010

75. Max Stocker provided a brief overview of the SC's draft work programme for monitoring and assessment of stocks, noting that the listed projects are ongoing. Other suggestions made by participants for inclusion in the work programme included:

- The comparative analyses of stock assessment software for South Pacific albacore was considered by the ME-SWG to be a very useful exercise for exploring the assumptions included in the model. It was suggested that this approach could be applied more broadly to all stock assessments for key species to improve the stock assessment process, even if simple alternative production models were also used as part of the stock assessment process;
- Stock assessment work on non-target species, particularly turtles and seabirds should continue to be encouraged; and
- The working group noted a suggestion that all research proposals should be prioritized by the SC to ensure high priority research is undertaken.

ADMINISRATIVE MATTERS

Terms of reference

76. No amendments to the existing terms of reference for the SA-SWG were suggested.

Election of co-conveners

77. Max Stocker (Co-convener) advised the working group that the term of both co-conveners of the SA-SWG will expire at the completion of SC3. Max Stocker stated that he would not be standing for a further term as Co-convener of the working group.

78. Max Stocker nominated the current Co-convener, Naozumi Miyabe to serve another term, while Naozumi Miyabe nominated Keith Bigelow as co-conveners of the SA-SWG. Berry Muller of the Marshall Islands was also nominated as a co-convener, but declined to accept the nomination. Participants accepted the nomination of Keith Bigelow and Naozumi Miyabe as the co-conveners of the SA-SWG for the next two years.

Other matters

79. No other matters were raised by the SA-SWG.

Attachment L, Appendix I

The Commission for the Conservation and Management of Highly Migratory Fish Stocks in the Western and Central Pacific Ocean

Scientific Committee
Third Regular Session

Honolulu, HI, USA
13–24 August 2007

AGENDA FOR THE STOCK ASSESSMENT SPECIALIST WORKING GROUP

1. Opening of meeting

2. Selection of rapporteurs

3. Adoption of agenda

4. Stock Assessment
   4.1. Bigeye and Yellowfin Assessments
   SA WP–6: Langley, A. *Analysis of yellowfin and bigeye catch and effort data from Japanese and Korean longline fleet collected from regional logsheets.* Oceanic Fisheries Program, Secretariat of the Pacific Community, Noumea, New Caledonia.
   SA WP–1: Langley, A.[1], J. Hampton[1], P. Kleiber [2], and S.Hoyle [1]. *Stock assessment of yellowfin tuna in the western and central Pacific Ocean, including an analysis of management options*. [1] Oceanic Fisheries Programme, Secretariat of the Pacific Community, Noumea, New Caledonia. [2] NOAA Fisheries, Honolulu, Hawaii.
   SA WP–5: Langley, A. [1], K. Briand [1], D. Kirby [1], and R. Murtugudde [2]. *Influence of oceanographic variability on recruitment of yellowfin tuna* Thunnus albacares *in the western and central Pacific Ocean (Abstract only).* [1] Oceanic Fisheries Programme, Secretariat of the Pacific Community, Noumea, New Caledonia. [2] Earth System Science Interdisciplinary Center, College Park, USA.
   SA WP–3: Langley, A. and J. Hampton. *Multi-fishery management options analyses for bigeye and yellowfin tuna*. Oceanic Fisheries Programme, Secretariat of the Pacific Community, Noumea, New Caledonia.

   Discussion and Conclusions

   Information Papers
   SA IP–1: Molony, B. *Trends in size composition of longline-caught albacore in the South Pacific*. Oceanic Fisheries Programme, Secretariat of the Pacific Community, Noumea, New Caledonia.

   SA IP–2: Kolody, D, [1], R. Campbell [1] and N. Davis [2]. *South-West Pacific swordfish stock assessment work-plan proposal for 2008c*. [1] CSIRO Marine and Atmospheric Research, Hobart, Australia, [2] NIWA Ruakaka, New Zealand.

SA IP–3: Reid, C., S. Sauni and L. Clark. *Economic and management implications of stock assessments on key tuna stocks in the WCPO*. Forum Fisheries Agency, PO Box 629, Honiara, Solomon Islands.

5. Responses to the Commission's requests

5.1. Refine stock assessment and scientific recommendations particularly for southwest Pacific swordfish, south Pacific albacore, yellowfin tuna and southwest Pacific striped marlin.

5.2. Mitigate the catches of small bigeye and yellowfin tunas caught by purse seine: "review spatio-temporal aspects of such catches and refine analyses of potential management options that the Commission might adopt in order to reduce such catches."

SA WP–4: Langley, A. [1] and S. Harley [2]. *Spatio-temporal patterns of purse seine catches of skipjack and juvenile bigeye and yellowfin tuna caught in association with floating objects*. [1] Oceanic Fisheries Programme, Secretariat of the Pacific Community, Noumea, New Caledonia. [2] Ministry of Fisheries, Wellington, New Zealand.

5.3. Consider any need for more specific information on other commercial fisheries catching bigeye and yellowfin in formulating advice on specific management measures for those fisheries.

Discussion and conclusions

6. Research planning

6.1. Short- and Medium-term Research Plan

6.2. Work programme for 2009–2010

7. Administrative matters

7.1. Terms of reference

7.2. Election of co-conveners

7.3 Other matters

8. Adoption of report

Attachment M

The Commission for the Conservation and Management of Highly Migratory Fish Stocks in the Western and Central Pacific Ocean

Scientific Committee
Third Regular Session

Honolulu, HI, USA
13–24 August 2007

INFORMAL SMALL GROUP SUMMARY ON JUVENILE BIGEYE AND YELLOWFIN TUNA (AGENDA ITEM 5.3 – JUVENILE BIGEYE AND YELLOWFIN TUNA[1])

SUMMARY OF INFORMAL SMALL GROUP MEETING

1. The Informal Small Group-3 addressing plenary Agenda Item 5.3 (Juvenile bigeye and yellowfin tuna) met from 12:30–13:50 on 16 August 2007. David Itano facilitated the meeting and led the discussion on summary document SC3-ISG-WP-2 (Small Tuna on Floating Objects). The ISG-3 was asked to:
   a) review any FAD-related, industry-associated research in relation to mitigating juvenile mortality of bigeye and yellowfin tuna;
   b) refine analyses of potential management options to reduce such catches; and
   c) review any outcome from industry-associated research (paragraph 7, CMM-2006-01);

2. The ISG-3 was also asked to prepare recommendations in support of the SCAgenda Item 5.3 on mitigation measures for small tuna catch with a focus on the use of FADs. These issues were discussed prior to the SC through email discussions with persons listed in Appendix I to SC3-ISG-WP-2.

3. Some members of the group objected to the terminology of "juvenile bigeye and yellowfin tuna", which implies some reference to actual maturity stage or reproductive status when in fact it is a general term that has been used to imply undesirably "small" tuna. The reality is that a large proportion of purse seine-caught yellowfin and longline-caught bigeye tuna are of an acceptable market size but are (technically) sexually immature.

4. It was clarified that the issue of concern refers to small tuna taken in association with floating objects. The meeting Convener suggested that this terminology and its acronym of STFO be adopted by the SC. Floating objects includes anchored FADs, drifting FADs, and all natural floating objects such as logs and natural flotsam as defined in SC3-FT-IP-4.

5. The issue refers to three categories of STFO to which the Scientific Committee and Standing Committee on Tuna and Billfish have recommended reductions in levels of fishing mortality due to concerns related to stock condition. These categories include:

[1] The SC agreed to adopt the terminology "small tuna on floating objects (STFO)" in place of "juvenile bigeye and yellowfin tuna" in subsequent discussions and documents.

a) **"undersize" tuna and tuna-like species** that have little or no current market value at purse-seine landing sites. These tuna often gill in the net or become crushed or damaged during the brailing operation and are often discarded. Discarding can occur during onboard sorting before loading to storage wells, during size and species sorting between wells or during the unloading process.

b) **"very small" tropical tuna** (skipjack, yellowfin and bigeye) and tuna-like species (*Euthynnus afinis, Auxis* spp.) that are landed in significant quantities in the Indonesia and Philippine surface fisheries (see Barbaran 2006). It should be noted that these fisheries concentrate their effort on anchored FADs.

c) **"all bigeye tuna"** in the WCPO and **"small yellowfin tuna"** taken by purse-seine and ringnet fisheries operating on floating objects.

6. The actual size of concern of "small yellowfin" was discussed. It was noted that discussions on restricting catches of "juvenile bigeye and yellowfin tuna" have been vague as to what size fish were actually being discussed, with some feeling that yellowfin and bigeye less than about 50 cm should be considered. The discussion Convener elected to use the term small tuna on floating objects (STFO) during the discussion and consider it for general use by the SC and SWGs.

7. It was suggested that an analysis should be carried out to determine what size of yellowfin tuna should be considered in discussions of reducing fishing mortality of STFO, incorporating such parameters as stock condition, recruitment indices, yield-per-recruit, and economic considerations.

8. In response, SPC-OFP noted that MFCL is based on catch-at-length data by fishery sector, thus can produce this sort of analysis easily (with the exception of economic considerations).

9. The SC3-ISG-3 examined and discussed possible mitigation measures for STFO. For reference purposes, an extensive matrix of potential output and input controls to mitigate STFO fishing mortality are attached to SC3-ISG-WP-2 (Small Tuna on Floating Objects).

10. It was noted that the ISG should not re-open debates on the relative merit of all STFO management options.

11. Instead, it was suggested that the Group should concentrate on reviews of industry-associated research relevant to STFO mitigation and propose recommendations for industry-associated research.

REVIEW OF INDUSTRY-ASSOCIATED RESEARCH

12. It was noted that very few research programmes that worked at sea in close collaboration with commercial fisheries to examine FAD-related and STFO issues have been conducted. Examples include:

a) The EC-funded FADIO[2] Program (Indian Ocean, chartered research vessel examining fish behavior in association with drifting FADs) (Dagorn et al. SC2-FT-WP-3).

b) Acoustic surveys on purse-seine supply vessels working with purse seiners (Miguel et al. SC2-FT-WP-8).

13. NOTE: These acoustic surveys lacked efficiency as they could not benefit from catch verification and fishermen's experience that would be available if work was conducted on a commercial purse seiner.

14. Studies that examined FAD-related influences on STFO catch and fishermen's knowledge of FAD associations include:

15. Lennert-Cody et al. (2007 and SC3-FT-IP-1) analyzed FAD-related parameters collected by IATTC purse seine observers in the EPO to examine their possible influence on bigeye catch, finding a positive relationship with bigeye catch and the depth of the "FAD appendage" that hangs vertically beneath a drifting FAD (DFAD).

16. These appendages are usually constructed of surplus purse-seine netting that is weighted to hang vertically beneath a drifting FAD. SC3-FT-IP-4 (A summary of operational, technical and fishery information on WCPO purse-seine fisheries operating on floating objects) describes FAD construction and the use of sub-surface structure in FAD construction. The Convener noted that sub-surface structure is so important to DFAD construction that some designs are completely submerged and have no surface float or raft at all to reduce potential pirating of DFADs by purse seiners.

17. NOTE: Studies of this type are possible only if adequate data is available suggesting that FAD-specific parameters should be collected by observer programmes.

18. Satoh et al. (SC3-FT-WP-4) described similar work conducted in the WCPO on the relationship between drifting FAD depth and catch rates of bigeye tuna. However, the work is very preliminary having recently begun with only a limited dataset examined to date.

19. Moreno et al. (SC3-FT-WP-5) was presented to FT-SWG. This paper describes a study that directly interviewed purse-seine captains to explore aggregative behavior of tuna and other fish to drifting FADs. However, means to reduce catches of STFO were not directly investigated.

15. NOTE: Studies of this type highlight the wealth of knowledge fishermen have on tuna behavior useful for targeting and bycatch avoidance that should be consulted.

16. Other papers noted that a relatively small number of purse seine vessels within a seemingly homogenous fleet captured disproportionately high percentages of bigeye tuna on floating object sets (Harley et al. 2004; Harley and Suter 2007 and SC3-FT-IP-2; Langley 2004).

17. NOTE: These studies suggest that some boats may be designing DFADs or employing FAD-associated fishing techniques that somehow increase bigeye catch.

[2] FADIO = fish aggregating devices as instrumented observatories of pelagic ecosystems). An EC-funded project on development of new observational instruments and the behavior of fish around drifting FADs.

18. Schaefer and Fuller (SC3-FT-WP-2) discuss the differences in swim bladder volume among skipjack, yellowfin and bigeye tuna that produce distinct and identifiable acoustic signatures on echo sounder and sonar equipment and other factors related to experience and verification with catch that allow purse seine captains to make reliable estimates of school size, species compositions and even size-specific estimates of tuna species prior to setting.

19. NOTE: This suggests that purse-seine fishermen could avoid bigeye tuna and STFO if provided with incentives or financial motivations to do so.

RECOMMENDATIONS ON INDUSTRY-RELATED RESEARCH ON STFO

SPECIALIST WORKING GROUP RESEARCH

1) An analysis to determine what size of yellowfin tuna should be considered in discussion of reducing fishing mortality of STFO incorporating such parameters as stock condition, recruitment indices, yield-per-recruit, and economic considerations.
2) A comparative study on relative rates of STFO and floating-object associated fauna between:
   - floating objects in the eastern vs. western regions of the WCPO;
   - analysis of the relative rates of STFO (especially bigeye) between drifting FADs and anchored FADs; and
   - relative rates of STFO taken in archipelagic areas close to large island environments vs. catch rates offshore or in high seas areas.
3) A detailed analysis of skipjack, yellowfin and bigeye catch on floating object sets by time of day.
4) An examination of vessel specific bigeye quotas with vessel owners as a means to reduce bigeye catch and improve targeting by purse-seine fisheries.

INDUSTRY-ASSOCIATED RESEARCH

1) Survey of purse-seine operators as to their accuracy in estimating set size, species composition and fish size prior to setting.
2) Designed acoustic studies onboard commercial purse-seine vessels engaged in commercial fishing operations to document the accuracy of set size, species composition and fish size prior to setting.

Note: this would test the feasibility of vessel or fleet-specific STFO quotas as a management option.

3) The use of net depth recorders or other depth recording devices in conjunction with ADCP or Doppler current meters and set details to characterize actual pursing depth of WCPO purse-seine gear in different areas and conditions.
4) Closer collaboration and communication between the SC and the tuna industry to seek new ideas and workable solutions to reducing the take of STFO, particularly on drifting and anchored FADs.

Note: designed personal interviews and surveys as conducted by Moreno et al (2007) should be conducted in the WCPO.

SUMMARY STATEMENT

The largest constraint of scientists working with commercial vessels was recognized as the prohibitive charter costs and potential loss of revenue by commercially operating fleets. Some means to offset vessel time while providing cooperating vessels with an incentive to participate will need to be developed. Structured scientific cruises working in close proximity to commercial fleets are desirable but extremely expensive.

The main point is that scientific research cruises attempt to emulate commercial conditions but are not able to better utilize the accumulated experience and knowledge of commercial fishermen who are undeniably the experts on acoustic recognition, school assessment and tuna behavior. Closer collaboration and communication with the tuna industry should be fostered by the SC and the Commission in order to seek practical and incentive based mechanisms to reduce fishing mortality on small tuna taken in WCPO surface fisheries.

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Attachment N

The Commission for the Conservation and Management of Highly Migratory Fish Stocks in the Western and Central Pacific Ocean

Scientific Committee
Third Regular Session

Honolulu, HI, USA
13–24 August 2007

INFORMAL SMALL GROUP SUMMARY ON THE REVIEW OF EFFECTIVE STRATEGIES TO REDUCE SEA TURTLE INTERACTIONS IN FISHERIES WHILE MAINTAINING VIABLE TARGET SPECIES CATCH RATES

SC2 and TCC2 reviewed research trials and measures relating to the use of circle hooks and other methods to reduce sea turtle bycatch in fisheries, and considered strategies to support research and promote efforts to implement mitigation measures. WCPFC3 requested the Scientific Committee (SC) to review mitigation measures that, when applied, can substantially reduce sea turtle interactions in fisheries covered by the Convention while maintaining viable target species catch rates. The effective methods for purse-seine fishing remain as described in Resolution 2005-04. The following tabulation presents bycatch reduction or mortality reduction strategies in relation to the types of longline fisheries in which they could be effective while allowing target species catch rates to be maintained. The scientific basis for the effectiveness of these methods comes from working papers that have been presented to the SC at this and previous meetings, and has been summarized in the background section, below.

Observer programmes, where they exist, indicate considerable variation in turtle bycatch rates depending on the style and target species of fishing, season, and area of fishing. And the maintenance of target species catches is also variable among fisheries. One method would clearly maintain target catch in all fisheries and is likely to contribute to the post-release survival of turtles (Column A). Other effective methods are suggested in Column B. Because turtles are highly migratory, measures to address turtle bycatch should be considered within the entire WCPFC Convention Area. In view of the variety of longline fisheries within the Convention Area, and the distribution of sea turtles and potential interaction hotspots, the application of mitigation measures must be flexible, although there were reservations on this statement by Japan.

A: All longline fisheries	B: Optional methods for longline fishing
• Carry and use dipnets (where appropriate), line cutters and dehookers to handle and release sea turtles using guidelines to be established by WCPFC	For shallow-set fisheries (majority of hooks <100 m) targeting swordfish, with possible bycatch of loggerhead or leatherback turtles: • Use large circle hooks[1] • Use fish bait as a replacement for traditional use of squid bait For other fishery sectors than that described above (if applicable): • Replace non-circle hooks with circle hooks that are at least as wide (minimum width) as those replaced • Replace non-circle hooks with hooks (any style) that are at least 20% wider (minimum width) • Use only fish for bait • Eliminate the shallowest-set hooks (i.e. <100 m) in deep-set fishing • Replace the shallowest set hooks (i.e. <100 m) with circle hooks

Discussion was not completed on the items in Column B due to reservations by Japan and will continue at further meetings of the WCPFC and its committees.

For any particular type of longline fishery, at least one Column B option should be able to maintain target catch, given appropriate adjustment and application in a particular fishery sector. In fisheries where peer-reviewed turtle bycatch estimates indicate a negligible rate of interaction with sea turtles, modification of fishing operations might not substantially benefit sea turtle population status. A scientific basis for establishing a negligible rate could require unavailable information on population impacts. Very low rates of turtle bycatch, including any rate >0, could result in substantial population impacts when the scale of fishing is very large. In the immediate term, defining a negligible of interaction might have to be a policy decision, since a scientific determination could be impossible.

Background on the tabulated methods for reducing turtle bycatch in longline fisheries

- There are available proven methods for reducing sea turtle bycatch and mortality without reducing target species catch in certain types of longline fisheries targeting certain species. CCMs should be able to adopt some effective strategies for reducing turtle bycatch based on available information.

- The proper use of line cutters, dehookers, and dip nets to release sea turtles from longline gear has been shown to considerably reduce the amount of gear remaining on released turtles, which should increase post-release survival. Assisting Pacific Island countries in conducting fisher training in the use of these methods, and wide distribution of training materials a variety of languages, also has the potential to improve the condition of turtles released from longline gear.

[1] For all methods, hooks should not have points offset any greater than 10 degrees. Review has shown that greater offsets can have negative effects in increasing the frequency of deep hooking as opposed to mouth hooking.

- Experiments to date have all shown that circle hooks of all sizes reduce the percentage of sea turtles swallowing hooks, which may improve post-release survival. Removing hooks located externally or in the mouth of sea turtles has been found to be easier than removing swallowed hooks, which should improve post-release survival.

- To date, fisheries with the highest documented rates of sea turtle bycatch have all been relatively shallow-set fisheries (e.g. fisheries that set <10 branchlines between floats).

- To identify and manage fishery sectors, fishing areas, and seasons with the greatest potential for sea turtle bycatch reduction, it will be necessary for CCMs to: 1) conduct fishery monitoring to identify these fishery sectors, areas and seasons, and 2) conduct analyses to define and be able to apply bycatch reduction measures appropriately in such sectors, areas or seasons.

- Although fishing depth, hook type, hook size, target species size, turtle size, and bait type all appear to influence the effectiveness of strategies for substantially reducing sea turtle bycatch, and the maintenance of target catch, the evolving record of research results suggests some generalities regarding these strategies as applied to various types of longline fishing.

    - Using a larger hook than the traditional hook size, independent of hook type, appears to substantially reduce the numbers of sea turtles that that ingest hooks.

    - Hook comparison experiments that have shown reduced target species catch rates, particularly for relatively smaller target species such as mahimahi (*Coryphaena hippurus*) and albacore (*Thunnus alalunga*) have usually involved testing of hooks with a considerably larger minimum width than traditionally used hooks.

    - In fisheries where the size of sea turtles caught (e.g. loggerheads, Caretta caretta, or leatherbacks, Dermochelys coriacea) and the target catch (e.g. swordfish, Xiphius gladius) are relatively large, it has been repeatedly shown (US New England and Hawaii-based fisheries, Brazil fishery) that replacing smaller J hooks with large (size 18/0 or equivalent) circle hooks can substantially reduce sea turtle bycatch (including predominantly entangled turtle bycatch such as leatherbacks) while maintaining economically viable target species catch rates.

    - The use of fish for bait instead of squid bait, independent of hook type, has repeatedly been shown to substantially reduce turtle sea turtle bycatch (US fishery, Spanish Mediterranean fishery, Indian Ocean fishery, and other studies). The maintenance of viable swordfish catch rates on circle hooks can be assisted by also switching from squid bait to fish bait, and this switch also enhances turtle bycatch reduction.

    - In fisheries where the traditional hook size, target species (e.g. mahimahi in Latin America, swordfish in the Mediterranean), and sea turtle bycatch (e.g. olive ridley, Lepidochelys olivacae, and loggerheads, respectively) are relatively smaller, studies have indicated that replacing traditional hooks with medium size (e.g. size 16/0) circle hooks substantially reduces turtle bycatch while maintaining target catch rates.

    - Where effective monitoring has been conducted, deep-set fisheries predominantly targeting tuna have been found to have an order of magnitude lower catch rates for sea turtles than shallow set fisheries targeting swordfish or mahimahi. Allowing only deep-

set fishing in particular areas or seasons can be an effective method of substantially reducing turtle bycatch. However, deep-set fishing also results in a much greater frequency of immediate capture mortality than in shallow-set fishing, in which the great majority of turtles can be released alive.

- Circle hook testing in tuna-targeted fisheries has usually shown that target species catch rates are maintained (Latin America, Hawaii) and even testing of large (≥size 18/0) circle hooks in comparison with much narrower tuna hooks has shown that catch rates for bigeye tuna are maintained or improved (Hawaii). These studies usually involve too few turtles to draw statistically significant conclusions regarding bycatch reduction. However studies in other fisheries have shown the benefits of these hooks for sea turtles.

- Testing of tuna longline fishing while eliminating all hooks shallower than 100 m compared with traditional tuna fishing has shown that catch rates for bigeye tuna are maintained or improved (Hawaii) when the hooks are all deeper than 100 m. This study involved too few turtles to draw statistically significant conclusions regarding bycatch reduction.

Re-emphasized information needs

- The WCPFC data longline data reporting requirement for data to be segregated by the number of hooks between floats (HBF) is critically important for identifying fisheries sectors with a greater likelihood of more frequent interactions with sea turtles (e.g. fisheries sectors with <10 HBF).

- Emphasis should be placed that the outcomes of the work of the IWGROP will need to ensure that sufficient spatial and temporal coverage is provided to adequately characterize what may be statistically rare events (i.e. sea turtle interactions), and that observer deployments are optimized to provide acceptable levels of uncertainty.

- Research related to developing robust estimations of WCPO sea turtle populations, including nesting and tagging studies, should be continued and expanded where appropriate by CCMs. Shore-based anthropogenic sources of mortality should be documented and evaluated in terms of their impact on populations.

Attachment O

The Commission for the Conservation and Management of Highly Migratory Fish Stocks in the Western and Central Pacific Ocean

Scientific Committee
Third Regular Session

Honolulu, HI, USA
13–24 August 2007

DRAFT WORK PROGRAMME OF THE SCIENTIFIC COMMITTEE FOR 2008–2010

The Convenors of the SWGs met to consider the size of the indicative research budget for 2009 and 2010. Consideration was given to the scope of the work programme adopted by the Scientific Committee (SC), which itemizes 59 substantive research projects, and the commensurate management issues for which scientific advice is required. Taking account of these issues, the Convenors therefore recommended that the 2008 budget be seen as a minimum budget level to fund research in the WCPO. They recommended that the Commission give consideration to significantly increasing this budget over future years.

The SWG Convenors request that the SC give consideration to also endorsing this recommendation.

DRAFT WORK PROGRAMME OF THE SCIENTIFIC COMMITTEE FOR 2008-2010

(Budget in USD)

Strategic research activity or project with priority identified at SC3		2008		2009		2010	
		Core	Other	Core	Other	Core	Other
1. Collection, compilation and verification of data from the fishery							
SPC-OFP Services	**Project 1. (Priority = High)** **Incorporate data provided by Members, Cooperating Non-Members and Participating Territories (CCMs) under the Commission's data provision policy into existing databases and facilitate access of Commission secretariat staff to those data as appropriate.**						**Ongoing**
SPC-OFP Services	**Project 2. (Priority = High)** **Compile estimates of annual catches by species, gear type and flag, as specified in the procedures for scientific data to be provided to the Commission.**						**Ongoing**
SPC-OFP Services	**Project 3. (Priority = High)** **For catches for which estimates are not otherwise available, conduct statistical analyses to estimate catches, particularly in regard to (a) purse-seine catches of bigeye tuna and yellowfin tuna, (b) discards of target tuna species, and (c) catches of non-target species.** • Includes estimating seabird interaction, bycatch and mortality as requested by CMM-2006-02: EB-SWG Priority						**Ongoing**
SPC-OFP Services	**Project 4. (Priority = Medium)** **Produce and publish on the Commission's website two issues of the Regional Tuna Bulletin, containing estimates of monthly catch rates for WCPO fleets, based on the most recent data available.**						**Ongoing**
SPC-OFP Services	**Project 5. (Priority = Medium)** **Produce and publish on the Commission's website the Tuna Fishery Yearbook 2006, containing annual catch estimates by gear type, flag and species.**						**Ongoing**
SPC-OFP Services	**Project 6. (Priority = High)** **Compile estimates of catch and effort in support of the functions of the Commission and its subsidiary bodies, such as (a) estimates of annual catches by vessel flag, EEZ, and archipelagic waters, for use in determining the catch component of the Commission's assessed contributions, and (b) estimates of catch and effort in support of Conservation and Management Measures.**						**Ongoing**

SPC-OFP Services	**Project 7. (Priority = High)** **Disseminate public domain catch, effort and size data on the Commission's website at agreed level of resolution.**	**Ongoing**
SPC-OFP Services	**Project 8. (Priority = High)** **Participate in the Indonesia and Philippines Data Collection Project (Projects 15 and 16) and the compilation of information on the tuna fisheries of Vietnam.**	**Ongoing**
SPC-OFP Services	**Project 9. (Priority = Medium)** **Develop data standards for port sampling and observer programmes in association with WCPFC Secretariat** • Subject to the progress of the observer programme, and requires on-going periodic monitoring. • This may be handled by the WCPFC Secretariat (rather than by SPC).	**Ongoing**
SPC-OFP Services	**Project 10. (Priority = High)** **Advise the Executive Director regarding the development of (a) Rules and Procedures for the Access to and Dissemination of Data and (b) the Information Security Policy.** • Will require ongoing periodic monitoring as the information and data management policies and procedures of the Commission evolve. • This has been in each annual work plan for many years. There has not been much year-to-year progress. It would be better to engage in this process only periodically (e.g. once every three years). Also need legal advice beyond the expertise of SPC.	**As required**
SPC-OFP Services	**Project 11. (Priority = High) - NEW** **Identify known data / information gaps in the current stock assessment, particularly in relation to operational level CPUE data.** • The ST-SWG noted that the timely provision of data was a very important issue for the work of the SC, and in particular for the stock assessments. A number of potential explanations for different data gaps were identified, including the time and resources required to access and collate historical records, the long voyage times for some distant-water longline fleets and the large and dispersed nature of small boat fleets in Indonesia and the Philippines. A number of members cited specific issues with the summary of data gaps presented in the paper and SPC-OFP undertook to revise the information accordingly in consultation with the relevant members.	**2008 and updated annually**

SPC-OFP Services	**Project 12. (Priority = High) - NEW** **Within the next 12 months deploy on the WCPFC website a prototype computer program that would allow data gaps to be easily identified.** • ST-SWG priority: To be undertaken in 2008 jointly with WCPFC Secretariat						**2008**
SPC-OFP Services	**Project 13. (Priority = High) - NEW** **Review current unloadings data forms used in the region, and the proposed WCPFC transshipment reporting form, to determine their adequacy for scientific purposes.** • ST-SWG priority						**2008**
Project 14. (Priority = High) **Indonesia and Philippines Data Collection Project (IPDCP)**		**115,000**		**115,000**		**115,000**	
Indonesia • An outline of a full project proposal for the IPDCP 2008-2010 in Indonesia was reviewed by the Steering Committee on the IPDCP and briefed at the SC3. USD61,000 is proposed for each year for 2008-2010 to be funded from the General Account Fund. • A preliminary research was commenced in June 2007 with a support of USD 30,000 from the Commission. Its progress report was provided at the 4th Steering Committee. Philippines • The Philippines has successfully finished two-year IPDCP in the country. It focused on the establishment of data collection system. The Commission considered the importance of the continuity of data collection in Philippines and supported Philippines basic funds to run the established system. A proposal and budget level for this continuity was submitted to the Steering Committee on IPDCP and the estimated budget agreed for each year of the period 2008-2010 was USD54,000.							
Project 15. (Priority = High) **Rescue of historical commercial catch data from countries in the western Pacific Ocean**		**15,000**		**15,000**		**15,000**	
• This research was identified as the highest priority to minimize data gaps in stock assessments.							
Project 16. (Priority = Medium) **Publication and distribution of Commission's training and educational materials.**		**7,500**		**7,500**		**7,500**	

• SWG conveners may recommend items to be published and distributed for the Commission's work. For example, during 2007 additional guides were developed by the FT-SWG on longline and purse seine bycatch species. Funding support to provide colour reprints of these guides as well as tuna guides in languages deemed useful for Commission objectives. • Includes development of training materials and the production of material to facilitate the identification of target and non-target species by fishermen, observers, and port samplers with the objective of improving data quality.						
Project 17. (Priority = High) – NEW **Draft list of minimum data fields for the regional observer programme be annotated with explanations of what each field is and why it is needed and detail describing the format (units of measure, codes etc) to be used when collecting each field.**						
• ST-SWG priority: To be undertaken by WCPFC Secretariat during 2008.						
Project 18. (Priority = High) - NEW **Determine appropriate sample sizes for length frequency sampling strategies.**						
• SA-SWG priority, relates to all target species but SA-SWG work programme for 2008 identified yellowfin tuna as priority species.						
Project 19. (Priority = High) - NEW **Identification and description of operational characteristics of the major WCPO fleets and identification of important technical parameters for data collection.**						
• FT-SWG priority. • Includes characterization of operational features at both vessel and set/operational levels useful for effort standardization and the evaluation of fishing efficiency, targeting and bycatch mitigation. • Includes use of simple proxies and other means as tangible indicators of increasing fishing power (i.e. individual or fleet landings per annum, and/or estimates of the number of FADs deployed each year). • Includes monitoring of operational features related to depths fished by longline hooks and depths of purse-seine nets. • Includes monitoring and reporting on new developments in fishing gear and practices, fishing modes and related shore side developments as they relate to changes in fishing power.						

Includes • Supply TDRs and hook timers to regional observer programmes undertaken by SPC-OFP.						
Project 20. (Priority = Low) - NEW **Examine and review the technical aspects of capacity measurement and monitoring of fisheries within the WCPFC-CA.**						
• Ongoing FT-SWG priority; will seek input at no additional cost to the Commission. • This project may be undertaken by the TCC, but the FT-SWG terms of reference were modified in 2006 to accommodate capacity work.						
Project 21. (Priority = Low) - NEW **Investigate and promote studies on socio-economic influences on fishing strategies, spatio-temporal fishing patterns and influences on effective fishing effort.**						
• Ongoing FT-SWG priority; will seek input at no additional cost to the Commission.						
2. Monitoring and Assessment of Stocks						
2a. Stock assessment and modeling						
Assessment of stock status						
SPC-OFP Services	**Project 22. (Priority = High)** **Undertake stock assessment for target and non-target species as requested by the Commission.** Includes: • Undertake full stock assessment for target and non-target species as requested by the Commission (bigeye, SP albacore and skipjack in 2008). Includes: • Refinement of data and data structure used for stock assessment • Quantification of changes in fishing efficiency due to changes in fishing gears and fish finding technologies – Medium Priority. (Used to model changes in selectivity over time required in MFCL assessment models - Cross-reference with Project 27 for non-OFP project work.) • Quantification of changes in longline selectivity due to changes in gears and patterns of deployment – Medium Priority. (Used to model changes in selectivity over time required in MFCL assessment models. SPC-OFP services as time allows.)					**Ongoing**

SPC-OFP Services	**Project 23. (Priority = High)** **Undertake standardisation of longline catch and effort data, including where appropriate operational-level data, and the construction of indices of stock abundance for species of interest to the Commission.** • There are many issues to explore relating to CPUE standardization. Need to develop a specific work programme on this with funding support.	**Ongoing**
SPC-OFP Services	**Project 24. Priority = Medium)** **Development and reporting of stock indicators for those key species not formally assessed.** • SA-SWG priority; required to assist formulate most-up-to-date management advice to Commission if full assessment not undertaken.	**Ongoing**
SPC-OFP Services	**Project 25. (Priority = High)** **Continued exploration of sensitivity of stock assessment outcomes to structural assumptions in models and data issues, including the comparison of various stock assessment models.** • As ME-SWG priority, this work also includes the development of better diagnostics to more objectively determine plausible model structure. • Work programme for 2008 includes a comparison of MFCL, SS2 and other stock assessment models for yellowfin or bigeye tuna. • This will be more routinely incorporated into the assessments if it is felt to be informative.	**Ongoing**

Project 26. (Priority = High) - NEW **Revised Stock assessment on southern swordfish**	**7,500**	**110,000**				

- CMM 2006-03 states that "The Commission will review this measure in 2008 on the basis of advice from the scientific committee following their consideration of an updated swordfish stock assessment…" and so this became a SA-SWG priority.
- This species is not one of the principal target species assessed by the SPC-OFP but is an important target species for a number of CCMs. Australian and New Zealand scientists are proposing to undertake this work but are seeking some funds from the Commission as the research is directly addressing a request from the Commission and will have broader regional benefits. Funding from the Commission would also help secure funds from funding sources from Australia and New Zealand.

Project 27. (Priority = Medium) - NEW **Investigation and quantification of changes in catchability of target and non-target species, including**						

bycatch and incidental species, over time not included in the CPUE standardization.							
• SA-SWG priority (cross-reference Project 23). • Many factors not reported on logbooks influence catchability. The comparison of catch rates obtained by individual research projects where details of gear and fishing practices have been extensively documented may allow changes in catchability to be investigated and possibly quantified. • Process needs to be made clear and transparent.							
Project 28. (Priority = Medium) - NEW **Development of procedures and decision rules to assist the interpretation of stock assessment results and the formulation of management recommendations.**							
• SA-SWG priority. The Scientific Committee participants should prepare ideas for discussion at SC4.							
Model development and refinement							
SPC-OFP Services	**Project 29. (Priority = High)** **Further refinement of the stock assessment model, MULTIFAN-CL, including simulation testing of new developments as appropriate and refinement of models for CPUE standardization.** • ME-SWG and SA-SWG priority. • Work programme for 2008 includes designing a more efficient recruitment parameterization (high priority) and incorporation of length-based selectivity (medium priority). • There are a number of other matters that need to be addressed, including a long-term project to re-write the software to make it more transparent, better documented, and include new features (multi-sex, species, and stock options).						**Ongoing**
SPC-OFP Services	**Project 30. (Priority = Medium)** **Development of recruitment indices independent of the MFCL model, including the investigation of recruitment and oceanographic trends.** • SA-SWG and ME-SWG priority. • Required to index recruitment in stock assessment models. Major advances made in 2007 need to be followed up and formally incorporated into assessments. •						**Ongoing**

Project 31. (Priority = High) - NEW **Improve existing, and explore alternative, models for standardization of effort and the construction of indices of stock abundance.**						
• SA-SWG and ME-SWG priority. • Includes tasks identified by the ME-SWG at the Scientific Committee – the continued identification of factors which influence CPUE, understanding and quantification of the changes in catchability over time not included in the CPUE standardization models, and identification of alternative catchability trends for inclusion in stock assessment models, and the calculation of regional weighting factors.						
Project 32. (Priority = Medium) - NEW **Further consideration of how to reflect uncertainty in projections.**						
• ME-SWG Priority.						
Project 33. (Priority = Medium) - NEW **Development of new stock assessment models and associated software.**						
• ME-SWG Priority.						
Evaluation of management options as requested by the Commission						
SPC-OFP Services	**Project 34. (Priority = High)** **Further review of spatio-temporal aspects of catches of juvenile bigeye and yellowfin tuna caught in association with fish aggregating devices (FADs) by updating the analysis presented in WCPFC 3-2006-16. Refine the assessment of management options presented in the paper on the basis of the latest available fishery information.** • Research items to be considered over the three-year planning horizon: 1) With new SKJ and BET assessments and YFT 2007 assessment, conduct multi-species management options analyses, including economic outcomes of options on each sector. 2) PS fishery characterization – as a first step in developing an operational model of the fishery and more formal management strategy evaluation (MSE) work. 3) More spatial analysis – perhaps adopting the statistical approach of estimating lat/long/season effects on associated set (small juvenile) YFT and BET catches.					**Ongoing**

2b. Biological Studies						
Project 35. (Priority = High) **Refinement of bigeye parameters Pacific-wide: A comprehensive review and study of bigeye tuna reproductive biology.**	**15,000**		**30,000**	**170,000**	**30,000**	**170,000**

Objectives

- To obtain accurate scientific information on maturity, spawning locations, sex ratios, and fecundity for inclusion in stock assessments of bigeye (including yellowfin and albacore) tuna in the Pacific Ocean.

Items to be considered as a joint research between IATTC and WCPFC

- Based on tagging studies to date, the movements of bigeye are geographically restricted. The limited amount of mixing across the Pacific Ocean can create differences in life history characteristics as a function of differences in oceanography and genetic structure. Therefore, obtaining size and age based estimates of bigeye reproductive characteristics from spatial strata across the Pacific Ocean would be useful for inclusion in bigeye stock assessments, since current estimates are based on inadequate spatial strata and limited sample sizes to have much confidence for inclusion in Pacific-wide assessments.

Funding

- The level of required budget may depend on the scope and duration of such biological researches in a joint proposal. The anticipated duration for bigeye biological study is 3 years with a rough amount of USD 400,000.
- Budget can be shared with IATTC, a preliminary study for feasibility in 2008 (USD 15,000) and two-year project $200,000 each year for 2009 and 2010. Any specific research and analysis requested by the Commission will be supported by the Commission's core budget.
- In addition, obtaining adequate numbers of bigeye samples may require a collaborative sampling effort by scientists from China, Japan, Korea, and Taiwan from their nation's commercial and research long-line vessels.

Notes

- It is important to address some of the outstanding issues related to the biological parameters for bigeye, but we also need to ensure work is done on other species for which much less data are available. Hopefully, the priority species will identify themselves through the Ecological Risk Assessment process. In the WCPO, we have a range of similar or even more critical issues related to yellowfin and albacore tuna.
- Though this is a high priority project, there appears to be no expectations of SPC-OFP support here.

Project 36. (Priority = High) **Age and growth of the target tuna species.**						
• An initial project within this category is regional differences in growth from length–frequency data for YFT and BET. • This has strong assessment implications. • Budget level: USD150,000 over two years (SPC proposal).						
Project 37. (Priority = High) **Analysis of FAD impacts on trophic dynamics.**						
• This work is required for a better understanding of the biological impacts of FADs. • Budget level: USD70,000 over two years (SPC and University of Hawaii proposal).						
Project 38. (Priority = Low) **Feasibility study to determine the effectiveness of otolith microchemistry to estimate stock mixing and large-scale tuna movement.**						
• Recent advances in extraction of microchemistry samples from fish otoliths provide the potential for observing regional water chemistry differentiation in the otoliths of pelagic species – hence a natural tag for estimating stock mixing and large-scale tuna movement. • The feasibility of this requires investigation. • Budget level**:** USD60,000K over one year (SPC and University of Hawaii proposal).						
Project 39. (Priority = High) - NEW **Regional study of the stock structure and life-history characteristics of South Pacific albacore.**	**25,000**	**190,000**	**25,000**	**190,000**	**25,000**	**190,000**
• This project was identified as a BI-SWG priority and a proposal to undertake this work is being developed by Australia and conjunction with New Zealand, SPC-OFP and other CCMs (e.g. New Caledonia, French Polynesia, FFA countries). It may directly addresses stock assessment needs for one of the principal target species in the WCPO and will be of direct benefits to a range of CCMs. • Funding from the Commission would also help secure funds from funding sources from Australia and New Zealand. A better description of the work and justification for the funding requested from WCPFC will be available during the WCPFC4, if necessary.						

Project 40. (Priority = Medium) - NEW **Life-history characteristics of non-target species identified by the ERA as high risk.**		**30,000**				
• BI-SWG Priority. • Ongoing (Scholarships for tertiary study).						
Project 41. (Priority = Medium) - NEW **Development of a biological database for inclusion on the WCPFC website.**						
• BI-SWG Priority.						
2c. Tagging studies						
Project 42. (Priority = High) **Pacific-wide tagging project.**	**10,000**		**10,000**	**2,500,000**	**10,000**	**2,500,000**

Objectives: The main objectives of these tuna tagging experiments are to obtain information on movement, stock structure, growth, mortality, behaviour, habitat utilization, and vulnerability for use in stock assessments for yellowfin, bigeye and skipjack tuna.

Progress of Pacific-wide tagging project (Joint tagging between IATTC and WCPFC)

- Phase-1 tagging project was done in PNG waters. A Phase-2 tagging project was proposed at SC3.
- IATTC are holding a tagging workshop in October 2007.

Level of budget and funding

- Funding is a limiting factor for Pacific Ocean tuna tagging experiments and should be sought from a broad range of sources, including member and non-member countries with substantial financial interests in these fisheries, GEF, and non-governmental organizations, particularly foundations interested in supporting scientifically based tuna conservation efforts.
- The budget required for a 2 year pan-Pacific tagging project would need at least USD 9 million to do a wide coverage project in the WCPFC-CA alone. Approximately USD 2.4 million has been identified through SPC projects. To provide some additional perspective, the IOTC tagging project over 3 years in a much smaller area than the Pacific (or even the WCPFC-CA) cost USD 19 million.
- The core budget will be used for the coordination of the project, including having a workshop, consultancy, and travel fee for the participation of experts.

Sub-projects included • Undertake a preliminary analysis of the vertical distribution of skipjack, yellowfin and bigeye tuna associated with fish aggregation devices, as indicated by acoustic tagging data. Scientists from other CCMs will participate in this project and related data analysis. • Ongoing and newly funded research with sonic and archival tags in Hawaii, PNG and other areas.						
3. Monitoring and assessment of the ecosystem						
Project 43. (Priority = High) **Ecological Risk Analysis, including PSA.**	**130,000**		**130,000**		**130,000**	
• On-going ERA Work Programme was presented to SC3 and the substance of the ERA Research Plan was endorsed as a three-year project by the SC3. • Annual budget includes USD30,000/year for identifying areas of spatial and temporal overlap of seabird and sea turtle interactions with tuna fisheries and for estimating seabird mortality as requested from CMM-2006-02. • More details on the project and priority of this project relative to other projects will be provided at WCPFC4, if necessary.						
Project 44. (Priority = High) **Seabird and turtle education and extension of fishers.**		**100,000**				
• Ongoing (includes travel and publication costs).						
Project 45. (Priority = High) **Education and dissemination of information relating to Turtle de-hooking devices.**		**50,000**				
• Ongoing (half of these funds are for personnel costs, half for equipment).						
Project 46. (Priority = Medium) **Development / review of models, such as full development of an ECOSIM model, for evaluation of fishery and environmental impacts on ecosystem, including development of reference points.**		**100,000**				
• Ongoing (required modeling and assessing fishery impacts on the ecosystems). • This is separate from the ERA work. SPC-OFP will be undertaking work under SCIFISH project on continued development of SEAPODYM model and application to WCPO pelagic ecosystems.						

• WCPFC may wish to consider contributing to this work if it wishes to request specific analyses using this model. • Estimated budget for the ECOSIM model: USD100,000 over two years (SPC proposal).						
Project 47. (Priority = Medium) **Turtle population assessments.**		**50,000**				
• Ongoing (three-year project to continue into 2009, involving collation of data eventually leading to quantitative assessments).						
Project 48. (Priority = Medium) **Survival of hooked and released seabirds.**		**30,000**				
• Ongoing (will require sourcing external funding for satellite/archival tags).						
Project 49. (Priority = Medium) **Turtle tagging and associated materials.**		**30,000**				
• Ongoing (will require sourcing external funding for satellite/archival tags. Conventional tags can probably be obtained at little or no cost from SPREP)						
Project 50. (Priority = Low) **Offal discards and haul-back mitigation studies.**		**250,000**				
• Not sure if it fits in here, but there is nothing anywhere else on the bycatch and bycatch mitigation database development. • If any use is to be made of this database, there would be considerable ongoing work required to populate the various database tables. Some of this, but not all, could be done under other OFP service items (bycatch estimation). • There is also a concern that the additional components added on (e.g. ERA attributes, non-target catch estimates and species utilization) probably weren't envisaged at the start and the work involved will go beyond the time/funds originally envisaged in the contract. • So some funding would need to be allocated in future budgets if this work is to be ongoing.						
Project 51. (Priority = High) **Extension services to member countries for within EEZ ERA.**						
• ERA methods can value add to EAFM approaches being adopted by WCPFC member countries for fisheries planning and management at the EEZ scale. • The extension services will capacity build ERA skills within these countries. • Possibly appropriate for JTF and/or SRF. • Budget level: USD50,000 over one year (SPC).						

Project 52. (Priority = High) - NEW **Shark Research Programme**		**25,000**				
• EB-SWG Priority. • CMM-2006-05 requested that shark stock assessments be undertaken for key shark species. • Scoping study required to identify areas and key species for priority research and assessment. • Review the feasibility of a regional shark tagging programme. • Review the development and implementation of NPOAs.						
Project 53. (Priority = Medium) - NEW **Investigation into the fishing activities and catch composition of small vessels (e.g. longliners <24m) should be undertaken.**						
• EB-SWG Priority. • To create a better understanding of the catch and effort and operational activities of small high seas vessels so that appropriate management measures (e.g. sharks and seabirds) can be considered for these vessels.						
Project 54. (Priority = Medium) - NEW **Review scientific data to assess in a holistic manner the effects of bycatch management measures using the different longline gears and mitigation measures on the catch of turtle, shark and other target and non-target longline species.**						
• EB-SWG Priority.						
Project 55. (Priority = Medium) - NEW **Undertake studies on the behaviour and distribution of target and non-target species around FADs, and on the various specifications and use of FADs and fishing gears in influencing purse seine catches taken in association with FADs, with a view to identifying their impact in relation to mitigation measures to reduce catches of juvenile tuna and non-target species by purse-seine gear.**						

• FT-SWG Priority • Includes seeking collaboration with industry to design industry-associated studies related to selectivity and avoidance of small tunas and bycatch on floating objects. Assistance of the commission in promoting industry cooperation with in kind contribution of vessel time is requested. • Ongoing, will seek input at not additional cost to the Commission.						
Project 56. (Priority = Medium) - NEW **Utilize underwater videos and other tools to characterize species, size composition and spatial distribution of tunas aggregating around floating objects.**	**5,000**					
• Utilize underwater videos and other tools to characterize species, size composition and spatial distribution of tunas aggregating around floating objects as a FT-SWG Priority • The unit used in the EPO by IATTC cost approximately $3000. On advice from IATTC, it will likely be necessary that gear be suitable to depths of at least 100 m due to deeper thermocline and mixed layer depth in the WCPO. This will require greater pressure ratings and length of cables.						
4. Evaluation of management options						
Project 57. (Priority = High) - NEW **Development of Scoping Paper, and draft Work Plan, on the potential costs, benefits and difficulties of alternative approaches for identification of appropriate reference points and implementation of an MSE within the WCPO.**	**10,000**		**10,000**		**10,000**	
• Development of Scoping Paper, and draft Work Plan, on the potential costs, benefits and difficulties of alternative approaches for identification of appropriate reference points and implementation of an MSE within the WCPO • This project was a ME-SWG Priority and recommended by the SC3 to be undertaken in 2008. • Research will be continued to further develop and refine the Commission's management tool. A workshop will be considered and CCMs may be able to fund travel for their respective scientists to participate in this process.						
Project 58. (Priority = Medium) **Identification and development of methods to evaluate potential management strategies, including MSE development and uncertainty.**						

• Linked to Project 57. • Required to evaluate efficacy of candidate management options. Current evaluation of options is included in SPC-OFP services. Additional funding is required for the development of a comprehensive MSE framework. • It is useful to conduct a feasibility study for the development of a regional and Pacific-wide MSE procedure in 2008 and development of MSE for 2009 and 2010						
Project 59. (Priority = Medium) **Management Strategy Evaluation for non-target and protected species using semi-quantitative models.**						
• ERA will identify species at risk from to the effects of fishing. For some of these species the information available will be insufficient for a robust statistical stock assessment approach. However a need to evaluate management options for these species will remain. • Loop modelling, information gap theory, fuzzy set theory provides methods for modelling management under severe data uncertainty. • Budget level: USD100,000 (SPC, CSIRO, IATTC, others).						
Project 60. Unallocated budget			**60,500**		**66,550[a]**	
• This contingency fund is prepared for any scientific research, analysis or project as requested by the Commission. Based on the amount of USD 55,000 for 2008, 10% of annual inflation rate was applied for 2009 and 2010.						
SUB-TOTAL (NON SPC-OFP SERVICES)	**325,000**	**300,000**	**388,000**	**2,860,000**	**394,050**	**2,860,000**
TOTAL SPC-OFP	**713,104**		**N/A**		**N/A**	
SUB-TOTAL (SPC-OFP SERVICES minus SPC-OFP subsidy)	**325,000**		**357,500**		**393,250[a]**	
GRAND TOTAL minus SPC-OFP subsidy	**650,000[b]**	**300,000**	**745,500**	**2,860,000**	**787,300**	**2,860,000**

[a] An annual increase of 10% was applied.
[b] An increase of USD15,000 from the indicative budget of USD625,000

Attachment P

The Commission for the Conservation and Management of Highly Migratory Fish Stocks in the Western and Central Pacific Ocean

Scientific Committee
Third Regular Session

Honolulu, HI, USA
13–24 August 2007

INDEPENDENT REVIEW OF THE COMMISSION'S TRANSITIONAL SCIENCE STRUCTURE AND FUNCTIONS

Introduction

The Convention on the Conservation and Management of Highly Migratory Fish Stocks in the Western and Central Pacific Ocean (the Convention) entered into force in June 2004, creating one of the first regional fisheries management organizations to be established since the 1995 adoption of the United Nations Fish Stocks Agreement (the Agreement).

The objective of the Convention is to ensure, through effective management, the long-term conservation and sustainable use of highly migratory fish stocks in the western and central Pacific Ocean (WCPO) in accordance with the 1982 United Nations Convention on the Law of the Sea (UNCLOS) and the Agreement. For this purpose, the Convention establishes a Commission for the Conservation and Management of Highly Migratory Fish Stocks in the Western and Central Pacific Ocean (WCPFC). A small Commission Secretariat is based at Kolonia, Pohnpei State, Federated States of Micronesia.

The Convention applies to all species of highly migratory fish stocks (defined as all fish stocks of the species listed in Annex I of UNCLOS occurring in the Convention Area and such other species of fish as the Commission may determine) within the Convention Area, except sauries. Conservation and management measures under the Convention are to be applied throughout the range of the stocks, or to specific areas within the Convention Area, as determined by the Commission. The Commission currently has 25 members and two cooperating non-members. The three Pacific Overseas Territories of France and Tokelau are participating territories within the Commission. Additional information concerning the Commission, including copies of recent decisions, is available from www.wcpfc.org

The Inaugural Session of the Commission in December 2004 adopted the Final Report of Working Group II, which was concerned with science structure and functions of the Commission. Among other matters, the Report recommended:

- a provisional science structure for the Commission for a transitional period (expected to last some three to five years and representing the period between the Convention coming into force and a fully functioning Commission);
- that, during this period, the structure and functions of the science secretariat be flexible and adaptable; and

- an independent review of the transitional structure and function be carried out two years after entry into force of the Convention, or earlier if required, to determine the effectiveness of the science structure and to recommend changes as appropriate.

These terms of reference have been prepared to solicit expressions of interest from suitably qualified and experienced individuals, institutions or firms to undertake the independent review. The expression of interest (EOI) should include a timetable for delivery of the consultancy outcomes and an estimate of the costs involved in undertaking the consultancy.

Objective

Using Articles 10 to 15 of the Convention as a basis, undertake, in consultation with interested Members, Cooperating Non-Members, and Participating Territories, a review of the science structure and science functions of the Commission.

Steering Committee

SC3 recommended the establishment of a Steering Committee that would solicit an EOI, and evaluate and select the provider of expert reviewer(s). The composition of the Steering Committee would be composed of five individuals: the Chair of the Commission, Chairs of the WCPFC SC, TCC and NC, and the Executive Director of the Commission.

Terms of reference for the Steering Committee

The Steering Committee will incorporate the terms of reference (TORs) for scientific data functions and science function included in SC3-GN-WP-15 and agreed to at the Scientific Committee for the procurement of services on this action. Completion and circulation of the TORs will be done through standard protocols and practices and will be the responsibility of the Secretariat.

The Steering Committee, working in conjunction with the Secretariat will review all expressions of interest, and make a recommendation for the selection of the provider to the Secretariat. The role of the Steering Committee will cease after selection of the provider. General administration of the review process will remain with the Secretariat who will update the Chairs of the WCPFC, SC, TCC and NC, as appropriate.

The final report will be made available to all CCMs for their review.

Scope and tasks

The assignment will address, among other matters, the following questions in relation to scientific data functions and science functions of the Commission.

1) Scientific data functions

<u>During the transitional period</u>

- Have the respective roles and responsibilities of the Commission's data submission and data management arrangements been adequately defined and specifically, are there any gaps, overlaps, or areas of ambiguity?
- Are the Commission's rules and policies (or standards and specifications where they exist) regarding the security and confidentiality of data, including physical and electronic

protection from unauthorized access, adequate?

- Has the Commission's data management performance been satisfactory in its provision of data custodianship services, and specifically have all of the Commission's rules and policies (or standards and specifications where they exist) for data compilation, processing, safekeeping and dissemination, been achieved?
- Are adequate resources available for both data stewardship and data custodianship services of the Commission?

Following the transitional period

What would be the advantages and disadvantages of each of the following options for the provision of data custodianship services to the Commission?

- Provision from within the Secretariat;
- Provision by a regional fisheries management organisation outside the Commission;
- Provision by an agency within the government of a member or participating territory;
- Provision by a private agency.
- Provision by SPC/OFP.

2) Science functions

Contracted Research

- Has contracted research been carried out to suitable standards?
- Have cost effective outcomes been obtained from the contract research?
- Is there adequate communication between research contractor, science manager and Scientific Committee?
- Are alternative cost effective research options available?
- Is the research contracting process transparent?
- Are the contactors free of conflicts of interests?

Secretariat and Scientific Committee

- Is the Secretariat adequately resourced to deal with the scientific matters (including data submission and data base contract management) of the Commission?
- Is the Scientific Committee functioning to meet the needs of the Commission (e.g. is the best available information made available to the Commission, and its subsidiary bodies including the Northern Committee) ?
- Following a review of the terms of reference of the specialist working groups (SWGs), and the review the function of each SWG, determine whether all or any SWGs should continue to exist? If so, is there any other function (SWG) necessary to reply to the requests of the Commission (e.g. economics)?
- Are other cooperative arrangements required?
- Is engagement with Members including Pacific Island States and Participating Territories adequate and balanced?

Reviewer attributes

Reviewer(s) could be individuals or be affiliated with a qualified firm or institution. In order to obtain an independent review, the reviewer(s) can not be staff members of the WCPFC Secretariat or Scientific Committee scientific provider (SPC) nor be an officer of the SC, TCC, NC or ISC or a Head of Delegation to these subsidiary bodies.

Reviewer(s) will be able to demonstrate:

- broad knowledge of marine science, fisheries biology, oceanography, socioeconomics and data management;
- detailed knowledge of oceanic pelagic fisheries, preferably with an emphasis on highly migratory species;
- detailed understanding of the role and functions of regional fisheries management organisations particularly those primarily concerned with highly migratory species;
- expert knowledge in one or more of the following fields: fisheries stock assessment, fisheries statistics, fisheries biology and ecology;
- demonstrable international standing in the field of fisheries research;
- expertise in conflict resolution in group processes; and
- extensive experience in the formulation of scientific advice for fisheries management purposes.

Dissemination of an EOI

The EOI will be distributed to CCM official contacts for further re-distribution within their member countries and also advertised internationally.
The consultancy will commence as soon as possible after the selection of the winning bid. Suitably qualified individuals, institutions or firms are invited to submit bids to undertake the assignment described above. Bids should include:

- a capability statement detailing qualifications and relevant experience for individual team members and/or the agency bidding for the consultancy;
- a work plan, with milestones and budget for the consultancy; and
- contact details for individuals who can comment on previous work by the bidder that is relevant to this consultancy.

Outputs

1. Reviewer participates in 2008 ISC meeting.
2. Initial feedback and consultation during Fourth Regular Session of the Scientific Committee.
3. Initial feedback and consultation during Fourth Regular Session of the Northern Committee.
4. Draft Report for the Fifth Regular Session of the Commission, December 2008.
5. Final Report to subsidiary bodies throughout 2009 for their review and consideration in advance of:
6. Presentation of the Final Report to the Sixth Regular Session of the Commission in December 2009.

Indicative schedule and outputs

Task	Timeframe
Finalize reviewer attributes, process and ToR	SC3, August 2007
Approve budget at WCPFC4	December 2007
Establish email Steering Committee	January 2008
Advertise opportunity and call for EOI to CCMs and International Community	Feb-March 2008

Close of EOI	Mar 2008
Steering Committee selects provider	Apr 2008
Formal and opportunistic consultations with full range of stakeholders including possible stock assessment preparatory workshop in Noumea (possibly June–July 2008)	April 2008–August 2009
Reviewer participates in ISC working group(s) and plenary	April–July 2008
Reviewer participates in SC4	August 2008
Reviewer participates in NC4	September 2008
Reviewer participates in WCPFC5 [presents Draft Report]	December 2008
Interim reporting[a]	April 2008–August 2009
Final Report	1 April 2009
Report to ISC plenary	July 2009
Report to SC5	August 2009
Report to NC5	September 2009
Presentation of Final Report with subsidiary body comments to WCPFC6	December 2009

[a] Secretariat will incorporate periodic reporting (quarterly) into the consultancy arrangement, and circulate to all CCMs an update on the status of the review.

Budget

SC3 reaffirmed the importance of the cost efficiency and cost effectiveness of the review process. Between SC3 and WCPFC4, the Secretariat will review the cost structure of the independent review (currently USD80,000) and present an estimate to the Finance and Administration Committee.
In assessing the merits of all bids, cost efficiency and cost effectiveness will be important considerations in determining the preferred bidder.

Request for additional information relating to this consultancy and submissions of EOI should be directed to:

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