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

Scientific Committee
Fifth Regular Session

Port Vila, Vanuatu
10–21 August 2009

SUMMARY REPORT

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

Scientific Committee
Fifth Regular Session

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EXECUTIVE SUMMARY

OPENING OF MEETING

1. The Chair, N. Miyabe (Japan), opened the Fifth Regular Session of the Scientific Committee (SC5), which took place in Port Vila, Vanuatu from 10–21 August 2009. A welcome address was delivered by the Hon. Ham Lini, Vanua Roroa, Deputy Prime Minister, Minister for Justice and Acting Minister for Fisheries, Republic of Vanuatu.

2. Matters considered by the SC5 and its six Specialist Working Groups — Biology (BI), Ecosystem and Bycatch (EB), Fishing Technology (FT), Methods (ME), Statistics (ST), and Stock Assessment (SA) — included:

a) a review of the fisheries in the western and central Pacific Ocean (WCPO) and the eastern Pacific Ocean (EPO);
b) a review of the status of stocks of yellowfin tuna, bigeye tuna. South Pacific albacore tuna stocks, and swordfish stocks in the southwest and south central Pacific Ocean with a focus on requests for advice and recommendations arising from the Fifth Regular Session of the Western and Central Pacific Fisheries Commission (WCPFC5) in Busan, Korea in December 2008;
c) an appraisal of Conservation and Management Measure 2008-01 with respect to the potential for achieving the objectives of that measure;
d) a summary of the most recent information and assessments for tuna and billfish stocks in the North Pacific Ocean;
e) a dedicated session of the ME-SWG to discuss reference points;
f) bycatch mitigation issues associated with seabirds, sea turtles, sharks, juvenile bigeye and yellowfin tunas;
g) issues associated with the data available to the Commission and initiatives to address data gaps;
h) a review of the advice and recommendations arising from the Independent Review of the Commission's Transitional Science Structure and Functions;
i) the status of the Indonesia and Philippines Data Collection Project (IPDCP)/West Pacific East Asia Oceanic Fisheries Management Project (WPEA), the Japan Trust Fund (JTF) and the Pacific Tuna Tagging Project (PTTP);
j) relations with other organizations;
k) the special requirements of small island developing States and territories;
l) the process for developing the programme of work for the SC and the 2010–2012 work programme and budget; and

m) administrative matters associated with the functioning of the SC, streamlining the operations of the SC, and reviewing of the Commission's Research Plan.

REVIEW OF FISHERIES

3. The provisional total Convention Area tuna catch for 2008 was estimated at 2,426,195 mt, the highest annual catch recorded, but only 6,000 mt higher than the previous record in 2007 (2,420,082 mt; Fig. 1). During 2008, the purse-seine fishery accounted for an estimated 1,783,669 mt (74% of the total catch, and a record for this fishery), with pole-and-line fishery taking an estimated 170,805 mt (7%), the longline fishery an estimated 231,003 mt (10%), and the remainder (10%) taken by troll gear and a variety of artisanal gear types, mostly in eastern Indonesia and the Philippines. The Convention Area tuna catch (2,426,195 mt) for 2008 represented 81% of the total Pacific Ocean catch of 3,009,477 mt, and 56% of the global tuna catch (the provisional global estimate for 2008 is just over 4.3 million mt).

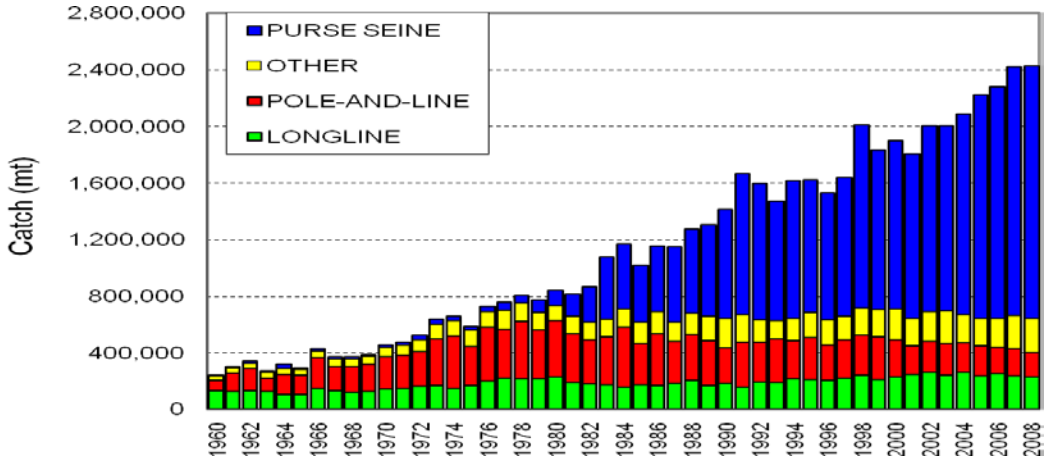

Figure 1: Catch (mt) of albacore, bigeye, skipjack and yellowfin tunas in the Convention Area, by longline, pole-and-line, purse-seine and other gear types.

4. The 2008 Convention Area catch of skipjack (1,634,617 mt – 67% of the total catch) was the second highest ever, and 74,000 mt less than the record catch of 2007 (1,708,605 mt; Fig. 2). The Convention Area yellowfin catch for 2008 (539,481 mt – 22%) was easily the highest on record and nearly 77,000 mt (17%) higher than the previous record in 1998 (462,786 mt). The Convention Area bigeye catch for 2008 (157,054 mt – 6%) was the second highest on record (slightly lower than the record catch taken in 2004 – 157,173 mt), mainly due to a relatively high estimated bigeye catch from the purse-seine fishery. The 2008 Convention Area albacore catch (95,043 mt – 4%) was the lowest in over 10 years, with reduced catches experienced in both the South and North Pacific fisheries in 2008 compared with recent years.

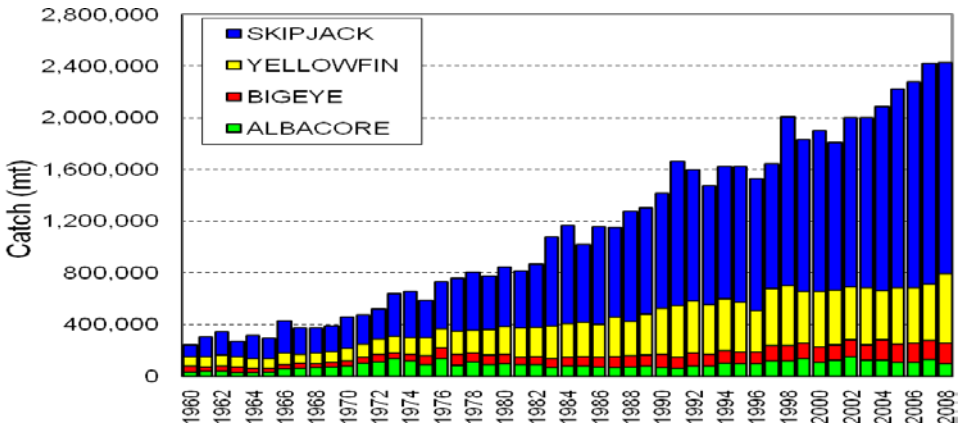

Figure 2: Catch (mt) of albacore, bigeye, skipjack and yellowfin tunas in the Convention Area.

STATUS OF THE STOCKS AND MANAGEMENT ADVICE AND IMPLICATIONS

WCPO bigeye tuna

Status and trends

5. SA-SWG selected six assessment runs to represent the stock status of bigeye tuna. For all six model runs, $F_{current}/F_{MSY}$ is considerably greater than 1, ranging from 1.51–2.01 for a variety of assumptions with similar steepness (~0.98). The range of $F_{current}/F_{MSY}$ ratios indicate that a 34–50% reduction in fishing mortality is required from the 2004–2007 level to reduce fishing mortality to sustainable levels at a steepness of ~0.98. The results indicate a 61% reduction in fishing mortality if a lower value (0.75) of steepness is assumed. All of the results conclude that overfishing is occurring on the WCPO bigeye tuna stock.

6. Current spawning biomass exceeds the estimated spawning biomass at MSY (>1.0) for five of the six assessment runs chosen ($SB_{current}/SB_{MSY}$, Table 1), indicating that the WCPO bigeye stock is not in an overfished state if the spawning biomass reference period is 2004–2007. However, if the spawning biomass period is considered as 2008 (SB_{latest}/SB_{MSY}), then only one of the six runs indicates that the bigeye stock is not in an overfished state. The bigeye stock status is concluded to be in a slightly overfished state, or will be in the near future. The calculated MSY, based on recent recruitment (average of the last 10 years), was almost double long-term MSY estimates, but still 20% below recent catches.

7. The 2009 bigeye assessment is comparable to the 2008 assessment (Table 1), although there are differences in catch and effort data, size frequency, and a few different structural assumptions. The 2009 range of $F_{current}/F_{MSY}$ estimates are substantially higher than the 2008 assessment value, and largely relates to the shift of the MSY-window from 2003–2006 to 2004–2007 for the updated 2009 model.

8. All of the models that were run using the 2009 data were rerun assuming the previous MSY time window (2003–2006) to see how the view of the past has changed. Not only have conditions deteriorated since the previous assessment, our view of past conditions is now more pessimistic. For example, $F_{current}/F_{MSY}$ for run 10 when calculated using the period 2003–2006 is 1.57 compared with 1.44 from run 4 in the 2008 assessment. The main reason for this appears to be the shift in selectivity for the increasingly influential domestic fisheries in Indonesia and the Philippines.

Table 1: Comparison of reference points from the 2009 bigeye stock assessment, considering six sensitivity analyses and the 2008 assessment.

Management Quantity	2009 Assessment	2008 Assessment
Most Recent Catch	134,315 mt (2008)	143,059 mt (2007)
MSY and MSY(recent R)	Range: 52,120–67,800 mt Range:110,000–146,114 mt	Base case: 64,600 mt Range: 56,800–65,520 mt
$\mathbf{F_{current}/F_{MSY}}$	Range: 1.51–2.55	Base case: 1.44 Range: 1.33–2.09
$\mathbf{B_{current}/B_{MSY}}$	Range: 1.11–1.55	Base case: 1.37 Range: 1.02–1.37
$\mathbf{SB_{current}/SB_{MSY}}$	Range: 0.85–1.42	Base case: 1.19 Range: 0.76–1.20
$\mathbf{Y_{Fcurrent}/MSY}$	Range: 0.12–0.92	Base case: 0.94 Range: 0.50–0.97
$\mathbf{B_{current}/B_{current,\ F=0}}$	Range: 0.18–0.29	Base case: 0.26 Range: 0.20–0.28

Management advice and implications

9. The SC provides management advice for bigeye tuna with regard to: i) the 2009 stock assessment; ii) evaluation of the effectiveness of conservation and management measure (CMM)-2008-01 to obtain the objective of a 30% reduction in fishing mortality from 2001–2004 levels; and iii) the frequency and necessity of consistent advice from the SC.

10. The SC concluded that the 2009 assessment indicates a continued decline of the WCPO bigeye stock as noted in previous assessments. Fishing mortality in relation to MSY ($F_{current}/F_{MSY}$) is considerably greater than 1, ranging from 1.51–2.01 for a variety of assumptions with similar steepness (~0.98) in the stock recruitment relationship. The range of $F_{current}/F_{MSY}$ ratios indicates that a 34–50% (average of 43% when steepness is assumed as 0.98) reduction in fishing mortality is required from the 2004–2007 level in order to reduce fishing mortality to sustainable levels. Current spawning biomass in relation to MSY indicates that the WCPO bigeye stock is not in an overfished state if the spawning biomass reference period is 2004–2007. However, if the spawning biomass period is 2008, then the bigeye stock is overfished. The bigeye stock status is concluded to be in a slightly overfished state, or will be in the near future with high levels of overfishing occurring. The SC also noted the continued high fishing mortality on juvenile bigeye due to associated purse-seine sets and the fisheries of Indonesia and the Philippines.

11. The SC supported an evaluation of CMM-2008-01 (WCPFC-SC5-2009/GN-WP-17), which indicates that the objective of a 30% reduction in fishing mortality on bigeye by 2011 will not be achieved. The lack of effectiveness of CMM-2008-01 is broadly related to: i) reductions in longline catches that do not result in the required reduction in fishing mortality; ii) increases in both purse-seine effort allowed under the measure, and purse-seine efficiency since 2001–2004; and iii) exclusion of archipelagic waters, which encompasses most of the fishing activity of the Indonesian domestic fisheries and some activity by the Philippines' domestic fleets.

12. The 2009 stock assessment concludes that a 34–50% reduction in fishing mortality from 2004–2007 levels is required to keep the biomass above MSY levels. This is an increase from a 30% reduction recommended by SC4 and the 25% reduction recommended by SC2. While Members agreed that consistent advice should be provided to WCPFC on necessary reductions of fishing mortality, some Members indicated that the evaluation of the newly introduced measure (CMM-2008-01) is based on a

variety of assumptions, and the actual behavior of the fisheries and consequent effects on stocks have not yet been evaluated.

13. A significant time lag exists between implementing a management measure and detecting a stock response from an assessment. Results of management implemented in 2009 will only be detected in assessments undertaken in 2011 and 2012 due to delays in providing data and significant uncertainty in estimates of fishing mortality and biomass in the last year of the assessment.

14. While acknowledging the delay between management actions and quantifying a stock response, the SC noted that the combination of increased fishing mortality on bigeye tuna to levels well above F_{MSY} (as documented in the 2009 assessment and the inadequacy of CMM-2008-01 in reducing fishing mortality by 30%) implies that stock biomass will continue to decline if the longer effective action is delayed. The SC views the identification and implementation of effective management measures to address the inadequacy of CMM-2008-01 as the most urgent issue facing the Commission with regard to maintaining the sustainability of target tuna stocks.

i. Although CMM-2008-01 will not achieve the targeted reduction in fishing mortality, the SC supports the objectives of the measure but recommends that further actions be identified and implemented to ensure the achievement of these objectives.
ii. To give effect to recommendation i), SC recommends a 30% reduction in fishing mortality from the 2001–2004 level in order to return fishing mortality to MSY levels (F_{MSY}).
iii. The SC recommends that the Commission note that recent estimates of F/F_{MSY} (i.e. 1.51–2.01, reference years 2004–2007) indicate that fishing mortality has increased significantly since 2001–2004; therefore, the 2009 streamlined assessment indicates a reduction in fishing mortality of 34–50% from 2004–2007 levels would be required, although there are some uncertainties.
iv. The SC recommends that the science services provider (SPC-OFP) conduct analyses for WCPFC6 (Attachment M) on the predicted annual catches and resulting fishing mortality and spawning biomass for a range of scenarios, that include illustrating the impacts of:
    a. The various exemptions, special considerations and areas not covered by the CMM by modelling the factors above with and without them incorporated into the measure; and
    b. Potential management options to strengthen the CMM, such as various percentage reductions in longline and purse-seine FAD catch and effort.
v. The SC endorsed a draft work plan prepared by SPC-OFP to guide this work.
vi. The SC also recommends that an assessment of bigeye stock status and evaluations of updated or additional CMMs aimed at reducing fishing mortality on bigeye be undertaken. An assessment of whether fishing mortality on bigeye and the objectives of CMMs are being achieved should be undertaken on an annual basis.
vii. The SC encourages all CCMs to provide data required to conduct stock assessments in a more timely manner so that the data between the most up-to-date assessment outcomes and management advice can be reduced to one year.

WCPO yellowfin tuna

Status and trends

15. The SA-SWG convenor noted that because a stock assessment was not conducted in 2008, SC4 did not provide new advice to the Commission.

16. Three specific issues were raised in discussions about stock assessment results and the SA-SWG report.

i. It was generally agreed that stock assessment results from the 2009 model are more optimistic than those in 2007, meaning that the general nature of advice required from SC5 may need to be different from previous years. However, a comparison of 2007 and 2009 stock assessments with similar steepness values indicate only a slight improvement.
ii. In noting this generally more optimistic state, the SC also noted advice from the SA-SWG, that Region 3, which supports approximately 95% of the catch, has significantly higher fishery impacts than other regions. This means that the more optimistic status may be "buffered" by biomass in other regions. SPC-OFP reminded the meeting that spatial heterogeneity exists throughout the regions, and it is unlikely that mixing is rapid enough to transfer fishery impacts in the short term, if at all. For some CCMs, this highlighted the importance of having a specific recommendation for Region 3, noting that specific information was provided in the SA-SWG report.
iii. It was also noted that this year, the SA-SWG provided advice on a range of model runs with different values of assigned steepness, each of which could be as feasible as the others. It would, therefore, be very difficult to provide the level of prescription in the recommendation that was provided in 2007, due to the sheer number of results that would need to be presented.

17. The SC adopted the stock status of WCPO yellowfin tuna from the SC5 SA-SWG report.

Management advice and implications

18. The range of estimates of $F_{current}/F_{MSY}$ ratios (0.41–0.85) in the 2009 assessment was lower than the base-case estimate (0.95) in the 2007 assessment. This change is largely due to the addition of fisheries data, assumptions of steepness, and because the period for computing the MSY-based reference points was advanced two years (from 2002–2005 to 2004–2007). Estimates of $F_{current}/F_{MSY}$ indicate that the entire WCPO yellowfin stock is not experiencing overfishing and the entire stock appears to be capable of producing MSY. Estimates of $SB_{current}/SB_{MSY}$ indicate that the WCPO yellowfin stock is not in an overfished state.

19. The SC noted a slightly improved status for the WCPO yellowfin stock compared with the 2007 stock assessment. However, the SC also noted that levels of fishing mortality, exploitation rates and depletion differ between regions, and that exploitation rates were highest in the western equatorial region, which accounts for ~95% of the total yellowfin tuna catch, and that the spawning biomass in this region is estimated to have declined to about 30% of the unexploited level. The SC reiterated SC3's advice that exploitation rates differ between regions, and that exploitation rates continue to be highest in the western equatorial region. The SC recommended that there be no increase in fishing mortality in the western equatorial region.

Requests from CMM-2008-01

FAD management and monitoring

20. FAD management options, including the marking, identification, electronic monitoring and limitation to the numbers of FADs deployed, were presented and discussed, and scientific issues related to FADs and FAD management considered. The SC supported the recommendations and work plan items relevant to FAD marking and monitoring as adopted during the FT-SWG session of SC5.

Fishing effort for bigeye and yellowfin tuna from other commercial tuna fisheries

21. The SC:
i. noted that the deadline for submission of these data has already passed;

ii. encouraged CCMs to submit these data as soon as possible; and
iii. recommended that non-compliance with data submission obligations be referred to the TCC for their consideration and action.

Review of CMM-2008-01

22. The SC made the following recommendations to WCPFC6:

i. CMM-2008-01 is likely to achieve one of its objectives: not exceeding levels of fishing mortality on the WCPO yellowfin tuna stock beyond the level experienced either in 2004 or the annual average of the period 2001–2004.
ii. However, even if fully implemented and complied with, CMM-2008-01 is extremely unlikely to achieve its most important objective: reducing fishing mortality on the WCPO bigeye tuna stock to at least 30% below the level experienced either in 2004 or the annual average of the period 2001–2004. Furthermore, if the high seas pockets closure results in efforts being transferred to high seas areas to the east, where bigeye tuna generally form a greater proportion of the purse-seine catch, the objectives of CMM-2008-01 will be even less likely to be achieved.
iii. The WCPFC science services provider (SPC-OFP) was tasked by the SC to model potential results of other measures that might be considered by WCPFC6 to reduce fishing mortality on bigeye tuna stocks to 30% below 2001–2004 levels, including the likely impact of a complete FAD closure. Results of this work will be presented in the first instance to WCPFC6 (Attachment M).

Capacity measuring and monitoring (para 44 of CMM-2008-01)

23. The SC noted the invitation from the Secretariat for CCMs to provide details of work completed, or planned, by CCMs in respect of the measuring and monitoring of capacity to assist TCC5 in consideration of this issue, and agreed that there is a role for the SC to consider scientific elements of capacity monitoring and measurement which is included within the terms of reference of the FT-SWG.

WCPO skipjack tuna

24. No new information on the stock status of this species was presented to SC5; therefore, management recommendations from SC4 are maintained.

South Pacific albacore

25. The SC adopted the stock status of South Pacific albacore from the SC5 SA-SWG report.

26. A full stock assessment was conducted in 2008 and a comparative assessment was conducted in 2009. Estimates indicate that overfishing is not occurring and that the stock is not in an overfished state. There is no indication that current catch levels are not sustainable with regard to recruitment overfishing. However, current levels of fishing mortality may be affecting longline catch rates on adult albacore.

South Pacific swordfish

27. The SC agreed that the data uncertainties have yet to be resolved but that results of the stock assessment are now accepted and finalized. The SC recommended to WCPFC6 that the catch limits specified in CMM-2008-05 be carried forward to future years as a continuing measure.

Southwest Pacific striped marlin

28. The SC noted that no stock assessment was conducted for southwest Pacific striped marlin in 2009; therefore, the stock status description and management recommendations from SC2 are still current.

North Pacific striped marlin

29. The SC reaffirmed the International Scientific Committee (ISC) plenary 2009's advice and recommended that 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). Noting that this is a bycatch species, mitigation methods should be explored in order to achieve the necessary reductions in fishing mortality.

Northern stocks

30. ISC's Chair, per SC's request, agreed to provide SC6 with tables indicating the status of northern stocks relative to reference points, based on the most recent assessments for each stock.

31. The SC recommended to the Northern Committee that they consider advising ISC that the scientific advice provided by ISC to SC contain information on the performance of a range of fishery indicators against appropriate reference points. Until the Commission identifies and formally adopts appropriate reference points, the SC suggested that this information should detail, at a minimum, the performance of the fishery against MSY-based reference points.

North Pacific albacore

Status and trends

32. No new stock assessment has been conducted since the last assessment in 2006, and a full stock assessment is planned for 2011. Therefore, ISC has no new stock status information or conservation advice to offer, and recognized that the lack of a more recent stock assessment increases the uncertainty about the stock status.

33. ISC completed work on determining $F_{SSB\text{-}ATHL}$ associated with the average level of the 10 historically low spawning stock biomasses for the albacore stock. $F_{SSB\text{-}ATHL}$ is 0.75/yr. This work was requested by the Northern Committee, which has adopted this parameter as an interim biological reference point (BRP).

Management advice and implications

34. Based on the 2004 stock assessment, the recommendation of not increasing F from current level ($F_{current(2002\text{-}2004)} = 0.75$) is still valid. However, with the projection based on the continued current high F, the fishing mortality rate will have to be reduced.

Pacific bluefin tuna

Status and trends

35. Spawning stock biomass (SSB) in 2005, estimated with the value for natural mortality (M) used in the 2008 stock assessment, was 20,000 mt based on the SS2 model and 23,000 mt based on the SS3 model. Applying the revised estimate of M from the 2009 workshops and the SS3 model, SSB was

estimated at 73,000 mt. These SSB estimates for 2005 are above the median level over the assessment period (1952–2006). If the future fishing mortality rate (F) continues at the current F level, short-term projections (2009–2010) indicate that SSB will decline. In the longer term, SSB is expected to attain levels comparable to median SSB levels over the assessment period.

36. Current F (2002–2004) is greater than commonly used BRPs that may serve, in principle, as potential target reference points. This includes F_{MAX} — a BRP that, given the assessment structure and assumptions, is theoretically equivalent to F_{MSY}. But the magnitude by which $F_{current}$ exceeds target BRPs is variable. If current F is reduced to F_{MAX}, spawning potential (%SPR) is expected to increase in absolute terms by 10%, and yield per recruit is expected to increase by 4% relative to current levels. Conversely, current F is less than commonly used BRPs that may serve, in principle, as potential recruitment overfishing threshold BRPs (e.g. F_{MED}); that is, Fs above which the likelihood of recruitment failure is high.

37. Fs on recruits (age 0) and on juveniles (ages 1–3) have been generally increasing for more than a decade (1990–2005). The catch (in weight) is dominated by recruits and juveniles (ages 0–3). Total catch has fluctuated widely in the range of 9,000–40,000 mt during the assessment period (1952–2006). Recent catches are near the average for the assessment period (~22,000 mt).

Management advice and implications

38. The ISC provided the following conservation advice that was adopted by the SC without modification:

1. If F remains at the current level and environmental conditions remain favourable, the recruitment should be sufficient to maintain current yields well into the future.
2. A reduction in F in combination with favourable environmental conditions, should lead to greater SPR.
3. Increases in F above the current level, and/or unfavourable changes in environmental conditions, may result in recruitment levels which are insufficient to sustain the current productivity of the stock.
4. Given the conclusions of the May–June 2008 stock assessment with regard to the current level of F relative to potential target and limit reference points, and residual uncertainties associated with key model parameters, it is important that the current level of F is not increased.

4[bis]. Given the conclusions of the July 2009 PBFWG, the current level of F relative to potential biological reference points, and increasing trend of juvenile F, it is important that the current [sic] level of F is decreased below the 2002–2004 levels on juvenile age classes.

North Pacific swordfish

Status and trends

39. ISC's 2009 stock assessment of swordfish in the North Pacific was based on two different stock structure hypotheses: a single homogeneous stock in the North Pacific Ocean and two stocks (one in the WCPO and another in the EPO) in the North Pacific with little or no mixing between them, the latter of which is the preferred hypothesis because most of the stock structure evidence so far supports this hypothesis.

40. Results using the single stock hypothesis indicate that MSY is 19,100 mt and the exploitable biomass has been well above this MSY level. The estimated harvest rate has been well below the harvest rate of 34% at MSY. The harvest rate for 2006 was 13%.

41. With the two-stock hypothesis, results for the WCPO stock indicate that MSY is 14,400 mt and the exploitable biomass has largely been above this MSY level for the entire time series of data. The estimated harvest rate at MSY is 26% and actual harvest rates have largely been below this level for the entire time series. In 2006, the harvest rate was 14%. Projecting this harvest rate to 2010 results in the exploitable biomass continuing to remain above the biomass at MSY.

Management advice and implications

42. ISC concluded that both swordfish stocks in the North Pacific Ocean are healthy and well above levels required to sustain recent catches. No management advice was provided.

Biological parameters and management related issues

Refinement of bigeye parameters Pacific-wide: A comprehensive review and study of bigeye tuna reproductive biology (Project 35)

43. The SC noted the importance of this biological work for future evaluations on the status of bigeye and its capacity building within CCMs. The SC recommended that the Commission endorse the project's continuation.

Technical workshop to consider suitability of MSY-based reference points as default limit reference points and how they may be operationalized (Project 57)

44. The SC agreed that the followings should be forwarded to the Commission for consideration:

i. Endorse the short-term and medium-term work plans on reference points adopted by SC5;
ii. Hold a workshop on management objectives during 2010 as proposed by WCPFC5. The objectives of such a workshop should include:
    a. Assisting managers to identify the information required to guide management decisions, and how these can be quantified;
    b. Providing guidance on identifying stock-specific limit and target reference points;
    c. Providing advice on how uncertainty in the estimation of performance indicators can be incorporated into management decisions.
iii. Note that SC6 will make a recommendation to WCPFC7 on appropriate provisional limit reference points, both types and associated values, for the key target species in the WCPFC.

BYCATCH MITIGATION

Fisheries impacts (Ecological Risk Assessment)

45. The SC recommended that:

i. Funding to support the continuation of the ERA project should be provided for the period 2010-2012

ii. SEAPODYM should be included as an affiliated, independently funded, project in the SC's programme of work. Further the EB-SWG encourages CCMs to cooperate with the request for data required for ongoing research using the SEAPODYM model.

Seabirds

46. The SC recommended that :

i. CCMs should be encouraged to provide information on new or existing mitigation measures on seabird interactions to the SC, consistent with para 6 of CMM-2007-04.
ii. Reviews of the effectiveness of mitigation measures for seabirds currently required under CMM-2007-04, and reviews of any new mitigation measures for possible incorporation into the CMM, should be conducted.
iii. Ongoing research, following from the spatial risk assessment presented in WCPFC-SC5-2009/EB-WP-6, during the intersessional period and for review at SC6 should be conducted. The EB-SWG further recommended the use of data from the Regional Observer Programme in order to validate spatial risk assessments so that a recommendation can be brought before SC6 to determine initial spatial zones for the differential management and monitoring of seabird bycatch. These assessments should be updated as new information becomes available. Access to observer data for these scientific purposes will be granted under the terms of the Commission's rules and procedures for access to data.

Sharks

47. The SC:

i. Requested SPC-OFP to commence work on preliminary stock assessments for key shark species, and to develop a research plan to support further assessment for consideration at SC6, if possible, in collaboration with IATTC and other relevant organizations. The work should be included as a component of the 2010 service agreement for the provision of science services to the Commission.
ii. Encouraged CCMs to collect and contribute catch and effort data, observer data, and biological data toward this exercise, and to cooperate in this research.
iii. Recognized the importance of observer data for analysis of fisheries impacts on bycatch, and encouraged collaboration between SPC-OFP, CCMs and other relevant organizations in analyzing ROP data related to bycatch for use by the SC, subject to the Commission's rules and procedures for data.
iv. Considered adding silky sharks to the list of key shark species specified in CMM-2008-06.

Sea turtles

48. The SC recommended to:

i. Adopt the draft WCPFC Guidelines on the Handling of Sea Turtles (WCPFC-SC5-2009/GN-WP-13), and the review by SC5 of further guidelines on entanglement and use of de-hookers.
ii. Specify to the Commission that in order to fulfil the requirements of para 7(b) of CMM-2008-03 by January 2010, observed mean sea turtle interaction rates must be lower than 0.019 sea turtles (all species combined) per 1,000 hooks, over the preceding three consecutive years.
iii. Encourage revision of this threshold as new data are collected and analyses are generated by SPC-OFP and EB-SWG, particularly on the population status of different sea turtle species and

the mortality rates that can be sustained. Species-specific interaction rates should also be considered.

iv. Set a reference level for shallow-set swordfish fishery for para 7b of CMM-2008-03 is not relevant to the scientific advice that would be offered regarding a reference level of sea turtle bycatch in deep-set fisheries for tuna that are larger in scope and lower in bycatch rates by an order of magnitude.

49. The SC approved that the WCPFC Guidelines on the Handling of Sea Turtles (WCPFC-SC5-2009/GN-WP-13) include guidance on how to release turtles from entanglement, given in Attachment N.

50. The SC recommended that Australia's Turtle Mitigation Plan be sent to the TCC for its review and recommendation.

51. The SC recognized New Zealand, for its shallow-set swordfish fishery, as having a minimal sea turtle interaction rate (nominal CPUE: 0.00057 sea turtles per 1,000 hooks; and average 0.0013 sea turtles per 1,000 hooks) as per para 7b of CMM-2008-03.

Small tuna on floating objects

52. In response to information and recommendations relevant to the reduction of fishing mortality on small tuna on floating objects (STFO) that were discussed during the FT-SWG session, the SC provided the following advice to the Commission:

i. Explore the feasibility of registering and monitoring the status of the electronic package attached to a drifting FAD as a means to monitor and study effort in the purse-seine fishery.
ii. Regarding further studies on FAD characteristics such as depth, construction and features of the associated electronic package, the SC recommended further study and support in collecting and recording data and operational details that may be necessary to conduct these studies.
iii. Regarding technical research on bycatch mitigation, SC advised that collaborative projects with industry are a cost-effective and operationally sound approach, and requested support of the Commission in facilitating such opportunities.

53. The SC strongly recommended that the studies named below, which are relevant to effort standardization and documentation of fishing efficiency, be advanced as soon as possible:

i. Conduct studies to help quantify changes in fishing efficiency in both longline and purse-seine fleets in the WCPO.
ii. Conduct a study (or studies) to identify and refine lists of necessary technical data inputs for effort standardization.
iii. Conduct a study to document and analyze fishing efficiency and historical changes in vessel and gear attributes in WCPO fisheries, including purse-seine net information.
    a. Regarding purse-seine fishing gear characteristics, the SC recommended that the actual depth to which purse seines effectively operate be examined on a per-vessel and per-fleet basis, using time-depth recording tags on purse seines.
    b. Conduct a detailed characterization of vessels or fleets that have high catch rates of STFO and bigeye tuna in particular.

DATA AND INFORMATION

Data gaps

Data gaps and progress towards addressing gaps

54. The SC recommended that:

i. The WCPFC Executive Director resend his letter to CCMs (copied to representatives of the SC) asking them to authorize the release to WCPFC of their operational logsheet data held by SPC-OFP.
ii. The issue related to the attribution of catch under charter arrangements be referred to the TCC.
iii. The issue of obtaining aggregate distant-water longline data for the Pacific Ocean (for use in stock assessments) should be covered in the data exchange protocols in the MOU with IATTC.
iv. All CCMs familiarize themselves and comply with, obligations of the Commission's data submission standards (Scientific Data to be Provided to the Commission).
v. CCMs report to the TCC on their progress in overcoming "domestic legal constraints" to the provision of data.
vi. The TCC consider non-compliance with data reporting obligations as a significant part of the Compliance with Conservation and Management Measures (CCMM) working group.

Review of "A study to identify causes of data gaps in the work of the WCPFC"

55. The SC recommended that the decisions on i) employing a data capture manager and ii) the holding of a workshop for data correspondents, be deferred until after consideration of the "Independent Review of the Commission's Transitional Science Structure and Functions".

Species composition of purse-seine catches

56. The SC recommended the continuation of Project 60, including additional surveys of canneries, to try and compare the cannery data, and making full use of logbook data when available, for specific trips, with data obtained from grab and spill sampling for the same trips.

Obtaining ISC data

57. The SC recommended that:

i. The Secretariat provide an inventory of Commission data holdings for North Pacific stocks to ISC by ISC10.
ii. The Secretariat, ISC, SPC-OFP, and interested CCMs complete a reconciliation of ISC and Commission data holdings for North Pacific stocks, to identify any data gaps by 1 October 2010.
iii. The Secretariat and ISC collaborate to exchange data, address data gaps for North Pacific stocks, subject to the Commission's "Rules and Procedures for the Protection of, Access to, and Dissemination of Data Provided to the Commission", and the rules and procedures governing data exchange that are contained within ISC's Operations Manual.
iv. The ISC and the Secretariat establish a mechanism for the periodic exchange of data to address gaps in the data for North Pacific stocks.
v. The Secretariat provide a report of progress on these matters to SC6.

Regional Observer Programme

Data fields contained in the FAD form

58. The SC recommended that the following fields be added to this interim list of FAD fields if this is practical:

i. Describe the floating object when first found by the vessel.
ii. Describe any changes or additions to the floating object prior to vessel departure.
iii. Depth of netting and/or other materials hanging from the floating object.
iv. FAD markings or numbers.

59. The SC recommended that an "investigate floating object" be added to the list of FAD activity codes if this is practical.

Definition of a FAD set

60. The SC recommended that:

i) WCPFC-SC5-2009/ST-WP-07 (Analysis of purse-seine set times for different school associations: a further tool to assist in compliance with FAD closures) be forwarded to TCC for its consideration;
ii) the work described in WCPFC-SC5-2009/ST-WP-07 continue;
iii) the TCC clarify the definition of FAD with regard to large living marine animals; and
iv) the TCC standardize the definition of a FAD and FAD set between high seas and in-zone fisheries.

Advice to Ad Hoc Task Group on Data

Scientific needs for VMS data

61. The SC recommended that CCMs provide any additional comments on the use of VMS data for scientific purposes, data requirements and timeframe to the Chair of the Ad Hoc Task Group on Data, and copied to the Secretariat, by 1 September 2009.

Review of public domain catch and effort data

62. The SC recommended that the Commission task the AHTG on Data with investigating changes to the Rules and Procedures (with regard to public domain data and the three-vessel rule) to protect confidentiality requirements of individual CCMs, while allowing those CCMs that wish their aggregate data to be made available without restriction to do so.

Tagging initiatives

63. The SC noted the progress to date and recommended the continuation of further work.

Data verification

64. The SC recommended that, with regard to transhipments, the list of fields to be collected for scientific purposes described in Annex 1 of WCPFC-SC5-2009/ST-WP-05 be forwarded to the TCC for its consideration. The SC noted that the Marshall Islands is leading the development of a CMM on transhipment, and encouraged CCMs to provide comments to RMI on the discussion paper, preferably in advance of TCC5.

COOPERATION WITH OTHER ORGANIZATIONS

65. The SC endorsed the revisions to the MOU with SPC to provide for a three-year arrangement as directed by the Commission (Attachment O).

66. In relation to the Memorandum of Cooperation on the Exchange and Release of Data with IATTC, the SC referred the draft to TCC5 for further consideration.

67. The SC had no comments on the draft MOU with the North Pacific Anadromous Fisheries Commission, and endorsed its submission to NC5 and TCC5 before being considered by WCPFC6.

CONSIDERATION OF THE SPECIAL REQUIREMENTS OF DEVELOPING STATES AND PARTICIPATING TERRITORIES

68. The SC urged other CCMs and organizations to voluntarily contribute funds to the Special Requirements Fund.

FUTURE WORK PROGRAMME AND BUDGET

Process of implementing the work programme of the Scientific Committee

69. The SC adopted revised 'Guidelines outlining the process for formulating the work programme and budget of the Scientific Committee' (Attachment P).

Progress of 2009 work programme, 2010 work programme and budget, and 2011–2012 provisional work programme and indicative budget

70. The SC reviewed its 2009 work programme and noted that four projects were completed and removed from the work programme. The remaining projects, and three additional projects that were added (Spatial Ecosystem and Populations Dynamics Model (SEAPODYM) simulation modelling, identifying provisional decision rules, and stock assessment of southwest Pacific striped marlin), now form SC's 2010 work programme. SC's work programme and budget for 2010, and indicative budget for 2011–2012 are shown in Table 2.

Table 2: List of SC work programme titles and budget for 2010, and indicative budget for 2011–2012 that require funding from the Commission's core budget (in USD). Table 6 in the SC4 Summary Report includes a detailed description of each project.

Strategic Research Activity or Project with priority identified at SC3	2010		2011		2012	
	Core	Other	Core	Other	Core	Other
Project 14. (Priority = High) Indonesia and Philippines Data Collection Project (IPDCP)	75,000		25,000		25,000	
Project 35. (Priority = High) Refinement of bigeye parameters Pacific-wide: A comprehensive review and study of bigeye tuna reproductive biology	30,000		62,000		50,000	
Project 39. (Priority = High) Regional study of the stock structure and life-history characteristics of South Pacific albacore	25,000	500,000				
Project 42. (Priority = High) Pacific-wide tagging project	10,000	2,500,000	10,000			
Project 56. (Priority = Medium) Utilize underwater videos and other tools to characterize species, size composition and spatial distribution of tunas aggregating around floating objects	2,000					
Project 57. (Priority = High) Identifying provisional limit reference points for the key target species in the WCPFC	20,000		20,000		20,000	
Project 60. (Priority = High) Collection and evaluation of purse-seine species composition data	54,500					
SUB-TOTAL	216,500		117,000		95,000	
UNALLOCATED BUDGET	12,050		280,050[a]		318,556	
SPC-OFP BUDGET	700,000		720,000		792,000[b]	
GRAND TOTAL BUDGET	928,550	3,000,000	1,117,050		1,205,556	

[a] Annual budget for completed ERA was incorporated for new project(s).
[b] An annual increase of 10% from the previous year.

71. The SC recommended that:

i. Project 60 (the collection and evaluation of purse-seine species composition data) be funded for its second year (2010);
ii. Project 56 (underwater videos) be supported in 2010 with an allocation of USD 2,000;
iii. Consideration of funding support for the ERA project beyond 2010 be postponed to SC6;
iv. An increase in funding of USD 150,000 (to support the science and data management services provided by SPC-OFP) to USD 700,000 (includes ERA funding) to accommodate a new stock assessment and data management post.

72. The SC requested that the science services provider conduct assessments of WCPO bigeye and skipjack tuna for consideration at SC6.

73. There was discussion about the overall budget of the SC, with some CCMs noting that the existing Commission's science budget should be expanded. The SC noted that the value of the fisheries was approximately USD 4.8 billion, and that the science component of the Commission's budget equated to only 0.014% of this amount.

74. The SC also noted that because only USD 12,050 remains unallocated in the 2010 science budget, essentially no funds remain to support a call for expressions of interest to progress the scientific work programme.

75. Given the extensive scientific research that needs to be untaken to support the provision of good scientific advice to the Commission, as identified in the Commission's scientific work programme, the SC recommended that the Commission consider increasing the science budget significantly.

76. The SC recommended the 2010–2012 budget in Table 2 to the Commission.

ADMINISTRATIVE MATTERS

Peer review of stock assessments

77. The SC agreed on the following points with regard to the recommendation of the Independent Review in respect of peer reviews of stock assessments undertaken by the Scientific Committee for consideration by the Commission:

i. A periodic peer review was seen as strengthening assessments and their outcomes, improving transparency, building understanding and confidence, and helping to ensure best practice in the delivery of stock assessments to the Commission.
ii. The results or absence of a peer review may not be used as an excuse to delay conservation and management actions.
iii. The SC recommended to undertake a peer review of a single stock assessment initially, and use the outcomes of this review to determine the scope and resource demands that would be considered in formulating subsequent reviews.
iv. The SC recommended that an SPC-OFP assessment be selected for the initial review, in particular, the bigeye assessment undertaken for the WCPO;
v. Given the perceived difficulties in completing the assessment by May for the review to be undertaken in June, and the report made available in July (as recommended by MRAG), the SC proposed the following process for undertaking the review:
    a. undertake a detailed review of the selected stock assessment considered by the SC the previous year;
    b. provide an interim report to the Preparatory SA Workshop;
    c. undertake a short review of the completed stock assessment report;
    d. provide the report on completed review to SC;
    e. stock assessment group to provide comments on interim report provided to the Preparatory SA Workshop.
vi. Participation by reviewer(s) in the SC (and possibly the Preparatory Stock Assessment Workshop) was seen as possibly being beneficial but would have additional cost implications.
vii. The independence and expertise of reviewers would need to be balanced against costs when selecting reviewers.
viii. A range of options for selecting reviewers were noted, including:

a. CCMs
b. other RFMOs (e.g. IATTC)
c. the Center for Independent Experts — a group affiliated with the University of Miami (USA) that provides independent peer reviews of the US National Marine Fisheries Service science nationwide, including reviews of stock assessments for fish and marine mammals
d. MRAG.

ix. A recommendation on a specific reviewer is difficult to make at this time until the costs associated with each of these options are more fully understood. However, the SC saw considerable benefit in the independence of the selected reviewer.

78. The SC noted that if the review of the SPC-OFP assessment was undertaken during 2010, there may be additional cost implications.

79. The SC requested that the proposal for peer reviewing an SPC-OFP assessment be passed to the Northern Committee and ISC as an information paper for their consideration.

Independent Review of the Commission's Transitional Science Structure and Functions

80. The SC recommended that issues from Attachment Q requiring further discussion be raised with the Commission and its subsidiary bodies at subsequent meetings.

81. The SC agreed to task R. Campbell (Australia), the Secretariat, the SC Chair and Vice-Chair, and SWG convenors with developing a proposal for re-structuring SC meetings. This proposal will be distributed to the SC well in advance of SC6, and if acceptable, will be trialled at SC6.

Next meeting

82. SC6 will be held in Tonga, and is provisionally scheduled for 9–20 August 2010.

Election of the Vice-Chair of the Scientific Committee

83. The SC's Vice-Chair, Keith Bigelow (USA), will conclude his term at the end of WCPFC6 in December 2009. The SC expressed its sincere appreciation to K. Bigelow for his invaluable contributions. A new Vice-Chair, Pamela Maru (Cook Islands) was nominated and recommended to the Commission for endorsement. K. Bigelow agreed to assist P. Maru until the conclusion of SC6. This arrangement was forwarded to the Commission for endorsement.

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

Scientific Committee
Fifth Regular Session

Port Vila, Vanuatu
10–21 August 2009

SUMMARY REPORT

AGENDA ITEM 1 — OPENING OF MEETING

1.1 Welcome address

1. The Chair, N. Miyabe (Japan) opened the Fifth Regular Session of the Scientific Committee (SC5), which took place in Port Vila, Vanuatu from 10–21 August 2009. The Chair welcomed participants to the meeting. A list of participants is appended as Attachment A.

2. The Hon. Ham Lini, Vanua Roroa, Deputy Prime Minister, Minister for Justice and Acting Minister for Fisheries, Republic of Vanuatu, welcomed delegates to the meeting and to Vanuatu. His Welcome Address is appended as Attachment B.

3. On behalf of all participants, K.N. Chung, Chinese Taipei, thanked the Deputy Prime Minister for his welcome.

4. A. Wright, Executive Director of the Western and Central Pacific Fisheries Commission (WCPFC), provided the meeting with an opening statement (Attachment C).

5. Matters considered by the SC5 and its six Specialist Working Groups — Biology (BI), Ecosystem and Bycatch (EB), Fishing Technology (FT), Methods (ME), Statistics (ST), and Stock Assessment (SA) — included:

a) a review of the fisheries in the western and central Pacific Ocean (WCPO) and the eastern Pacific Ocean (EPO);
b) a review of the status of stocks of yellowfin tuna, bigeye tuna, South Pacific albacore tuna stocks, and swordfish stocks in the southwest and south central Pacific with a focus on requests for advice and recommendations arising from the Fifth Regular Session of the Commission (WCPFC5) in Busan, Korea in December 2008;
c) an appraisal of Conservation and Management Measure 2008-01 with respect to the potential for achieving the objectives of that measure;
d) a summary of the most recent information and assessments for tuna and billfish stocks in the North Pacific;
e) a dedicated session of the ME-SWG to discuss on reference points (RPs);
f) by-catch mitigation issues associated with seabirds, sea turtles, sharks, juvenile bigeye and yellowfin tunas;
g) issues associated with the data available to the Commission and initiatives to address data gaps,

h) a review of the advice and recommendations arising from the Independent Review of the Commission's Transitional Science Structure and Functions;
i) the status of the Indonesia and Philippines Data Collection Project (IPDCP)/West Pacific East Asia Oceanic Fisheries Management Project (WPEAOFMP), the Japan Trust Fund (JTF) and the Pacific Tuna Tagging Project (PTTP);
j) relations with other organizations;
k) the special requirements of small island developing States and territories;
l) the process for developing the programme of work for the SC and the 2010-2012 work programme and budget; and
m) administrative matters associated with the functioning of the SC, streamlining the operations of the SC, and reviewing the Commission's Research Plan.

6. The following countries attended the session as Commission Members and as participating territories: Australia, Canada, China, Cook Islands, European Union, Federated States of Micronesia, Fiji, French Polynesia, Japan, Kiribati, Korea, Marshall Islands, Nauru, New Caledonia, New Zealand, Niue, Palau, Papua New Guinea, Philippines, Samoa, Solomon Islands, Chinese Taipei, Tonga, Tuvalu, United States of America (USA) and Vanuatu. The following Members, Cooperating Non-Members and Participating Territories (CCMs) were unable to attend: American Samoa, Belize, Commonwealth of the Northern Mariana Islands, El Salvador, Guam, Indonesia, Mexico, Tokelau, Senegal, and Wallis and Futuna.

7. The United Nations Food and Agriculture Organization (FAO), Agreement for the Conservation of Albatross and Petrels (ACAP), Inter-American Tropical Tuna Commission (IATTC), Pacific Islands Forum Fisheries Agency (FFA), Secretariat of the Pacific Community (SPC), Birdlife International, Greenpeace, the International Scientific Committee for Tuna and Tuna-like Species in the North Pacific Ocean (ISC), the International Union for the Conservation of Nature (IUCN), and the International Sustainable Seafood Foundation (ISSF) attended as Observers.

1.2 Adoption of agenda

8. The agenda was adopted (Attachment D).

1.3 Meeting arrangements

9. 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, three steering committees met to discuss:

i. The Pacific Tuna Tagging Project;
ii. The Indonesia Philippine Data Collection Project (IPDCP)/ West Pacific East Asia Oceanic Fisheries Management Project (WPEA); and
iii. The Japan Trust Fund.

10. Several informal small groups (ISGs) were convened to consider the following matters:

i. The Independent Review of the Commission's Transitional Science Structure and Functions Report;
ii. SC's work programme and budget;
iii. The three-year arrangement with SPC's Oceanic Fisheries Programme (SPC-OFP);
iv. Sea turtle handling guidelines;
v. Peer review of stock assessment;
vi. Strategic Research Plan; and
vii. The process for formulating the SC's work programme.

1.4 Reporting arrangements

11. The Chair advised the session on expectations in relation to preparing formal reports for each SWG, the reporting of the steering committees, and ISGs to the plenary session during the second week of SC5 and the preparation of an Executive Summary that would serve as the basis for the report, advice and recommendations of the SC to the Commission.

12. A list of abbreviations and acronyms used in this report, and a list of documents for SC5 are included as Attachment E and Attachment F, respectively.

1.5 Intersessional activities of the Scientific Committee

13. The Commission's Science Manager, S.K. Soh, presented a brief report on the SC's intersessional activities for the last 12 months (WCPFC-SC5-2009/GN-IP-01).

AGENDA ITEM 2 — REVIEW OF FISHERIES

2.1 Overview of western and central Pacific Ocean fisheries*

14. P. Williams (SPC-OFP) and P. Terawasi (FFA) co-presented an "Overview of Tuna Fisheries in the Western and Central Pacific Ocean, Including Economic Conditions — 2008" (WCPFC-SC5-2009/GN-WP-01).

15. The provisional total Convention Area tuna catch for 2008 was estimated at 2,426,195 mt, the highest annual catch recorded, but only 6,000 mt higher than the previous record in 2007 (2,420,082 mt; Fig. 1). During 2008, the purse-seine fishery accounted for an estimated 1,783,669 mt (74% of the total catch, and a record for this fishery), with pole-and-line taking an estimated 170,805 mt (7%), the longline fishery an estimated 231,003 mt (10%), and the remainder (10%) taken by troll gear and a variety of artisanal gear types, mostly in eastern Indonesia and the Philippines. The Convention Area tuna catch (2,426,195 mt) for 2008 represented 81% of the total Pacific Ocean catch of 3,009,477 mt, and 56% of the global tuna catch (the provisional global estimate for 2008 is just over 4.3 million mt).

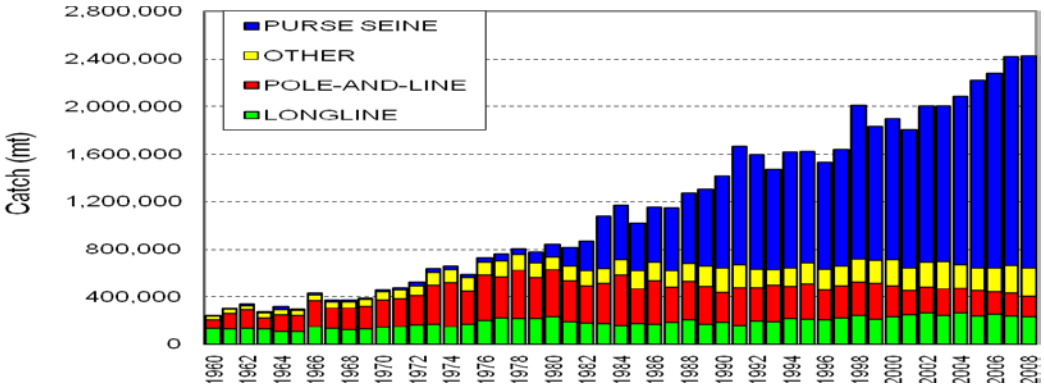

Figure 1: Catch (mt) of albacore, bigeye, skipjack and yellowfin tunas in the Convention Area, by longline, pole-and-line, purse-seine and other gear types.

16. The 2008 Convention Area catch of skipjack (1,634,617 mt – 67% of the total catch) was the second highest ever, and 74,000 mt less than the record catch of 2007 (1,708,605 mt; Fig. 2). The Convention Area yellowfin catch for 2008 (539,481 mt – 22%) was easily the highest on record and

nearly 77,000 mt (17%) higher than the previous record in 1998 (462,786 mt). The Convention Area bigeye catch for 2008 (157,054 mt – 6%) was the second highest on record (slightly lower than the record catch taken in 2004 – 157,173 mt), mainly due to a relatively high estimated bigeye catch from the purse-seine fishery. The 2008 Convention Area albacore catch (95,043 mt – 4%) was the lowest in over 10 years, with reduced catches experienced in both the South and North Pacific fisheries in 2008 compared with recent years.

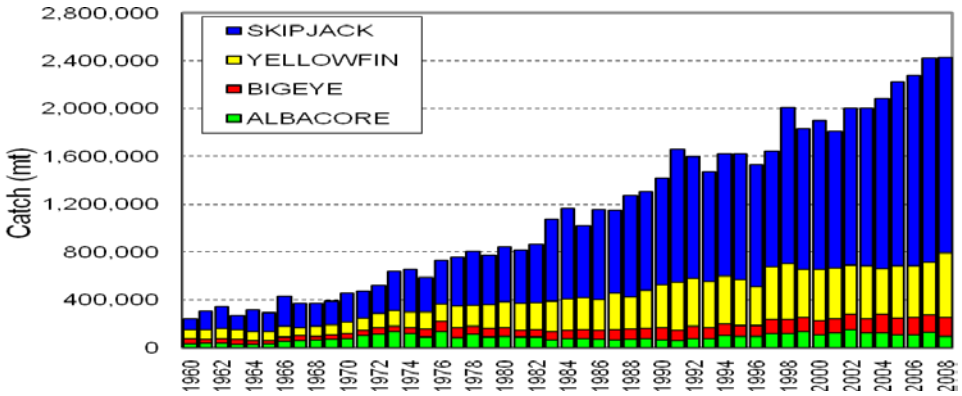

Figure 2: Catch (mt) of albacore, bigeye, skipjack and yellowfin tunas in the Convention Area.

17. The provisional 2008 purse-seine catch of 1,783,669 mt was the fifth consecutive record for this fishery but only 3,000 mt higher than the previous record in 2007. The 2008 purse-seine skipjack catch (1,409,921 mt – 79% of the total catch) was clearly lower than the record catch of 2007, although the purse-seine skipjack catch has now increased by more than 500,000 mt (or 59%) since 2001 (919,410 mt), at an average of about 70,000 mt per year. The 2008 purse-seine yellowfin catch (325,904 mt – 18%) was clearly the highest on record – the 2008 yellowfin catch was more than 95,000 mt (40%) higher than in 2007, and 65,000 mt (25%) higher than the previous record taken in 1998. The provisional catch estimate for bigeye tuna for 2008 (46,811 mt – 3%) was also the highest on record but may be revised once all observer data for 2008 have been received and processed (noting that purse-seine bigeye catches are adjusted to account for the mis-identification of bigeye as yellowfin in operational catch data, and reports of unloadings by a process that uses observer data).

18. The 2008 catch estimates for the key pole-and-line fleets operating in the Convention Area have yet to be provided, although the total catch estimate is expected to show a further decline in levels in recent years — carrying over 2007 catch estimates for these key fleets provides a provisional catch for 2008 of 170,805 mt, which is the lowest annual catch for this fishery since the mid-1960s.

19. The provisional Convention Area longline catch (231,003 mt) for 2008 was the lowest since 2000 and around 12% lower than the highest on record, which was attained in 2004 (262,584 mt). The Convention Area albacore longline catch (69,920 mt – 30%) for 2008 was the lowest since 2000. The provisional bigeye catch (87,504 mt – 38%) for 2008 was higher than the average for the period 2000–2008, and the yellowfin catch (69,516 mt – 30%) was similar to the 2007 catch, but the lowest since 1999.

20. The 2008 troll albacore catch (3,497 mt) was the highest since 2004, mainly due to good catches experienced by New Zealand's domestic fishery. New Zealand's troll fleet (168 vessels caught 3,349 mt in 2008) and USA's troll fleet (4 vessels caught 148 mt in 2008) typically account for most of the albacore troll catch, with minor contributions coming from fleets from Canada, the Cook Islands and French Polynesia.

Economic overview of WCPO tuna fisheries

PRICES: PURSE-SEINE FISHERY

21. Skipjack prices continued a strong uptrend that began in 2007 and reached record levels around mid-2008 with Bangkok benchmark skipjack prices (4–7.5 lb, cost and freight, c&f) at USD 1,920/mt and Yaizu prices at USD 1,929/mt. This upward trend follows from similar trends in global food and oil prices as well as shortages in skipjack supplies. This upward trend also contrasts with preceding years' trends, when between 1997 and 2001 prices plummeted to their lowest level with only modest recoveries between 2001 and 2006. Skipjack average prices in 2008 were at record levels with Bangkok prices averaging USD 1,543/mt while Yaizu prices averaged USD 1,768/mt. Respective averages in 2007 were USD 1,280/mt and USD 1,287/mt.

22. Purse-seine-caught yellowfin also displayed noticeable upward trends over the first half of 2008 (which was a continuation of the trend in 2007), followed by sharp declines in the third quarter of 2008. Bangkok yellowfin prices (20 lb and up, c&f) in 2008 averaged USD 1,969/mt compared with USD 1,773/mt in 2007. Yaizu purse-seine-caught yellowfin prices averaged USD 1,778/mt in 2008 compared with USD 1,430/mt in 2007.

VALUE: PURSE-SEINE CATCH

23. The estimated delivered value of the Convention Area purse-seine tuna catch in 2008 was USD 3,124 million. This exceeds last year's record level of USD 2,393 million and represents an increase of USD 731 million or 41%. The increase was driven by a USD 496 million (25%) increase in the delivered value of the skipjack catch estimated at USD 2,491 million in 2008, resulting from a 31% increase in the composite price that more than offset the decline of 4% in the catch. The value of the purse-seine yellowfin catch rose even more sharply, by almost 60%, to around USD 633 million as a result of a 13% increase in the composite price and a 41% increase in catch.

PRICES: POLE-AND-LINE FISHERY

24. During 2008, the Yaizu price of pole-and-line-caught skipjack in waters off Japan averaged JPY 243/kg (USD 2,353/mt), a decrease of 14% from 2007. By contrast, the Yaizu price of pole-and-line-caught skipjack in waters south of Japan increased, averaging JPY 250/kg (USD 2,420/mt) during 2008, a rise of 32%.

VALUE: POLE-AND-LINE CATCH

25. The estimated delivered value of the total pole-and-line catch in the WCPFC for 2008 was USD 372 million. This represents a 15% increase in the estimated 2007 catch value driven by a 28% rise in prices that more than offset the decline in catch of 11%. The estimated delivered value of the pole-and-line skipjack catch in the WCPFC for 2008 was USD 271 million. This represents a 32% increase in the estimated 2007 catch value resulting from a 34% increase in prices that more than outweighed a 2% decrease in catch.

PRICES: LONGLINE FISHERY

26. Longline-caught yellowfin prices (ex-vessel) landed at Yaizu rose by 13% to JPY 635/kg and average fresh yellowfin prices (ex-vessel) at selected Japanese ports dropped 11% to JPY 656/kg. Fresh yellowfin import prices (c.i.f., cost, insurance and freight – import price upto port of entry) rose 10% to

JPY 862/kg. In US dollar terms, the rise was greater as a result of the depreciation of the US dollar against the Japanese yen, with prices rising by 25% to USD 8.33/kg. Japanese import prices for fresh yellowfin sourced from Oceania rose 8% to JPY 925 /kg (USD 8.94/kg).

27. Frozen bigeye prices (ex-vessel) at selected major Japanese ports rose 7% in 2008 to JPY 857 /kg while fresh bigeye prices (ex-vessel) rose 4% to JPY 1,170/kg. Fresh bigeye import prices (c.i.f.) rose almost 1% to JPY 907/kg while frozen bigeye import prices (c.i.f.) rose 11% to JPY 743/kg. In US dollar terms, fresh bigeye import prices were up to USD 8.77/kg while frozen bigeye import prices rose 26% to USD 7.18/kg.

28. The Bangkok albacore market price (10 kg and up, c&f) averaged USD 2,225/mt in January 2008. According to the FFA database, the price level steadily rose in the following months to a peak of USD 2,650/mt in September. Prices dropped slightly in the months that followed, and held steady at USD 2,625/mt until December. Thai import prices improved by 28% in 2008 to USD 2,488 (2.49/kg) from USD 1,948/mt in 2007.

VALUE: LONGLINE CATCH

29. The estimated delivered value of the 2008 longline tuna catch in the Convention Area was USD 1,384 million. This represents an increase of USD 263 million in the estimated 2007 catch value. The value of the albacore catch increased by USD 20 million (13%) while the value of the bigeye catch increased by USD 148 million (26%), and the value of the yellowfin catch increased by USD 96 million (25%). The albacore catch was estimated to be worth USD 174 million in 2008, with the 13% increase being driven by the 28% increase in the composite price that more than offset a 12% decline in catch. The bigeye catch was estimated to be worth USD 724 million, with the catch rising 6% and the composite price increasing 18%. The estimated delivered value of the yellowfin catch (USD 486 million) was influenced by the 25% increase in the composite price.

2.2 Overview of the eastern Pacific Ocean fisheries

30. K. Schaefer (IATTC Secretariat) presented a review of EPO fisheries for 2007 (WCPFC-SC5-2009/GN-WP-02). The fishing capacity of the purse-seine fleet fishing in the EPO has increased over the last 10 years, but stabilized in mid-2006. The reported nominal longline effort has fluctuated between about 150 and 275 million hooks set annually between 1978 and 2007. Total tuna catches increased beginning in 1995, peaked in 2003, and then declined to levels of about 10 years previously.

31. Yellowfin tuna catches have remained fairly stable since the mid-1980s, except for a peak from 2001–2003 followed by a substantial decline from 2006–2008. The 2008 catch on dolphin associated schools remained low, similar to 2006 and 2007, and there were also reduced catches on unassociated schools. The stock assessment method for yellowfin has changed to the stock synthesis model. Since 2001 recruitment has been relatively low, although not quite as low as it was during 1977 through 1985. The spawning biomass ratio for 2008 is above the level corresponding to MSY. The spawning stock size is above MSY, and fishing mortality rates are close to those corresponding to MSY. The current stock status is considerably more pessimistic if a stock recruitment relationship is assumed.

32. The skipjack stock status has been evaluated using eight different data and model-based indicators. The purse-seine catch has been significantly increasing since 1994, and in 2008 was above the upper reference level. Except for a large peak in 1999, the catch per days fished on floating objects has generally fluctuated around an average level since 1992. Biomass and recruitment have been increasing over the past 10 years, and the exploitation rate has been increasing over the past 20 years. The main concern with the skipjack stock is the constantly increasing exploitation rate.

33. There have been substantial historical changes in the EPO bigeye fishery. Beginning in 1994, purse-seine catches increased substantially due to targeting tunas associated with drifting FADs in the equatorial EPO. Longline catches have been significantly less during the past 13 years, versus the previous 20-year period. Recruitment estimates have been above average from 2001–2008, except for 2007. Recent estimates indicate that the bigeye stock is overexploited and that overfishing is taking place. The recent spawning biomass ratio levels are below those corresponding to MSY and this result is consistent across various modeling scenarios.

34. A tuna conservation resolution was adopted by IATTC in July 2009, for the three-year period 2009–2011. This includes an EPO-wide closure for purse-seine (>182 mt) fishing of 59 days in 2009, 62 days in 2010, and 73 days in 2011, along with a 30-day closure of a core offshore FAD fishing area. For longline vessels (>24 m), the resolution includes fixed bigeye catch limits for China, Japan, Korea, Chinese Taipei and other CPCs (IATTC Party, cooperating non-Party, fishing entity or regional economic integration organization are collectively called "CPCs"), not to exceed 500 mt or their respective catches in 2001 (whichever is greater).

2.3 Annual Reports (Part 1) from Members, Cooperating Non-Members and Participating Territories (CCMs)

35. Members and Cooperating Non-Members presented annual Part 1 reports for 2008. Part 1 reports for 2008 were not available from El Salvador, Indonesia and Mexico at the conclusion of SC5.

Australia

36. Total catches reported in logbooks for the eastern tuna and billfish fishery (ETBF) decreased from 5,965 mt in 2007 to 5,505 mt in 2008. This is down from a peak of 8,229 mt in 2002. Longline fishing effort in this fishery has fallen from a peak of 12.40 million hooks in 2003 to 8.04 million hooks in 2008. This is mainly a result of the surrender of permits under the 2006 structural adjustment component of the recent Australian Government "Securing Our Fishing Future" package, increased operating costs and unfavorable export conditions, including the strength of the Australian dollar in 2008. Fifty-four vessels reported longlining in the Convention Area during 2008.

37. Logbook catch records for albacore tuna (*Thunnus alalunga*) decreased from 1,834 mt in 2007 to 1,083 mt in 2008. This was primarily a result of longliners switching from targeted albacore tuna techniques to other target species, mainly due to market forces. As a consequence, logbook catch records for the other four main target species increased in 2008 from those reported in 2007: bigeye tuna (*Thunnus obesus*) – 900 mt in 2008 (892 mt in 2007); yellowfin tuna (*Thunnus albacares*) – 1,478 mt in 2008 (1,251 mt in 2007); broadbill swordfish (*Xiphias gladius*) – 1,241 mt (1,202 mt south of 20°S) in 2008 and 1,133 mt (1,110 mt south of 20°S) in 2007; striped marlin (*Tetrapturus audax*) – 374 mt in 2008 (331 mt in 2007).

38. The Australian Fisheries Management Authority (AFMA) observer programme has deployed observers on domestic longliners since 2001 as part of a programme to test the effectiveness of seabird mitigation devices. Since July 2003, observers have been deployed more broadly across the fishery with the aim of collecting additional fishery data, including information on fishing gear and the size and species composition of catches. In 2008, observers monitored 834,698 hooks in the fishery (10.38% of the total number of hooks deployed in the fishery).

39. AFMA has agreed to manage the ETBF using output controls in the form of individually transferable quotas. AFMA has begun drafting the necessary amendments to the ETBF Management Plan to implement individually transferable quotas.

Canada

40. Catch, effort and catch per unit of effort data for the Canadian troll fishery targeting albacore (*Thunnus alalunga*) in the Convention Area for 2008 were summarized. Canadia focused exclusively on North Pacific albacore in the EPO in 2008 due to the availability of albacore in coastal areas of North America and high fuel costs. As a result, Canadian vessels did not fish in the Convention Area north or south of the equator. Both catch and effort by the Canadian fleet in the Convention Area have been declining since 2002. Historically, the total Pacific albacore tuna catch in the WCPO has ranged from 83 mt in 2005 to 453 mt in 2003; effort has ranged from 56 vessel-days in 2007 to 408 vessel-days in 2002. Canada participated in two ISC-Albacore Working Group meetings in 2008 and began a voluntary programme to record daily catch size composition data.

China

41. There are two types of tuna fisheries in the Convention Area: longline and purse-seine. The longline fishery consists of ice fresh tuna longline and deep frozen tuna longline. In 2008, the total tuna catch from the longline fishery was estimated at 33,980 mt while that for the purse-seine fisheries was 55,554 mt. China has 199 longline and 12 purse-seine vessels.

42. Catches of bigeye by Chinese deep longliners are exported to Japan for sashimi, and catch of albacore by longliners are sold for cannery products. Catches of skipjack by purse seiners are also sold for cannery products.

43. There were three scientific observers for Chinese deep longliners in 2008 and two scientific observers were sent to the high seas area of the Convention Area in 2009. The observers collected all relevant fishery data and biological data.

44. Data coverage of catch and effort was 100%. Since 1 Jan 2009, 100% logbook coverage collection for the longline fishery has been achieved. This will increase the quality of the data collected for Chinese vessels.

Cook Islands

45. In 2008, a change in licensing policy allowed the licensing of foreign fishing vessels. The initial policy that prohibited the licensing of foreign fishing vessels was implemented in 2000. During the implementation of this new policy, all licensing was put on hold, which contributed to the reduction in the total annual catch.

46. The Marine Resources Longline Fishery Regulations were adopted in 2008, imposing an effort limit of 40 fishing licenses for Cook Islands' EEZ, with a total catch limit of 4,000 mt in any consecutive four-quarter period. These regulations will be reviewed biennially.

47. The Cook Islands troll fleet has been diminishing over the years and has only had one troll vessel in its fleet since 2007. In total, 23 vessels were active in the longline fleet during 2008. The total annual catch estimate for 2008 for the Convention Area was 2,602 mt ,with the majority of this catch caught within Cook Islands' EEZ. Albacore contributed to 73% of the reported catch composition, bigeye 9.4% and yellowfin 8.8%.

48. With the threat of canneries closing in Pago Pago, the Cook Islands government is looking for alternative operation strategies for vessels operating in the northern fishery.

49. The re-established national observer programme recruited an observer from the Solomon Islands, who conducted seven trips on the small-scale vessels based in Rarotonga during the year. Of the total effort within national waters, 1% of total hooks were observed, however, this accounted for 9.6% of the effort for the Rarotongan-based fleet. From the observer data collected, albacore made up 22.5% of the total catch composition, and bigeye, yellowfin and skipjack made up 5.9%, 8% and 3.7%, respectively. Swordfish accounted for 4.6% of total observed catches. No interactions with sea turtles, seabirds or cetaceans were observed. Sharks accounted for 2.7% of observed catches, with six shark species identified.

50. Cook Islands is currently carrying out a hook standardization project to test the efficacy of 16/0 circle hooks on target species and bycatch catch rates. Swordfish tagging with P-Sat tags is also planned for September 2009.

European Community

51. There are two EC-Spain fishing fleets operating in the Pacific Ocean: a purse-seine fleet targeting tropical tuna, and a surface longline fishery targeting swordfish.

52. In 2008, four EC-Spain purse seiners, all with over 1500 mt (GRT), fished in the Convention Area, a similar number as in the previous year. Three of the vessels had 100% observer coverage from the Agreement on the International Dolphin Conservation Program. In the case of one vessel, most of the data came from the EC mandatory logbook. Total landed catches were 35,497 mt (5,751 bigeye; 24,987 skipjack; 4,759 yellowfin). There is no clear trend in the catch composition by area, nor in the effort distribution by time of the year.

53. Regarding the longline fishery, 17 longliners fished in the Convention Area (either year round or temporarily), while in 2007, there were 15 vessels. The vessels involved in the fishery are around 300 mt (GRT) and are 40.8 m in length on average. This fleet has continued operating the same way as in previous years; that is with monofilament, surface longline, American-style gear, and with an average of 1,000–1,400 hooks per set. The gear is usually set between late afternoon and midnight (thus, these are night sets). There are, on average, five branch lines between buoys, measuring over 14 m. Estimated swordfish catches in 2008 were 3,410 mt in the Convention Area, while in 2007 catches were 4,217 mt. In the case of the longline fleet, data are obtained from the mandatory EC logbooks, with 100% coverage. Swordfish size sampling was conducted for around 17% of catches in the whole Pacific Ocean in 2008. In the Convention Area, it was conducted for 17.4% of catches in 2007 and for 12.9% of catches in 2008.

54. Data on bycatch were also provided. For further details, please see the annual report to the Commission Part I (WCPFC-SC5-AR/CCM-05).

Federated States of Micronesia

55. The estimated 2008 total catch by purse-seine and longline vessels of the Federated States of Micronesia (FSM) within the Convention Area is 18,800 mt. Skipjack, yellowfin and bigeye are the key target species, accounting for 98% of catches; the remaining 2% were non-target species. Approximately 94% of the total catch is taken by purse-seine gear and 6% by longline gear. These are the only two gear types employed by FSM within the Convention Area. The total number of vessels employed by FSM in 2008 was five purse seiners and 21 longliners.

56. By species composition, skipjack accounted for 81% (15,245 mt) with yellowfin at 13% (2,472 mt), bigeye at 5% (846 mt), and other species at 1%. In general, the catch from FSM's domestic fleet within the Convention Area has increased 25% over 2007, and 49% over 2006 catches, mainly due to purse-seine catches. The total catch by FSM's longline fleet decreased compared with 2006 and 2007.

57. At present, data for the artisanal fishery are not available because these fall within the states' responsibility.

58. FSM's total EEZ catch in 2008 (by all gear types) was 37,338 mt (94% by purse seine and 6% by longline), comprising 77% skipjack, 17% yellowfin, 5% bigeye tuna, and 1% other species. By flag, Japan accounted for 38% followed by the USA with 24%, and Chinese Taipei with 23%, making these the three main purse-seine fleets with the most effort in FSM's EEZ in 2008. The total longline EEZ catch is reported as 1,193 mt with bigeye accounting for 59%, yellowfin 18%, billfish 15%, and other species 6%. By flag, FSM accounted for 56% of the total longline catch followed by Japan 17%, Chinese Taipei 14%, and China 13%.

59. In 2008, purse-seine effort was down to just 1,236 days, resulting in just 35,203 mt of catch, the lowest effort and catch over the last decade in FSM's EEZ for purse seiners. In contrast, longline effort increased in 2008 to 4,156 days, the highest over the last five years, but the corresponding catch was 1,632 mt, the lowest in the last five years. FSM's longliners accounted for nearly 60% of the longline effort in FSM's EEZ in 2008 but accounted for only 56% of the total longline catch overall.

60. FSM's observer programme operates with a pool of 12 observers. In 2008, there were 32 successful placements, 18 on longliners and 14 on purse seiners. The low number of purse-seine observer trips is attributed to longer purse-seine trip days in 2008 by FSM Arrangement vessels and US Treaty vessels compared to previous years.

61. Port sampling coverage for 2008 was 83% (an increase of 13% over 2007) for purse seiners and 89% for the longliners.

62. In 2008, 157 purse-seine vessels reported transhipping in FSM ports with a total volume of 111,819 mt of tuna transhipped. By species, skipjack accounted for 99%, with the remaining 1% comprising mixed yellowfin and bigeye. Pohnpei remains the most active port in FSM. The majority of the purse-seine vessels unloading in FSM in 2008 were Chinese Taipei purse seiners, accounting for 83 transhipments followed by the USA with 11, FSM Arrangement vessels with 22, FSM with 25, China with 9, and Korea with 7.

63. In total, 486 unloadings of longliners was reported in 2008, which amounts to 2,372 mt (56% bigeye 18% yellowfin, and 26% other species). Most of the unloaded volume by longliners was by FSM-flagged vessels (65%), followed by Chinese Taipei (20%), and China (15%).

Fiji

64. In the early 1990s, when fishing activity was relatively low, albacore accounted for about 50% of the tuna catch but this increased to around 70–80% from 1995 onwards. The yellowfin catch has remained throughout the years at 15–25% of total tuna catch with the highest recorded in 2004. The percentage composition of bigeye averages around 8%. The 2008 catches of these three tuna species totaled 11,024 mt from 96 longline vessels. There are no Fijian pole-and-line vessels operating in the WCPO.

65. Blue shark is the most common non-target species in the catch. Total non-target catches have decreased since 2006 from 4,660–3,050 mt in 2008.

66. Fiji continues to collect scientific information from its longline fleet through its observer programme. The team comprises 10 fully-fledged observers who are continually placed on Fijian-licensed longline vessels fishing principally within Fiji's national waters and occasionally in adjacent high seas pockets. Observers are also placed on US Treaty purse-seine vessels licensed under FFA, to which Fiji is a party.

67. In 2008, there were a number of collaborative studies undertaken with a number of fisheries agencies. This year, in collaboration with World Wildlife Fund-South Pacific, the Fisheries Department will be undertaking a project on the levels of bycatch of Species of Special Interest by longline vessels.

French Polynesia

68. The tuna fishery is a major component of the French Polynesian economy. The overall nominal catch for the commercial tuna fisheries in 2008 is estimated at 7,500 mt, of which 67% were caught by longliners. Albacore, the target longline species, accounted for 43%, with yellowfin tuna comprising 11%, skipjack 13% and bigeye 7%. Port and observer sampling occurred in 2007. The longline fleet is entirely based in Tahiti, and this facilitates port sampling operations. The longline fleet usually exploits one-half to two-thirds of the EEZ, but the core fishing ground remains as it historically has been in the north part of the EEZ (10–20°S and 140–150°W) and around Tahiti. Since 2001, no foreign fleets have operated in French Polynesia.

Japan

69. The total number of commercial longline vessels (>10 GRT) was 533 in 2007, which is 47 vessels (8%) less than that in 2006. In 2009, the national fleet reduction programme caused 87 of these longline vessels to stop fishing. The total number of pole-and-line vessels (>20 GRT) was 116 in 2007, which is 7 vessels (6%) less than in 2006. For purse-seine vessels, the number of vessels over 200 GRT, which operate in equatorial waters, was 36 in 2008, which was that the same as in 2007. The number of the purse-seine vessels between 50 GRT and 200 GRT, which operate in the area north of 20°N, was 36 in 2008. This represents an increase of two vessels over 2007 levels.

70. The total Convention Area catch of tunas (Pacific bluefin, albacore, bigeye, yellowfin and skipjack) by the Japanese fishery in 2007 was 482,840 mt, which corresponds to 105% of the 459,679 mt catch in 2006. In 2007, the tuna catch by the purse-seine fishery was 270,997 mt (56% of the total catch of tunas), with 128,632 mt (27%) by pole-and-line, 69,943 mt (15%) by longline, and the remaining 3% by the other gear types. The local coastal skipjack fishery has suffered from low catches during these five years, and in the 2009 fishing season the offshore skipjack fishery in temperate waters also reported low catches.

71. Japan started an observer programme for the longline fishery in 2008, and covered four trips in this fishery in addition to the ongoing observer programme for the purse-seine fishery. With respect to research activities on tunas, tagging studies for tropical tunas and sharks, bluefin tuna larval sampling, longline fishing and collection of gonad samples for albacore were conducted. Currently, research investigating the behavioral characteristics of juvenile bigeye in order to develop a technique for reducing the catch of small tunas on FADs is being conducted in the western Pacific with the participation of an R/V of the Fisheries Agency, a Fisheries Research Agency experimental tuna purse seiner and a commercial purse seiner. In addition, bycatch mitigation research involving experiments comparing the

effectiveness of two types of tori line (normal type and light streamer type) were conducted. Results confirmed that there is no significant difference between the performance of these two types of tori lines

Kiribati

72. Tuna fishing in Kiribati is predominately carried out by foreign fishing vessels, although artisanal fishermen continue to play an important role in this fishery by providing food security for local people. These artisanal fishermen use small skiffs and local craft that are less than 7 m in length. In 2008, around 4,800 of these small craft were operating, with an estimated total catch of around 12,600 mt valued at around AUD 33 million, which is equivalent to what Kiribati received from access fees. Most of the artisanal catches were sold locally while some were kept for subsistence use.

73. Kiribati joint venture purse-seine vessels continued to fish in Parties to the Nauru Agreement (PNA) Member waters under the FSM Arrangement. The highest reported catch occurred in 2005 at over 7,100 mt. In subsequent years, the catch level dropped but then progressively increased to over 5,700 mt in 2008.

74. With a limited capacity to harvest its own tuna resources, Kiribati continues to license foreign fishing vessels to fish for tuna within its EEZ in return for access fees. In 2008 over 400 licenses were issued. In that year, the purse-seine catch exceeded 192,000 mt, an increase of around 16% when compared with the previous year. In the longline fishery there was a substantial drop in catch by around 86% in 2008 (882 mt) if compared to the 2007 catch of 6,500 mt. This can be attributed to the delay in logsheet submission from fishing operators, as well as a drop in the number of vessels fishing in Kiribati's waters.

75. In 2008, access fees contributed around 40% towards the country's national budget. The tuna fishery continues plays a very important role in achieving the country's social and economic aspirations. Because of the fishery's great social and economic value, it is very crucial for Kiribati to see that the management and development of tuna resources is sustainable in the long term.

Korea

76. Over 90% of Korea's total Pacific Ocean tuna catches are taken from the Convention Area. Convention Area catches fluctuated between 216,000 mt and 285,000 mt, averaging 262,000 mt. Purse-seine catches during the last five years ranged from 183,000 mt to 258,000 mt, averaging 231,000 mt. Skipjack and yellowfin tuna comprised 80.3% and 19.6% of this catch, respectively. Korea's longline fishery targets bigeye and yellowfin tuna, with minor catches of albacore, and comprising 86.0% of the total catch. Billfish and other fish species are incidentally caught by the longline fishery. Total annual catches of these species by longliners in the Convention Area ranged from 22,800 mt to 38,400 mt during the past five years. The number of longliners and purse seiners fishing in the Convention Area in 2008 was 108 and 28, respectively, which represents a decrease of 14 longliners compared with the previous year.

77. The fishing strategy of Korean tuna longliners changed due to soaring fuel prices. These vessels no longer want to move long distances to search for fish and so they are operating mainly in the western Pacific rather than the eastern Pacific.

78. Korea's Ministry for Food, Agriculture, Forestry and Fisheries initiated the development of an observer programme for distant-water fisheries, including tuna fisheries, in 2002. In 2008, five observer trips totaling 462 days were conducted to monitor Korean tuna longline and purse-seine fisheries, of which four trips were carried out in the Pacific Ocean.

79. Biological sampling of 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 tunas. In total, 1,653 skipjack, 1,010 bigeye, 3,419 yellowfin and 368 albacore tunas were sampled for morphometric measurements and gonad somatic index during 2008.

80. To solve practical problems commonly encountered by fishermen when recording bycatch species, the National Fisheries Research and Development Institute (NFRDI) issued a "Field Guide to Bycatch Species in Korean Distant-Water Fisheries" in 2008. This field guide provides color drawings or photos of 333 species of target and bycatch species for the Korean tuna fisheries, including sharks, seabirds, sea turtles and cetaceans.

81. NFRDI introduced a new logbook data sheet this year for collecting bycatch species data; the logsheet includes five to six species of seabirds, sea turtles and sharks.

Marshall Islands

82. The tuna fishery in the Republic of the Marshall Islands (RMI) comprises foreign-flagged purse-seine, pole-and-line and longline vessels and RMI-flagged purse-seine and longline vessels. Some of the foreign-flagged longline vessels operate in support of domestic development activities and are based locally.

83. In 2008, the total catch of the national purse-seine fleet operating throughout the WCPO was 32,218 mt, which is slightly more than half of the previous year's total catch of over 59,000 mt. Conversely, the national longline fleet catch increased from just 6 mt in 2007 to 552 mt in 2008.

84. Available catch estimates from fleets operating within RMI's EEZ in 2008 indicate a decline in catches when compared with the previous year, with the exception of the locally based foreign longline fleet whose catch experienced a slight increase.

85. The Marshall Islands Marine Resources Authority continues to run an active observer and port sampling programme, with 1,653 sea days observed and nearly 79,000 fish measured during 2008.

Nauru

86. Nauru reported the essential information on coastal state reporting obligations in its annual report. This focused on the main fishery, which is the offshore purse-seine fishery of fishing partners. The report included annual catch estimates from the fleets and the composition of vessels in those fleets. Annual catch estimates were fairly consistent from 2004–2008 with a range of 50,000–60,000 mt.

87. The report also included artisanal catch estimates from the inshore fishery. There was a marked increase in the 2008 estimates, which is attributed to improved data collection methods by the fisheries authorities.

New Caledonia

88. Fishing for tuna and associated species by New Caledonian vessels started in 1981 with pole-and-line (less than three vessels), which stopped very rapidly (1981: 228 mt; 1982: 998 mt; 1983: 492 mt).

89. Longliners started operating at the same time, and it took almost 20 years before this domestic fleet showed significant activity.

90. In 2008, 23 domestic longliners fished in New Caledonia's EEZ. No licenses have been issued to foreign vessels since early 2001.

91. A 14% catch increase was reported last year as a consequence of a similar increase of fishing effort. The annual catch of 2,384 mt was mainly composed of albacore, which comprised 62% of the total (1,506 mt). Yellowfin was the second most abundant species (424 mt and 18%).

92. Shark catches have been decreasing since 2006 due to an increasing use of monofilament branch lines.

93. After appointing a new programme coordinator under the SciFish project, port sampling and observer activities resumed in mid-2008, reaching a coverage level of 9.5% of all longline sets for the second half of the year. The main objective of these activities is to collect information for cross-checking with other data sources, particularly logsheets.

94. New Caledonia (through the ZoNéCo programme) also continues to participate in regional efforts to improve knowledge of tuna behavior, in particular South Pacific albacore, as this is the main species of interest for its fishery. Information paper EB-SWG-IP6 presents the first conclusion of this ecosystem approach to albacore stock dynamics.

New Zealand

95. Since 2002, skipjack (25,244 mt in 2008), which is nearly all taken by purse seine, has comprised the greatest part of the New Zealand catch of all tuna species, both within and beyond its fisheries waters. Outside New Zealand's fisheries waters, yellowfin (2,897 mt) make up most of the balance. Yellowfin are rarely part of the purse-seine catch within New Zealand's fisheries waters due to the domestic purse-seine fishery focusing on free schools of skipjack. The second most important component of New Zealand's domestic fisheries is albacore (3,739 mt), taken mostly by troll gear but also landed as target and bycatch species by the longline fishery. Despite the fact that the domestic longline fleet targets both bigeye and southern bluefin tuna and more recently swordfish, the greatest part of the catch consists of albacore. Over 150 mt of striped marlin are caught annually by the recreational fleet, with well over half the fish tagged and released. Most highly migratory species caught in New Zealand's waters are exported, and the destination of exports varies depending on the species.

96. New Zealand has four Class-6 purse seiners fishing offshore in the EEZs of Pacific Island States and in high seas areas of the equatorial WCPO. These vessels have also fished domestically along with six smaller capacity domestic-based purse seiners. The number of purse seiners has declined from 11 vessels in 2005 to 10 vessels in 2008. New Zealand's tuna longline fleet consists of domestically owned and operated vessels (mostly between 15 m and 25 m in length). The number of longline vessels operating in New Zealand has declined from 151 vessels in 2002 to 35 in 2008.

97. Blue shark is the most common non-tuna bycatch species in the longline fishery followed by Ray's bream. Recent reductions in longline effort have resulted in catch reductions of major bycatch species.

98. New Zealand's longline vessels fishing south of 30^{o}S are required to use tori lines in order to reduce seabird catches during the setting process. In addition, longline vessels fishing for tuna or swordfish in New Zealand's fishery waters may only set their lines at night unless using line weighting. New Zealand's longline vessels have been provided with turtle de-hooking and mitigation equipment. Because the purse-seine fishery in New Zealand's fishery waters is based on free schools of skipjack,

bycatch is minimal (e.g. 1% by mass). No interactions with non-fish bycatch (e.g. seabirds, turtles, and marine mammals) were observed in the purse-seine fishery. Purse-seine operators have agreed to apply purse-seine provisions of FAO guidelines with respect to sea turtle handling and mitigation, and the provisions of CMM-2008-03 by way of a code of practice.

99. New Zealand has an observer programme and two active domestic port sampling programmes. In 2008, 18.2% of longline effort (hooks) was observed, and almost 28% of the New Zealand purse-seine sets were observed. A considerable amount of research is directed at tunas, tuna-like species and bycatch species in New Zealand. Fishers and fish receivers are required to furnish returns (monthly reports) to the Ministry of Fisheries. New Zealand has four systems in place to collect catch and effort data, as well as a system for collecting information on non-fish bycatch from fishers.

Niue

100. Niue's 2008 longline fishing effort and activity was constrained to one active alia-designed longline vessel fishing within Niue's EEZ targeting primarily albacore tuna. This vessel also landed catches of bigeye and yellowfin tuna and associated bycatch species such as wahoo (*Acanthocybium solandri*) and mahi mahi (*Coryphaena hippurus*). Catches for 2008 equated to just over 17 mt.

101. Niue plans to undergo a review of its management of pelagic fisheries (under the current Tuna and Billfish Management Plan and development policy) with a view toward employing the ecosystems approach to fisheries management. This will include a review of the current sustainable catch limits. In addition, an ecological risk assessment is also likely to provide additional information for the ongoing sustainable management of pelagic longline resources within Niue's EEZ in the future.

102. Niue continues to undertake collection of valuable catch statistics through the implementation of the port sampling programme, and collection of catch and effort data as outlined in its National Data Collection and Procedures document.

Palau

103. The longline fishery in Palau's EEZ continues to be the most important contemporary fishery. The longline fishery has been dominated by domestically and offshore-based foreign fleets of Japan and Chinese Taipei since the 1950s. Japanese longline effort declined in the 1980s but is increasing, while the Chinese Taipei and Chinese fleets have been dominant since 1990. Up to 300 vessels have operated within the EEZ in any one year, with the number of vessels fluctuating between 85 and 164 since 2000.

104. In 2006, the total catch reached its highest level of nearly 5,000 mt. Bigeye tuna has been the dominant species since the late 1980s. Catches of bigeye continued to increase over the previous years, and in 2008 were 25% less than in 2006 when the highest bigeye catches were recorded. Recent yellowfin tuna catches are much lower than in previous years. Besides these two species of tuna, there are much smaller catches of other species dominated by blue marlin and swordfish; however, catches of these two species have been less than 100 mt each in recent years.

105. The central-eastern area of Palau's EEZ is where most longline effort and catch are focused. Fishing effort in 2008 declined compared with 2007. Chinese Taipei fleets continue to fish in the central-eastern area year round as opposed to the recent operation of the Japanese fleet. Japanese longline effort was more pronounced in the southern part of Palau's EEZ but recently, this effort shows a greater concentration in the northern part.

106. The general catch per unit of effort for all fleets operating in Palauan waters over the last four years is gradually increasing for bigeye (except for 2007), while yellowfin has been decreasing.

Papua New Guinea

107. The tuna fishery of Papua New Guinea (PNG) is made up of purse-seine and longline sectors. The longline sector is a domestic fishery with all vessels fishing only in PNG waters. The purse-seine sector is a mix of both domestic and foreign access vessels. The domestic sector comprises PNG flag vessels and PNG chartered vessels that support onshore processing facilities in PNG. PNG chartered vessels fish both within PNG's waters and waters outside of PNG, especially those licensed under the FSM Arrangement.

108. The 2008 catch in PNG's waters declined from 2007 levels. Longline catches dropped from 2,858 mt in 2007 to 1,209 mt in 2008. This was a result of a reduction in effort from 60,000 hundred hooks to 20,000 hundred hooks. The catch by domestic purse-seine vessels in PNG's waters increased slightly to 24,723 mt, which was an increase from 21,494 mt in 2007. However, the catch by these vessels dropped to almost zero (0.3 mt) outside PNG's waters, indicating that the fleet fishes almost entirely within PNG's waters. Catch in PNG waters by PNG chartered vessels in 2008 was 112,286 mt, a decline from the 2007 catch of 124,572 mt. Catch by these vessels outside PNG's waters also dropped from 80,030 mt in 2007 to 65,901 mt in 2008. The catch by foreign vessels in PNG's waters in 2008 was 249,866 mt, a decrease from the 2007 catch of 320,132 mt.

109. All declines in catch were due to declines in effort. Total catch in PNG's waters for 2008 was 388,084 mt, which was a decrease from the 2007 catch of 466,208 mt. Most of the sets in PNG's waters in the last five years were associated sets, in particular, sets on logs and debris.

110. PNG's observer programme currently has about 150 observers, but will increase to 200 observers by the end of 2009. Observer coverage level by PNG observers has been very high for all fleets fishing in PNG. Coverage level on domestic purse-seine vessels is about 90%, on PNG chartered purse-seine about 60%, and on foreign vessels just under 30%. Port sampling has been carried out in four major ports, and results of the 2008 sampling are presented in the paper WCPFC-SC5-2009/EB-IP-16.

Philippines

111. The Philippine fishing industry consists of the municipal and commercial sectors, with the former involving vessels less than 3 GRT in size, and under the jurisdiction of the Local Government Units. Larger commercial vessels (> 3GT) are required to fish outside the municipal waters, more than 15 km offshore, and are required to secure commercial fishing vessel licenses from the Bureau of Fisheries and Aquatic Resources (BFAR). Fishing vessels fishing on the high seas are also required to secure international fishing licenses from BFAR. The Republic Act 9379 or the Handline Fishing Law instituted a separate category for handline vessels targeting large pelagic fish. Over 1.5 million people depend on the fishing industry for their livelihood.

112. Provisional 2008 catch estimates for the three tuna species of concern to WCPFC are: skipjack – 222,010 mt; yellowfin – 168,411 mt; and bigeye – 35,141 mt. Catch breakdown by species needs further review and verification.

113. Ongoing research activities of the National Stock Assessment Program have continued to collect data on species composition, length-frequency, and vessel catch and effort information from key tuna landing sites around the country. The West Pacific East Asia Oceanic Fisheries Management Project will help strengthen national capacities and international cooperation on priority transboundary concerns

relating to the conservation and management of highly migratory fish stocks in the western Pacific Ocean and Southeast Asia (Indonesia, Philippines and Vietnam).

114. BFAR launched a catch documentation scheme that includes a catch and effort logsheet system for purse-seine and ringnet vessels. Aside from this, BFAR also requires canneries to submit monthly cannery unloading data. All of these efforts are geared towards improving tuna statistics and data gathering.

115. BFAR also conducted observer training in June 2009. There are currently 30 trained observers ready to board vessels, especially those vessels intending to fish during the FAD closure period (1 August–30 September 2009). BFAR is also working in close collaboration with the private sector for the development of the national vessel monitoring system (VMS).

116. The Philippines, through BFAR-NFRDI is making great efforts to improve data collection and to strengthen its national capacity and international cooperation on transboundary concerns in relation to the sustainable conservation and management of highly migratory fish stocks.

Samoa

117. Samoa's tuna fishery is composed of a troll fishery and a tuna longline fishery. Both fisheries operate within Samoa's EEZ of approximately 120,000 km^2, and involve vessels ranging from 9 m to over 20 m in length.

118. The troll fishing fleet, comprising some 25 alia fishing vessels (catamaran style) 9–11 m in length, landed just over 154 mt of fish in 2008, and has averaged around 132 mt annually over the past three years.

119. Samoa's tuna longline fishery is much more industrialized, and the bulk of the catch is exported. The fishery targets South Pacific albacore, and all the catch landed is caught within Samoa's EEZ. An estimated 2,977 mt of fish were landed from the tuna longline fleet in 2008, a decrease of around 20% from the 2007 catch. Albacore comprised over 78% of the total tuna longline catch in 2008. Yellowfin tuna catches accounted for around 10.6% of the total catch in 2008, followed by bigeye tuna at around 3.6%. Pelagic species, including broadbill swordfish, marlin, wahoo, dolphin fish and others, comprised the rest of the catch. The fishery involves some 44 vessels, of which over half are alia vessels as well as some bigger vessels 12.5–20.5 meters in length. The tuna longline fishing fleet is based in Samoa and the participation is highly domestic.

Solomon Islands

120. The Solomon Islands tuna fishery can be divided into three categories: 1) the artisanal fleet, 2) the domestic industrial fleet and 3) the distant-water industrial fleet. All three are equally important and essential contributors to national food security, employment and foreign exchange.

121. The artisanal fleet is characterized by dug-out wooden pirogues and outboard motor-powered canoes that operate in nearshore coastal waters. Catch estimates for this fleet for 2008 and preceding years are unknown. The Fisheries Department needs to find a cost-effective means of getting reliable estimates for this fleet in the future.

122. The industrial domestic fleet consists of vessels owned, operated and chartered by local companies, notably Soltai and NFD Ltd. Production from purse seiners and pole-and-line vessels by the domestic industrial fleet for 2008 was 18,646 mt, declining from 20,075 mt in 2007. This decline is

indicative of the continuing decline of Soltai Ltd's fishing fleet, which in 2008 had only 5 vessels as compared with 14 in the previous year. The difficulty is due to Soltai's ongoing financial situation. Of the overall catch volume by the domestic industrial fleet in 2008, 92% was from purse seiners while only 8% was from pole-and-line vessels. Species composition was 93% skipjack and 7% yellowfin for pole-and-line vessels, and 40% skipjack, 57% yellowfin and 3% bigeye for purse-seine landings.

123. The industrial distant-water fleet consists of foreign-owned vessels that are licensed to fish within the country's EEZ. Fleets from 12 foreign countries undertook fishing in 2008 with a total catch of 85,859 mt, an increase from 63,911 mt in 2007. The fleet consists of 145 longline vessels, 174 purse-seine vessels and 12 pole-and-line vessels. The overall catch volume comes from purse-seine catches (86%) followed by longline catches (10%) and pole-and-line catches (4%). In terms of countries, catch volumes are dominated by China, Japan, Korea and Chinese Taipei, all of which have more than 50 vessels each operating within Solomon Islands' EEZ. Catch composition by longline vessels consists of 85% skipjack, 11% yellowfin, 2% bigeye and 2% albacore. In comparison, the catch by purse-seine vessels consists of 87% skipjack, 11% yellowfin and 2% bigeye. Total recorded landings for all fleets in Solomon Islands' EEZ for 2008 is 104,505 mt, an increase from 83,986 mt in 2007.

124. Fishing effort in 2008 by purse-seine vessels of the industrial, distant-water fleet focused in the northwestern part of Solomon Islands' EEZ, extending to the EEZs of PNG, Nauru and FSM. Significant fishing also occurred in the southwestern part of the EEZ. Foreign longline effort is centered in the southern part of Solomon Islands' EEZ, extending to Vanuatu's EEZ. Significant longline effort is also being expended in the eastern and western part of the EEZ.

125. Solomon Islands has an active national observer programme that closely collaborates with FFA in the regional observer programme (ROP). All observers are placed on purse-seine vessels; none are placed on longline vessels. This limitation means that Solomon Islands lacks independent data on seabird and sea turtle mortality caused by longlining activities. Observer data from purse-seine vessels shows silky shark to be the main bycatch in Solomon Islands' EEZ. An independent bycatch report will be produced for SC6. Solomon Islands plans to achieve 100% purse-seine vessel observer coverage and 5% longline vessel coverage in 2010.

Chinese Taipei

126. Three types of Taiwanese tuna fishing operations take place in the Convention Area: large tuna longline fishery (LTLL fishery), distant-water purse-seine fishery (DWPS fishery) and small tuna longline fishery (STLL fishery). In 2008, total catches of LTLL and DWPS were 18,484 mt and 203,973 mt, respectively. The total catch of tuna and tuna-like species by the STLL fishery was 37,537 mt in 2008. In 2008, there were 84 LTLL vessels, 1,260 STLL vessels, and 34 DWPS vessels operating in the Convention Area.

127. In 2008, 21 observers were dispatched to the Pacific Ocean for onboard observation of LTLL or DWPS vessels, and for the collection of fishing and biological data. The main shark catch of LTLL and STLL in 2008 was blue shark. From 2002–2006, 23 trips on LTLL fishing vessels were observed in the Pacific Ocean. Observation days totaled 1,590, with an average coverage rate of 3.5% by trips. Forty-three trips of LTLL observer data in Pacific Ocean from 2004 to 2007 were used to analyze the scale of discard and bycatch species. Seabirds and sea turtles were bycatch in these trips, but no cetaceans were caught.

Tokelau

128. Tokelau's tuna fisheries contain two elements. The first is the small, but important, artisanal fishery, comprising small boats ranging from 12–16 foot. Fishing is primarily for local consumption using troll and handline methods. The government is developing a strategy for Tokelauans to participate in a small-scale commercial tuna fishery. The second is the offshore fishery, which is currently undertaken by licensed vessels from New Zealand, Chinese Taipei, United States, and Vanuatu. There are no Tokelauan-flagged fishing vessels. Average fishing effort during 2002–2008 was around 100 vessel days, resulting in average catches of 2,000 mt of skipjack, and 190 mt of yellowfin tuna.

129. Tokelau presently has a small fisheries administration with only three staff members. The tuna research and statistics needs of Tokelau are largely met by the support of the SPC-OFP. All foreign fishing vessels are required to carry on board an FFA-approved automatic location communicator or mobile transmitting unit, and while within Tokelauan waters they are monitored by FFA's VMS workstations that were installed in Tokelau in 2004. Tokelau has yet to establish observer and port sampling programmes.

Tonga

130. The operation of the tuna longline fleet in Tonga continued in 2008 in a similar manner as in 2007, but with fewer fishing vessels than those reported to SC4 in 2007. Tonga continued to operate its tuna fishery as a fully domestic longline fleet only, operating mainly within Tonga's EEZ.

131. The tuna fishery's total catch quantity and value for 2008 declined, despite having increased since 2004. This is a result of effort reduction and is consistent with the decline in the number of active fishing vessels. However, the total annual fishery catch rate (i.e. catch per unit of effort, CPUE) has increased since 2004 and continued to do so in 2008. This trend is based on increasing CPUE of yellowfin even though CPUE for albacore and bigeye have declined. Yellowfin comprised the highest percentage of the total tuna catch for 2008 with a large component of the remainder of the catch being albacore and bigeye. Most Tongan longline vessels target bigeye and yellowfin tuna for fresh fish markets, with high catches of albacore tuna. Dolphinfish and sharks dominated the bycatch. From observer reports, the Tongan tuna fishery has no impacts on species of special conservation interest (e.g. turtles, marine mammals and seabirds).

132. SPC-OFP continued to provide assistance to Tonga Fisheries with relevant information about tuna stocks in Tongan waters relative to the entire WCPO stock. The total tuna catch by the Tongan fleet in 2008 is not likely to have any major impact on the regional stock or the WCPO stock. Despite the ample room for improvement and development of tuna fleets in Tonga, high fuel costs have restricted fishing operations to areas near the main fishing port, Nuku'alofa.

133. Tonga Fisheries continues to improve its tuna data collection systems established a few years ago with assistance from SPC-OFP and FFA, and recently by the Commission. This system includes port sampling, observer coverage on domestic vessels through the ROP, and a compulsory domestic VMS programme. At the same time, the Commission's measures and resolutions are being implemented and monitored by Tonga Fisheries.

Tuvalu

134. Fleet structure in 2008 was relatively the same as in previous years. A sudden surge in fishing effort (days) occurred in recent years, particularly for the US purse-seine fleets. Some fishing vessels transhipped their catches in the Funafuti lagoon in 2008.

135. The artisanal fleet landed a total catch of 25.7 mt. In contrast, foreign fleets landed a total catch of 36,463 mt. The purse-seine fleet accounted for 99.6% of this total; longline fleets contributed 0.3%. Unfortunately, no catch data are available for pole-and-line fleets.

136. Collection of data on artisanal catches is extremely poor. Fish centers in rural areas represent the only places where fisheries information can be obtained. However, information is very limited and restricted to fish purchases and sales only.

USA

137. Large-scale US fisheries for highly migratory species in the Pacific include purse-seine fisheries for skipjack tuna (*Katsuwonus pelamis*) and yellowfin tuna (*Thunnus albacares*); longline fisheries for bigeye tuna (*Thunnus obesus*), swordfish (*Xiphias gladius*), and associated species; and a troll fishery for albacore (*Thunnus alalunga*). Small-scale fisheries include troll fisheries for a wide variety of tropical tunas and associated species, handline fisheries for yellowfin and bigeye tuna, and a pole-and-line fishery for skipjack tuna. Associated species include other tunas and billfishes, mahi mahi (*Coryphaena hippurus*), and wahoo (*Acanthocybium solandri*). The large-scale fisheries operate on the high seas, within the US EEZ, and within the EEZs of other states. US small-scale fisheries operate in the nearshore waters in the EEZs of American Samoa, Commonwealth of the Northern Mariana Islands, Guam and Hawaii.

138. Total USA landings in the WCPFC statistical area in 2008 increased as a result of increased purse-seine activity. Purse-seine landings increased to 157,849 mt (or 78% over 2007 landings) in 2008. Longline landings decreased in 2008 after peaking in 2007. Bigeye tuna and albacore landings by longline vessels reached record highs in 2007 of 5,599 mt and 5,426 mt, respectively. Excluding landings from US territories (i.e. American Samoa), longline landings of bigeye tuna declined from 5,381 mt in 2007 to 4,526 mt in 2008. Swordfish longline landings decreased slightly to 1,302 mt in 2008 from a peak of 1,441 mt in 2007. Small-scale (tropical) trollers and handliners operating in Pacific Island waters represented the largest number of US-flagged vessels but contributed a small fraction of landings. The longline fleet was the next largest fleet, numbering 156 in 2008, the same as in 2007. The albacore troll fishery declined, with active vessels reduced from 6 in 2007 to 4 in 2008.

139. The US National Oceanic and Atmospheric Administration's National Marine Fisheries Service (NMFS) conducted a wide range of research on Pacific tuna and associated species at its Southwest and Pacific Islands Fisheries Science Centers, and in collaboration with scientists from other organizations. Monitoring and economic survey work included retail market monitoring in Honolulu to explore market impacts of regulations and how price changes affect producers, retailers and consumers. Economic studies showed increasing costs of longline fishing operations primarily due to rising fuel prices. Interviews were conducted to explore longline fishermen's experiences with bycatch reduction methods. Longline observer data were used to describe shark catches. Stock assessment research was conducted in collaboration with Member scientists of WCPFC and ISC.

140. NMFS biological research on tunas, billfish and sharks addressed fish movements, habitat choices, post-capture survival, and age and growth. Results included a high rate of post-release survival of longline-caught sharks. A meta-analysis of pop-up satellite archival tag deployments across a wide variety of species over many years indicated very low retention of tags to their programmed pop-up dates, and found lower tag reporting rates for deep-diving species and increasing tag reporting rates in recent years. Research on bycatch and longline fishing technology included continued testing of circle hooks to reduce sea turtle bycatch or to demonstrate successful fishing for target species, and testing of electropositive metal ingots to reduce shark bycatch.

Vanuatu

141. Vanuatu's fleet consists of 27 purse-seine vessels and 64 longline vessels. The number of active vessels in the Convention Area in 2008 was 61 distant- and offshore-based longliners, 9 offshore fleet vessels based in Fiji and Vanuatu, and 18 bilateral access, Vanuatu-flagged purse-seine vessels fishing under FSM and PNG bilateral agreements.

142. Catch and effort coverage for Vanuatu's fleet has been high but size data coverage is uncertain due to a lack of onboard observers, especially most longline vessels, and due to a lack of unloading data from landing ports. Within Vanuatu's EEZ, the only foreign fleet with high catch and effort data coverage is Fiji's fleet. In the period 2004–2008 annual catch estimates of Vanuatu's fleet have generally increased as has fishing effort (sets) and the number of fish per 100 hooks. For purse-seine vessels, there were more sets on unassociated than associated schools. Catch estimates were determined from logsheet data raised using information on actual vessel activity (e.g. VMS data).

143. The major tuna species caught by the longline fleet were albacore (60%), yellowfin (16%) and bigeye (10%). Unraised and provisional estimates for the longline fleet in 2007 were 9,339 mt, 1,558 mt and 936 mt for albacore, bigeye and yellowfin, respectively.However, if raised, these figures would be higher. Catch estimates for 2006–2008 were taken from SPC's TUFMAN database system. Logsheet coverage is not known but is expected to be high. Catch estimates prior to 2006 include areas outside the Convention Area. Billfish estimates for 2006–2008 come from logsheets.

144. Data for Vanuatu's EEZ were based on unraised logsheet data. Fishing in Vanuatu's EEZ was by foreign fleets from China, Fiji and Taiwan. Based on the number of license issued in 2008, the Taiwanese fleet has decreased but the Chinese and Fijian fleets have increased rapidly. It is likely that by 2009, all foreign-flagged, locally based vessels will be required to unload all of their catch in Port Vila; therefore, we expect 100% coverage in port.

Wallis and Futuna

145. Wallis and Futuna communicated to the Secretariat that it does not currently support any domestic tuna fisheries but that it has plans to develop tuna fishing in the near future.

Belize

146. Belize's longline tuna fleet operating in the Convention Area has shown a steady decrease in its catch and effort from 2003–2008. There has been a reduction of 30 vessels fishing in 2003 to 6 in 2008. All six vessels were licensed exclusively for operation within the Convention Area. There were a further four longliners that were also licensed to fish in the Convention Area but did not do so in 2008. Belize now has one reefer carrier currently operating in the Convention Area. Due to the reduction in fishing effort, all of Belize catches have decreased when compared with earlier years. There has been a 92% reduction in overall catches from 3,446 mt in 2003 to 283 mt in 2008, and a 58% reduction in overall catches from 683.8 mt in 2007. However, this reduction is a result of four vessels being laid up for a little over six months due to socioeconomic costs. Albacore was the main target species from 2003–2006, although catches of yellowfin tuna exceeded those of albacore in 2007 and 2008. The average size of vessels has also risen from 191 GRT in 2003 to 646 GRT in 2007 and 497 in 2008. The majority of vessels operating during 2003–2006 were between 51 GRT and 200 GRT. In 2008, five Belizean vessels were over 500 GRT and one was under 100 GRT.

147. Black marlin is the most common non-tuna bycatch in the longline fishery followed by blue marlin and sailfish. Large reductions in longline effort have also resulted in the reduction of major bycatch species.

148. No seabird or sea turtle interactions were reported by Belizean vessels in 2008. In 2008, measures were introduced to mitigate the impacts to seabirds and sea turtles and the Secretariat was advised of the measures currently being used by Belizean vessels.

149. Fishing vessel owners and operators are required to submit data on their fishing operations based on a format that is in compliance with WCPFC's reporting guidelines. For the purpose of ensuring compliance, surveillance is conducted on a regular basis or as a result of an investigation.

150. In the future, it is intended to re-expand the longline fishing fleet to eight active fishing vessels exclusively in the Convention Area, which will fish within the limits set by WCPFC.

Senegal

151. Tuna in Senegal are exploited by four activities: industrial, longline, artisanal and recreational fishing.

152. With regard to industrial fishing, the main species fished in Senegal are: yellowfin, skipjack and bigeye tunas. Tuna catches in 2008 are estimated to be 6,983 mt, consisting of 816 mt of yellowfin, 2,278 mt of skipjack, 804 mt of bigeye and 3,085 mt of mixed tuna. Landings of tuna fishing in the port of Dakar in 2008 were mainly provided by a fleet of seven vessels.

153. Senegal's longline fishery is composed of three vessels targeting swordfish. These vessels conducted fishing operations in the Indian Ocean and the Pacific between 2003 and 2007. In 2008, the total catch of these vessels amounted to 140 mt, of which 137 mt were swordfish and sharks. This compares to 160 mt caught in the Atlantic.

154. Artisanal fisheries use lines (hand troll) or small seines to target tunas, mackerels, bonitos, Spanish mackerel, and wahoo, with swordfish and marlins as bycatch. Artisanal fishing catches showed a decrease of smaller s tuna species between 1991 and 2000, followed by an increase in 2000 with a peak in 2004.

155. Recreational fishing in Senegal is monitored in the two major fishing areas of Dakar and Mbour. Sport fishing activities target swordfish, marlin and sailfish. The fishing season is from May to December. There was a decrease in catches from 1996–2004 for Dakar.

156. Collection of fisheries catch and effort data is conducted daily at the port for the fishing industry, and at various landing sites for artisanal fisheries. Samples are taken from landings at the port of Dakar. Billfish sampling is conducted at the main landing ports for artisanal fisheries. Regarding the implementation of CMMs, Senegal has established monitoring and control of all fishing activities, inspections are conducted at the port, and vessels engaged in illegal fishing are identified.

Discussion

157. Observations raised during the presentation of national reports included:

i. A request for better characterization of bycatch in the EC longline swordfish and purse-seine fisheries;

ii. An explanation from Chinese Taipei regarding the relatively large skipjack catch by their purse-seine fishery but apparent associated low catches of bigeye. Chinese Taipei explained that data are obtained from vessel logbook data, which is reconciled against cannery receipts.

2.4 Reports from regional fisheries bodies and other organizations

158. On behalf of Greenpeace, G. Quirk presented a statement to SC5; further details are provided in SC5-GREENPEACE. Greenpeace called upon the SC to recommend i) the establishment of fully protected marine reserves in the four high seas pockets between Pacific Island countries; ii) an immediate precautionary cut of 50% in effort from 2001–2004 levels for the entire Convention Area; iii) an immediate ban on transhipment at sea and the use of FADs; and iv) implementation of ecosystem-based management approaches and precautionary limits. In addition, Greenpeace urged the SC to fully use the spatial ecosystem and population dynamics model (SEAPODYM) model to forecast environmental effects due to climate change, and incorporate these into stock assessments. The SC was also encouraged to investigate the feasibility of using trade data to correct catch data for stock assessments, and to establish a programme to collect trade data from CCMs for this purpose.

159. On behalf of FAO, J. Majkowski made a presentation on FAO's activities with regard to tuna. He noted the ongoing re-organization of the FAO Fisheries and Aquaculture Department, including changes to the names of units to better reflect their activities. A re-organization of information on tuna on FAO's website has been nearly completed. Three global databases of tuna catches have been updated, including catches by: i) species, FAO statistical area and year; ii) species, stock, fishing gear and year; and iii) species, fishing gear, 5x5 degree square, year and quarter. The preparation of seven relevant documents (proceedings from a 2007 workshop, and a primary publication, on estimation of tuna fishing capacity; an historical perspective on the status of tuna stocks; past tuna fisheries management and future challenges; recent developments in the tuna industry; bycatch in tuna fisheries; and fishery resources off Pacific SIDS) were highlighted. The SC was asked to consider joining the FAO's Fishery Resource Monitoring System as outlined in WCPFC-SC5-2009/GN-WP-18.

AGENDA ITEM 3 — SPECIALIST WORKING GROUPS

3.1 SWG reports

Report of the Biology SWG

160. The Biology SWG (BI-SWG) met for half a day on 15 August 2009, and was convened by M. Ogura (Japan). Five working papers were submitted by participants. Two working papers covered basic biology such as age, growth, and maturity of striped marlin and skipjack. One working paper investigated yellowfin biological parameters for the assessment model. Two other working papers reported progress of ongoing research programmes on bigeye and South Pacific albacore. The BI-SWG recommends to support these two research programmes as well as further research on biological parameters of striped marlin, and to promote biological studies of species of interest in the Convention Area to improve stock assessments. The full report of the BI-SWG is provided as Attachment G.

Report of the Ecosystem and Bycatch SWG

161. The Ecosystem and Bycatch Specialist Working Group (EB-SWG) met on 13 August 2009 and was convened by P. Dalzell (USA); 10 working papers were presented, with 16 supporting information papers. There were four main topic areas on the agenda for this meeting, including Ecosystem Effects of Fishing, Sharks, Seabirds, and Turtles. Under "Ecosystem Effects of Fishing" the EB-SWG heard about the progress of SPC-OFP's work on ecological risk assessment (ERA), and recent developments in the

application of the SEAPODYM model for examining long-term ecosystem effects of fishing. A blue shark stock assessment was presented to the EB-SWG under the "Sharks" agenda item, as well as the feasibility of conducting future stock assessments on key shark species. A novel approach to estimating Pacific shark catches from the volume of shark fins traded through Hong Kong was also presented under this agenda item. Under the "Seabirds" agenda item, there was a review of seabird bycatch mitigation measures, and a summary of research on spatial risk indicators for seabird–longline interactions. The "Turtles" agenda item included an overview of longline and purse-seine interactions with sea turtles in the WCPO, and a review of the Commission's sea turtle safe handling guidelines. Also presented under "Turtles", was a presentation on a preliminary minimum sea turtle interaction limit of shallow-set longline fisheries in the WCPO. The EB-SWG provided 10 recommendations 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

162. The Fishing Technology SWG (FT-SWG) met during the morning session of 14 August 2009, and was convened by D. Itano (USA). Three working papers and two information papers were made available to the FT-SWG for consideration by the SC. The papers described studies on FAD characteristics related to catch composition and the use of underwater video to assist acoustic discrimination and avoidance of juvenile tuna and bycatch. A third paper prepared in response to para 24 of CMM-2008-01 provided information relevant to the marking and monitoring of FADs and set the stage for discussion and the provision of advice regarding the scientific objectives and data needs of FAD-related research. The meeting was also informed of projects and research initiatives of IATTC, EC and ISSF related to bycatch mitigation and the reduction of fishing mortality on small tuna resulting from purse-seine effort on floating objects. The FT-SWG provided advice to the SC for consideration under agenda item 5.2 and endorsed an operational research plan for 2009-2010 and a medium-term work programme for the SWG. The full report of the FT-SWG is provided as Attachment I.

Report of the Methods SWG

163. The Methods Specialist Working Group (ME-SWG) met during the morning session on 11 August. R. Campbell (Australia) served as convenor. Acting on a directive agreed at WCPFC5, this meeting of the ME-SWG was devoted to a special workshop on reference points (RPs). The aims of this workshop were to provide more capacity building on this issue and review some of the technical characteristics of RPs. Two working papers were presented to, and reviewed, by the meeting while one additional working paper and information paper were also noted. Recommendations from the two consultancy reports presented to past meetings of the SC were reviewed, and a work programme was discussed and adopted to further progress the identification of appropriate RPs for WCPFC. This work programme identified a number of short-term tasks to be undertaken over the next 12 months and to be presented to SC6, and outlined the main components of issues to be addressed over the longer term to progress work on the development of candidate decision rules and appropriate harvest strategies. The ME-SWG also recommended that the SC support, and provide input to, the proposed Workshop on Management Objectives to be held in 2010, and that SC6 undertake to make a recommendation to the Commission on appropriate provisional (limit) RPs, both types and associated values, for key target species. The full report of the ME-SWG is attached as Attachment J.

Report of the Statistics SWG

164. The Statistics SWG (ST-SWG) met for several sessions during the first week of the SC. K. Duckworth (New Zealand) served as convenor. The ST-SWG considered 12 items on its agenda, and presentations were received on 11 documents. The full report of the ST-SWG is provided as Attachment K. One particularly noteworthy recommendation was that all CCMs familiarize themselves, and comply

with, the obligations of the Commission's data submission standards, and that the TCC consider non-compliance with data reporting obligations as a significant part of the compliance with Ccnservation and management measures working group process. In addition, the SWG agreed to support the continuation of Project 60 on collecting and evaluating purse-seine species composition data.

Report of the Stock Assessment SWG

165. The meeting of the Stock Assessment SWG (SA-SWG) took place from 11–12 August 2009. K. Bigelow (USA) served as convenor of the meeting. Eight working papers were presented to the SA-SWG, including CPUE standardizations for assessment indices, and stock assessments for WCPO bigeye and yellowfin tuna, and South Pacific albacore. Two methodological working papers were incorporated from the ME-SWG given the special session on RPs. On the basis of the presentation of the stock assessment working papers and the discussions of the SA-SWG, stock status descriptions and management advice and implications were formulated for three species: WCPO bigeye and yellowfin tuna and South Pacific albacore. The SA-SWG identified short- to medium-term research items to advance stock assessments of WCPO bigeye, yellowfin and skipjack tuna. The full report of the SA-SWG is provided as Attachment L.

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

4.1 WCPO bigeye tuna

a. Status and trends

166. The SA-SWG selected six assessment runs to represent the stock status of bigeye tuna. For all six model runs, $F_{current}/F_{MSY}$ is considerably greater than 1, ranging from 1.51–2.01 for a variety of assumptions with similar steepness (~0.98). The range of $F_{current}/F_{MSY}$ ratios indicate that a 34–50% reduction in fishing mortality is required from the 2004–2007 level in order to reduce fishing mortality to sustainable levels at a steepness of ~0.98. The results indicate a 61% reduction in fishing mortality if a lower value (0.75) of steepness is assumed. All of the results conclude that overfishing is occurring on the WCPO bigeye tuna stock.

167. Current spawning biomass exceeds the estimated spawning biomass at MSY (>1.0) for five of the six assessment runs chosen ($SB_{current}/SB_{MSY}$, Table 1), indicating that the WCPO bigeye stock is not in an overfished state if the spawning biomass reference period is 2004–2007. However, if the spawning biomass period is considered as 2008 (SB_{latest}/SB_{MSY}), then only one of the six runs indicates that the bigeye stock is not in an overfished state. The bigeye stock status is concluded to be in a slightly overfished state, or will be in the near future. The calculated MSY, based on recent recruitment (average of the last 10 years), was almost double long-term MSY estimates, but still 20% below recent catches.

168. The 2009 bigeye assessment is comparable to the 2008 assessment (Table 1), although there are differences in catch and effort data, size frequency ,and a few different structural assumptions. The 2009 range of $F_{current}/F_{MSY}$ estimates are substantially higher than the 2008 assessment value, and largely relates to the shift of the MSY-window from 2003–2006 to 2004–2007 for the updated 2009 model.

169. All of the models that were run using the 2009 data were rerun assuming the previous MSY time window (2003–2006) to see how the view of the past has changed. Not only have conditions deteriorated since the previous assessment, our view of past conditions is now more pessimistic. For example, $F_{current}/F_{MSY}$ for run 10 when calculated using the period 2003–2006 is 1.57 compared with 1.44

from run 4 in the 2008 assessment. The main reason for this appears to be the shift in selectivity for the increasingly influential domestic fisheries in Indonesia and the Philippines.

Table 1: Comparison of reference points from the 2009 bigeye stock assessment, considering six sensitivity analyses and the 2008 assessment.

Management Quantity	2009 Assessment	2008 Assessment
Most Recent Catch	134,315 mt (2008)	143,059 mt (2007)
MSY and MSY(recent R)	Range: 52,120–67,800 mt Range:110,000–146,114 mt	Base case: 64,600 mt Range: 56,800–65,520 mt
$\mathbf{F_{current}/F_{MSY}}$	Range: 1.51–2.55	Base case: 1.44 Range: 1.33–2.09
$\mathbf{B_{current}/B_{MSY}}$	Range: 1.11–1.55	Base case: 1.37 Range: 1.02–1.37
$\mathbf{SB_{current}/SB_{MSY}}$	Range: 0.85–1.42	Base case: 1.19 Range: 0.76–1.20
$\mathbf{Y_{Fcurrent}/MSY}$	Range: 0.12–0.92	Base case: 0.94 Range: 0.50–0.97
$\mathbf{B_{current}/B_{current,\ F=0}}$	Range: 0.18–0.29	Base case: 0.26 Range: 0.20–0.28

b. Management advice and implications*

170. The SC provides management advice for bigeye tuna with regard to: i) the 2009 stock assessment; ii) evaluation of the effectiveness of CMM-2008-01 to obtain the objective of a 30% reduction in fishing mortality from 2001–2004 levels; and iii) the frequency and necessity of consistent advice from the SC.

171. The SC concluded that the 2009 assessment indicates a continued decline of the WCPO bigeye stock as noted in previous assessments. Fishing mortality in relation to MSY ($F_{current}/F_{MSY}$) is considerably greater than 1, ranging from 1.51–2.01 for a variety of assumptions with similar steepness (~0.98) in the stock recruitment relationship. The range of $F_{current}/F_{MSY}$ ratios indicate that a 34–50% (average of 43% when steepness is assumed as 0.98) reduction in fishing mortality is required from the 2004–2007 level in order to reduce fishing mortality to sustainable levels. Current spawning biomass in relation to MSY indicates that the WCPO bigeye stock is not in an overfished state if the spawning biomass reference period is 2004–2007. However, if the spawning biomass period is 2008, then the bigeye stock is overfished. The bigeye stock status is concluded to be in a slightly overfished state, or will be in the near future with high levels of overfishing occurring. The SC also noted the continued high fishing mortality on juvenile bigeye due to associated purse-seine sets and the fisheries of Indonesia and the Philippines.

172. The SC supported an evaluation of CMM-2008-01 (WCPFC-SC5-2009/GN-WP-17), which indicates that the objective of a 30% reduction in fishing mortality on bigeye by 2011 will not be achieved. The lack of effectiveness of CMM-2008-01 is broadly related to: i) reductions in longline catches that do not result in the required reduction in fishing mortality; ii) increases in both purse-seine effort allowed under the measure, and purse-seine efficiency since 2001–2004; and iii) exclusion of archipelagic waters, which encompasses most of the fishing activity of the Indonesian domestic fisheries and some activity by the Philippines' domestic fleets.

173. The 2009 stock assessment concludes that a 34–50% reduction in fishing mortality from 2004–2007 levels is required to keep the biomass above MSY levels. This is an increase from the 30%

reduction recommended by SC4 and the 25% reduction recommended by SC2. While Members agreed that consistent advice should be provided to WCPFC on necessary reductions of fishing mortality, some Members indicated that the evaluation of newly introduced measure (CMM-2008-01) is based on a variety of assumptions and the actual behavior of the fisheries and consequent effects on the stocks have not been evaluated yet.

174. A significant time-lag exists between implementing a management measure and detecting a stock response from an assessment. Results of management implemented in 2009 will only be detected in a 2011/2012 assessment due to delays in providing data and significant uncertainty in estimates of fishing mortality and biomass in the last year of the assessment.

175. While acknowledging the delay between management action and quantifying a stock response, the SC noted that the combination of increased fishing mortality on bigeye tuna to levels well above F_{MSY} (as documented in the 2009 assessment and the inadequacy of CMM-2008-01 in reducing fishing mortality by 30%) implies that stock biomass will continue to decline if the longer effective action is delayed. The SC views the identification and implementation of effective management measures to address the inadequacy of CMM-2008-01 as the most urgent issue facing the Commission with regard to maintaining the sustainability of target tuna stocks.

i. Although CMM-2008-01 will not achieve the targeted reduction in fishing mortality, the SC supports the objectives of the CMM but recommends that further actions be identified and implemented to ensure the achievement of these objectives.
ii. To give effect to recommendation, SC recommends a 30% reduction in fishing mortality from the 2001–2004 level in order to return fishing mortality to MSY levels (F_{MSY}).
iii. The SC recommends that the Commission note that recent estimates of F/F_{MSY} (i.e. 1.51–2.01, reference years 2004-2007) indicate that fishing mortality has increased significantly since 2001–2004; therefore, the 2009 streamlined assessment indicates a reduction in fishing mortality of 34–50% from 2004–2007 levels would be required, although there are some uncertainties.
iv. The SC recommends that the Commission's science services provider (SPC-OFP) conduct analyses for WCPFC6 (see Attachment M) on the predicted annual catches and resulting fishing mortality and spawning biomass for a range of scenarios that illustrate the impacts of:
    a. The various exemptions, special considerations and areas not covered by the CMM by modelling the factors above with and without them incorporated into the measure; and
    b. Potential management options to strengthen the CMM, such as various percentage reductions in longline and purse-seine FAD catch and effort.
v. The SC endorsed a draft work plan prepared by SPC-OFP to guide this work.
vi. The SC also recommends that an assessment of bigeye stock status and evaluations of updated or additional CMMs aimed at reducing fishing mortality on bigeye be undertaken. An assessment of whether fishing mortality on bigeye and the objectives of CMMs are being achieved should be undertaken on an annual basis.
vii. The SC encourages all CCMs to provide data required to conduct stock assessments in a more timely manner so that the data between the most up-to-date assessment outcomes and management advice can be reduced to one year.

4.2 WCPO yellowfin tuna

a. Status and trends

176. The SA-SWG convenor noted that because a stock assessment was not conducted in 2008, SC4 did not provide new advice to the Commission. The management advice from SC3 to the Commission was that the WCPO yellowfin tuna fishery can be considered to be fully exploited, with both the 2006 and

2007 assessments indicating a high probability that overfishing is occurring. 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 rate of fishing mortality would be required.

177. Three specific issues were raised in discussions about stock assessment results and the SA-SWG report.

i. It was generally agreed that the stock assessment results from the 2009 model are more optimistic than those in 2007, meaning that the general nature of advice required from SC5 may need to be different from previous years. However, a comparison of 2007 and 2009 stock assessments with similar steepness values indicate only a slight improvement.
ii. In noting this generally more optimistic state, the SC also noted advice from the SA-SWG that Region 3, which supports approximately 95% of the catch, has significantly higher fishery impact than other regions. This means that the more optimistic status may be "buffered" by biomass in other regions. SPC-OFP reminded the meeting that spatial heterogeneity exists throughout the regions, and it is unlikely that mixing is rapid enough to transfer fishery impacts in the short term, if at all. For some CCMs, this highlighted the importance of having a specific recommendation for Region 3, noting that specific information was provided in the SA-SWG report.
iii. It was also noted that this year the SA-SWG provided advice on a range of model runs with different values of assigned steepness, each of which could be as feasible as the others. It would, therefore, be very difficult to provide the level of prescription in the recommendation that was provided in 2007, due to the sheer number of results that would need to be presented.

178. The SC adopted the stock status of WCPO yellowfin tuna from the SC5 SA-SWG report.

b. Management advice and implications*

179. The range of estimates of $F_{current}/F_{MSY}$ ratios (0.41–0.85) in the 2009 assessment was lower than the base-case estimate (0.95) in the 2007 assessment. This change is largely due to the addition of fisheries data, assumptions of steepness, and because the period for computing the MSY-based RPs was advanced two years (from 2002–2005 to 2004–2007). Estimates of $F_{current}/F_{MSY}$ indicate that the entire WCPO yellowfin stock is not experiencing overfishing and the entire stock appears to be capable of producing MSY. Estimates of $SB_{current}/SB_{MSY}$ indicate that the yellowfin stock in the WCPO is not in an overfished state.

180. The SC noted a slightly improved status for the WCPO yellowfin stock compared with the 2007 stock assessment. However, the SC also noted that levels of fishing mortality, exploitation rates and depletion differ between regions, and that exploitation rates were highest in the western equatorial region, which accounts for ~95% of the total yellowfin tuna catch, and that the spawning biomass in this region is estimated to have declined to about 30% of the unexploited level. The SC reiterated SC3's advice that exploitation rates differ between regions, and that exploitation rates continue to be highest in the western equatorial region. The SC recommended that there be no increase in fishing mortality in the western equatorial region.

4.3 Requests from CMM-2008-01

a. High Seas Vessel Day Scheme

181. WCPFC's Executive Director recalled that WCPFC4 (para 325d) had requested the Secretariat to start a process in early 2008 to support the implementation of similar measures [*sic* vessel day scheme, VDS)] to limit purse-seine effort on the high seas, consistent with para 9 of CMM-2005-01, and in waters

under the national jurisdiction of non-PNA Members of the Commission, consistent with para 10ii of CMM-2005-01. As part of that process, SC4 and TTC4 were invited to consider:

i. the unit of measurable fishing effort to apply to purse-seine vessels; and
ii. the availability of data for a suggested unit of purse-seine effort in the high seas and the waters under the national jurisdiction of non-PNA Members of the Commission.

182. Subsequently, WCPFC5 invited CCMs to provide comments on the options and recommendations contained in WCPFC5-2008/13, and referred the issue of a high seas VDS to SC5 and TCC5 for further discussion (WCPFC5 Summary Record, para 168 and 169).

183. The ST-SWG had been presented with a report from the Secretariat (WCPFC-SC5-2009/GN-WP-16), advising of developments during 2009, including provisions of CMM-2008-01 relating to the implementation of the Commission's VMS, communications with CCMs concerning validation of historical (2001–2004) high seas, purse-seine effort, and the fate of historical effort in the high seas pockets when they are closed in January 2010. It was noted that this item would also be discussed at TCC5.

184. Kiribati, speaking in its role as Chair of PNA, noted that PNA Members have already submitted a response to the Secretariat on the issues raised, and that any high seas VDS:

- must not restrict the development of small island developing States;
- should not include historical effort from the high seas pockets, which are being closed (as this would result in an undesirable relocation of effort); and
- should be separate from in-zone VDSs, and days should not be transferable between the two.

185. One CCM referring to the interventions that they had already made within the ST-SWG, stated that the issue is wider than just the high seas VDS because it also impacts on allocation. There is a need to consider the excess fishing mortality that may shift into EEZs due to a provision for "existing arrangements" under the South Pacific Tuna Treaty (SPTT)[1], longline exemptions, archipelagic waters exemptions, and other exemptions.

b. FAD management and monitoring

186. WCPFC's Executive Director noted that CMM-2008-01 required the Secretariat to prepare a report on FAD management options for consideration by SC5, TCC5 and the Commission. The report was to include i) marking and identification of FADs; ii) electronic monitoring of FADs; iii) registration and reporting of position information from FAD-associated buoys; and iv) limits to the number of FADs deployed or number of FAD sets made. He advised that the FT-SWG had received a report from the Secretariat on these matters (WCPFC-SC5-2009/FT-WP-01).

187. FT-SWG's convenor asked that the meeting keep in mind the scientific issues related to FAD management plans, specifically the scientific uses to which information describing FADs can be put. He noted the FAD-related work is documented in the report of the FT-SWG.

188. The SC supported the recommendations and work plan items relevant to FAD marking and monitoring as adopted during the FT-SWG session of SC5.

[1] The Multilateral Treaty on Fisheries between the US government and certain Pacific Island States.

c. Fishing effort for bigeye and yellowfin tuna from other commercial tuna fisheries

189. WCPFC's Executive Director noted that para 39 of CMM-2008-01 required CCMs to provide the SC with estimates of fishing effort or proposals for the provision of effort data from other commercial fisheries north of 20°N and south of 20°S for 2009 and future years. He advised that no CCMs had responded to a request from the Secretariat to provide this information by 1 July 2009 (so that the information could be compiled for SC5). The Executive Director noted that the Secretariat already held information for a number of CCMs (WCPFC-SC5-2009/GN-WP-09). He noted that considerable gaps exist in the limited effort data held by SPC-OFP for these other commercial tuna fisheries.

190. New Zealand made the following statement on behalf of FFA Members: FFA Members appreciate the efforts of the Secretariat to encourage those Members with fisheries other than longlining and purse seining between 20°N and 20°S to supply the data called for in para 39 of CMM-2008-01. We are disappointed that these data appear to not have been provided, because the arrangement to provide these data was part of a compromise to continue with capacity limits for these other fisheries (rather than move to effort limits). We propose that the SC refer this issue to the TCC for consideration and action.

191. Samoa supported the intervention made by New Zealand, and specifically that this issue should be referred to the TCC for consideration and action.

192. The SC:

i. noted that the deadline for submission of these data has already passed;
ii. encouraged CCMs to submit these data as soon as possible; and
iii. recommended that non-compliance with data submission obligations be referred to the TCC for their consideration and action.

d. Review of CMM-2008-01

193. The Chair drew attention to para 46 of CMM-2008-01, which requires that "the Scientific Committee will provide scientific advice to the Commission for its annual review on the impacts and compliance with this Measure".

194. A paper (WCPFC-SC5-2009/GN-WP-17) was presented by WCPFC's science services provider, SPC-OFP, outlining an assessment of the potential implications of the application of CMM-2008-01 to bigeye and yellowfin tuna.

195. This assessment points out that CMM-2008-01, adopted in December 2008, seeks to reduce fishing mortality on bigeye tuna by 30% from the 2001–2004 average level, and limit yellowfin tuna fishing mortality to its 2001–2004 level, in order to maintain stocks at levels capable of producing MSY. This objective is pursued though a combination of measures involving longline catch limits, purse-seine effort limits, a closure relating to purse-seine fishing using FADs and a closure of two high-seas pockets to purse-seine fishing. Most of these measures have various exemptions or alternatives built in and are phased in over the period 2009–2011. The purpose of the paper is to conduct a technical evaluation of CMM-2008-01 to see if it is capable of meeting its objectives. The method used for the evaluation involves conducting stock projections over a 10-year period (2009–2018) using two alternative stock assessment models for bigeye and yellowfin tuna each as a base. The alternative models for each species have different assumptions concerning purse-seine catches, which are a major data uncertainty for both assessments. In conducting the projections, levels of longline catch (in the case of bigeye tuna), purse-seine effort, and effort for other fisheries have been specified to reflect the various provisions of CMM-2008-01. Levels of catch and effort in 2011 are assumed to be continued through 2018. It was attempted, where possible, to capture the various exemptions associated with these provisions. Where there is

ambiguity in applying the provisions, or where there are portions of the fishery that are unregulated by the measure, conservation assumptions were made regarding future catch and effort levels. Thus, the estimated stock conditions should be regarded as "best case" outcomes, noting that there is significant uncertainty in how future catch and effort levels in the major fisheries will evolve.

196. The performance indicators used for the evaluation are the ratio of projected fishing mortality in 2018 to the fishing mortality at MSY (F/F_{MSY}) and the ratio of the projected spawning biomass in 2018 to the spawning biomass at MSY (SB/SB_{MSY}). F/F_{MSY} is an appropriate indicator for measuring performance in relation to fishing mortality objectives, while SB/SB_{MSY} is appropriate for measuring performance in relation to the objective of maintaining stocks at levels capable of producing MSY. Separate projections were undertaken to estimate the individual effects of longline catch limits (for bigeye tuna), purse-seine effort limits, purse-seine FAD closure, and closure of high-seas pockets to purse-seine fishing. Projections were also undertaken incorporating all purse-seine provisions combined and all purse-seine and longline provisions combined. A base projection, which simply involved projecting forward of the estimated 2007 fishing effort for all fisheries, was undertaken for comparison.

197. The projections showed that CMM-2008-01 is highly unlikely to meet its objectives of a 30% reduction in bigeye tuna fishing mortality from the 2001–2004 level, or maintaining the bigeye tuna stock at a level capable of producing MSY over the long term. The measures are predicted to result in little, if any, reduction in bigeye tuna F/F_{MSY} from the high levels in excess of 2.0 estimated for 2007–2008, and accordingly, spawning biomass (SB) is predicted to fall to around 0.4–0.6 of SB_{MSY}. The main reasons for the lack of effectiveness of the measure are: i) reductions in longline catches do not result in the required reduction in fishing mortality on adult bigeye tuna; ii) the increase in purse-seine effort allowed under the measure, and the increase in purse-seine catchability (fishing mortality per unit effort) that has occurred since 2001–2004, is not sufficiently offset by the FAD and high-seas pocket closures to reduce purse-seine fishing mortality below 2001–2004 average levels; and iii) the exclusion of archipelagic waters, which encompasses some of the fishing activity of the Indonesian and Philippines' domestic fleets and significant amounts of purse-seine effort in Papua New Guinea and Solomon Islands, from the measure effectively quarantines an important source of fishing mortality on juvenile bigeye tuna.

198. For yellowfin tuna, current assessment estimates that recent $F/F_{MSY} < 1$ and $SB/SB_{MSY} > 1$. Projections assuming the various purse-seine provisions of CMM-2008-01 and 2007 levels of effort for all other fisheries (including longline) suggest that levels of fishing mortality in 2018 ranging from 8% below to 15% above the 2001–2004 average level could result under CMM-2008-01. Yellowfin tuna spawning biomass in 2018 is predicted to be similar to the 2001–2004 average, or to decline slightly from that level, and to remain above or close to the MSY level, depending on the stock assessment model assumptions used.

DISCUSSION

199. In the discussion following this presentation, several issues were clarified by SPC in response to questions, and several suggestions were made.

200. It was felt that the analysis of the effectiveness of the different component measures would be improved if estimates of fishing mortality and spawning biomass were also presented as an annual trajectory across the entire evaluation period (2009–2018) for each of the components of the CMM evaluation.

201. In response to a question about what additional measures it might take to fully achieve the objectives of CMM-2008-01, the WCPFC science services provider, SPC-OFP, explained that testing further measures was not part of the evaluation brief, but the Committee could direct that SPC evaluate

the potential effect of other measures, and try to anticipate what exemptions might be negotiated on them.

202. The possibility was raised of the Committee identifying the components of the fishery (i.e. the fleets) that contribute most to fishing mortality on bigeye tuna stock, and thus where cuts in effort might be most effectively targeted. The increase in purse-seine effort and catchability were felt to be dramatic, however the presentation did not make it clear which components of the purse-seine fleet, and which areas, were contributing most to the increase. It was clarified that a significant part of the likely increase in purse-seine effort resulted from allowing for additional effort that is provided for under the SPTT.

203. There were also different levels of impact on bigeye from different purse-seine fleets as a result of their differential dependency on fishing on floating objects. Some purse-seine vessels, notably those of Korea, concentrated on free schools, and if more purse seiners could operate profitably by targeting free schools then the effect on bigeye tuna fishing mortality would be beneficial. Targeting free schools could also increase the yield-per-recruit of skipjack and yellowfin, because the fish caught in association with FADs and other floating objects are smaller on average than those caught from free schools.

204. SPC pointed out that there is also a spatial component to the bigeye fishing mortality issue. The purse-seine fishery has concentrated on the western side of the WCPO in recent years, and bigeye catchability appears to be lower in the west compared with the east, perhaps because the mixed layer is deeper. During a strong El Nino — as may soon be the case — purse-seine fleets are likely to move to the east with significant potential for increasing impacts on bigeye.

205. There might be cause for optimism in the effort reduction programmes of certain CCMs, however, it was clear that the purse-seine fleet as a whole continues to expand due to transfers between fleets and between oceans, as well as the construction of new vessels. Although VDS has the potential to cap the effort of any number of vessels, new investments in additional capacity continue to be made.

206. The committee also noted that if the Philippines' claim to historical effort was validated, there would be a large increase in historical fishing effort to take into account, however, this claimed that the historical effort would be either in the EEZ or on the high seas pockets that are now closed.

207. Several CCMs noted the likelihood that CMM-2008-01 would not achieve the objective of a 30% reduction in bigeye fishing mortality, and that there would thus be a requirement for additional measures to be implemented to bring the indicators in line with MSY-based RPs. These CCMs recommended that the SC convey this advice as clearly as possible to the Commission. Several participants also mentioned the need to develop a more holistic approach in presenting scientific information to decision-makers, where the multi-species nature of the fishery is taken into account, and it would be more apparent where a decision made on the basis of the indicators of one stock would be likely to result in effects on another.

208. The representative from IUCN expressed concern at the lack of success of CMM-2008-01 in reducing fishing mortality, and encouraged the SC to make a clear recommendation to WCPFC to revise the CMM to achieve this objective.

209. It was noted that the current exercise did not include substantive evaluation of the catch retention measure under CMM-2008-01 due to the lack of relevant data, but the potential shift in selectivity of the purse-seine fishery as a result of this measure should become progressively more possible to include in future evaluations.

210. As a result of this presentation and discussion, the SC made the following recommendations to WCPFC6:

i. CMM-2008-01 is likely to achieve one of its objectives: of not exceeding levels of fishing mortality on the WCPO yellowfin tuna stock beyond the level experienced either in 2004 or the annual average of the period 2001–2004.
ii. However, even if fully implemented and complied with, CMM-2008-01 is extremely unlikely to achieve its most important objective: reducing fishing mortality on the WCPO bigeye tuna stock to at least 30% below the level experienced either in 2004 or the annual average of the period 2001–2004. Furthermore, if the high seas pockets closure results in effort being transferred to high seas areas to the east, where bigeye tuna generally form a greater proportion of the purse-seine catch, the objectives of CMM-2008-01 will be even less likely to be achieved.
iii. The WCPFC's science services provider (SPC-OFP) was tasked by the SC to model potential results of other measures (that might be considered by WCPFC6) to reduce fishing mortality on bigeye tuna stocks to 30% below 2001–2004 levels, including the likely impact of a complete FAD closure. Results of this work will be presented in the first instance to WCPFC6 (Attachment M).

e. Capacity measuring and monitoring (Para. 44 of CMM-2008-01)

211. The Executive Director referred to para 44 of CMM-2008-01, which requests the Secretariat to prepare a report on measuring and monitoring fishing capacity. He noted that the report was to draw on work relating to this completed by CCMs. He further noted that, although scheduled for discussion at TCC5, the Secretariat had invited CCMs to contribute details of work completed — either directly or through their participation in subsidiary bodies of the Commission, such as the SC. The SC noted that capacity-related research has been discussed since SC1 and has been incorporated into the terms of reference of the FT-SWG. Capacity-related research was included in SC4's work programme (see SC4 Summary Report/Attachment I/para 35, and SC3 Summary Report/Attachment O/Project 20) although it was unfunded. This type of research is also included in the medium-term research plan for the FT-SWG as adopted by SC5.

212. Most FFA Members noted that capacity is a low priority (and currently unfunded) issue in the SC work programme and that para 44 of CMM-2008-01 was explicitly addressed to TCC.

213. Other CCMs stated that fishing capacity management is a high priority, and capacity-related information would be useful to consider for a range of issues in both SC and TCC but that there are other higher priority issues that require the Commission's attention and resources. It was also noted that this subject is included in the terms of reference for the FT-SWG and has been taken up by that SWG.

214. The representative of ISSF noted that effective capacity management had been a major challenge for tuna fisheries around the world since it was first adopted in the EPO fishery in 1966. He referred to research undertaken on capacity monitoring and management under the auspices of the FAO capacity project using data envelopment analysis and assessments that show there is over-capacity in almost all world purse-seine and longline fisheries. He noted that until the issue of reconciling the development aspirations of coastal States and distant-water fishing nation effort is resolved, capacity-related issues would continue to hamper efforts to establish sustainable tuna fisheries.

215. The SC noted the invitation from the Secretariat for CCMs to provide details of work completed or planned with regard to the measuring and monitoring of capacity to assist TCC5 in consideration of this issue, and agreed that there is a role for the SC to consider scientific elements of capacity monitoring and measurement, which is included within the terms of reference of the FT-SWG.

4.4 WCPO skipjack tuna

216. The last assessment for skipjack tuna was presented to SC4 in 2008, and indicated that there had been little change in the stock status since the previous assessment in 2005. Because no new information on the stock status of this species was presented to SC5, the management recommendations from SC4 are maintained.

217. Some CCMs raised a concern regarding potential contractions in stock distribution and biomass, which may be first indicated by changes in the presence or abundance of fish at the edges of the distribution. These effects may not have been fully accounted for in the stock assessment for WCPO skipjack, which focused on the centre of the stock's distribution in tropical waters. Assessment results may not thus be sensitive to early effects that may occur at the edges of the skipjack stock distribution. Given that temperate waters such as those off Japan, and also the southern edge of the distribution in South Pacific waters, represent the edges of the WCPO skipjack stock, the importance of carefully and continuously monitoring these indicators, and comparing them to indicators for the central distribution of the stock in tropical waters, was highlighted for future research.

218. In response, other CCMs suggested that those concerned about potential indicators in the edges of the distribution undertake studies to determine whether there may be other factors influencing the observed indicators. These studies could then be brought before the SC for further discussion.

219. Japan agreed to study the situation independently and also to collaborate with SPC-OFP on ways of addressing such issues in future stock assessments.

4.5 South Pacific albacore

220. The SC adopted the stock status of South Pacific albacore from the SC5 SA-SWG report.

221. A full stock assessment was conducted in 2008 and a comparative assessment was conducted in 2009. The latest results produced realistic levels of stock size and MSY based on a credible model with many sources of potential bias being removed. There is considerable uncertainty about the early trend in biomass, although the trend has a negligible effect on management advice. Estimates indicate that overfishing is not occurring and that the stock is not in an overfished state. There is no indication that current catch levels are not sustainable with regard to recruitment overfishing. However, current levels of fishing mortality may be affecting longline catch rates on adult albacore.

4.6 South Pacific swordfish

222. The results of the last assessment for South Pacific swordfish, a joint effort of Australia and New Zealand, were presented to SC4 in 2008. The report containing these results was subsequently published and was made available to SC5 (as WCPFC-SC5-2009/GN-IP-02). On the basis of this assessment, WCPFC5 agreed on CMM-2008-05 — Conservation and Management of Swordfish — which replaced CMM-2006-03.

223. FFA Members noted that due to some uncertainties in historical swordfish catch data, CMM-2008-05 imposed a limit on catches only for 2009 with a provision for review of the measure at WCPFC6 based on advice from SC5 regarding data uncertainties.

224. SC5 agreed that the data uncertainties have yet to be resolved but that results of the stock assessment are now accepted and finalized. The SC recommended to WCPFC6 that the catch limits specified in CMM-2008-05 be carried forward to future years as a continuing measure.

4.7 Southwest Pacific striped marlin

225. SC5 noted that no stock assessment was conducted for southwest Pacific striped marlin in 2009; therefore, the stock status description and management recommendations from SC2 are still current.

4.8 North Pacific striped marlin

226. G. Sakagawa, ISC Chair, reported on the work of ISC with regard to stock status and conservation advice for striped marlin in the North Pacific. He reported that ISC is planning to conduct a full stock assessment in 2011 after completing a recent assessment in 2007. He informed participants that updated catches of striped marlin, 1952–2006, continue to show a downward trend since the late 1960s. Most of the biomass (two-thirds) in the North Pacific is located north of 20°N, and the fishing mortality rate on spawners (ages 5+) has been increasing, reaching a high level in 2003, the last year estimated by the 2007 assessment. The spawning biomass also declined sharply since the early 1970s and was at a historical low level in 2005.

227. The ISC continues to believe that the 2007 assessment provides the best available information on the stock status of striped marlin in the North Pacific, and that the conservation advice provided by ISC7 is still valid. That is, overall F for striped marlin should be reduced. The degree of reduction would be guided by the biological reference points (BRPs) that need to be selected by management authorities, population biology characteristics of the species, and the nature of the fisheries. Until such an action is adopted, the fishing mortality rate should not be increased.

DISCUSSION

228. Some CCMs stated that fishing mortality rates on striped marlin should be reduced, and voiced concern that this has not occurred in recent years. These CCMs also stated there has not been a stock status report produced for striped marlin in the past two years and they would like to see that completed as soon as possible, so as to produce a CMM for this species.

229. Questions were raised regarding whether any new information available from the ISC on current fishing mortality rates could help evaluate what catch or effort reductions are required to reduce fishing mortality to F_{MSY} levels. G. Sakagawa reported that there has been no assessment by ISC since 2007 and so such an evaluation would have to wait until the full assessment is completed in 2011. He also stated that BRPs for northern stocks have not been specified, and management measures are not being considered within ISC as that is the responsibility of WCPFC.

230. Other CCMs stated that guidance on RPs should be provided to WCPFC from the SC. These CCMs stated that current levels of effort should be capped for striped marlin north of 20°N, and that fishing effort should be reduced to 2003–2004 levels.

231. A number of CCMs raised a concern regarding the statement that two-thirds of the biomass occurs north of 20°N. It was clarified that this has never been established by the SC.

232. One CCM reminded the SC that during SC4 there was an informal working group meeting for this species. SC4 incorporated a North Pacific striped marlin mitigation methods project into the SC workplan. There has not been an inclusion of North Pacific striped marlin in the list of species under the competence of the Northern Committee (NC); therefore, the SC could propose reduction in fishing mortality for this stock and proceed with developing a CMM.

233. North Pacific striped marlin is considered a bycatch species, rather than a target species, and any management advice needs to consider this bycatch aspect.

234. The last assessment was conducted in 2007 and presented at ISC7. The SC reaffirms ISC plenary 2009's advice and recommends that 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. Noting that this is a bycatch species, mitigation methods should be explored in order to achieve the necessary reductions in fishing mortality.

4.9 Northern stocks

235. Annex I of the Commission's Rules of Procedure defines "northern stocks" to be "northern Pacific bluefin,[2] northern albacore and the northern stock of swordfish". G. Sakagawa, ISC Chair, introduced the ISC's work on these northern stocks. He reported that progress with ISC administrative matters as well as the latest information on stock status and conservation advice is contained in the report of ISC9, which was held from 15–20 July 2009. He also noted that the presentations to follow on North Pacific albacore stock status, Pacific bluefin tuna stock status and North Pacific swordfish stock status are based on information contained in Annexes 9, 10 and 7, respectively of ISC9's plenary report.

DISCUSSION

236. In general, the SC expressed its appreciation for the work and information provided by ISC. However, throughout the course of these presentations, as well as during discussions regarding North Pacific striped marlin, several participants expressed concerns that in many instances, ISC does not provide specific management advice, which in turn frustrates the ability of the SC to comment on management advice to the Commission for some northern stocks. ISC explained that in the absence of clear direction from the NC on appropriate RPs for these stocks, ISC has no basis upon which to make specific management recommendations. ISC indicated that they have inquired with the NC regarding appropriate RPs for inclusion in ISC assessments, but that with the exception of advice provided on Pacific bluefin tuna, none have been forthcoming.

237. Some CCMs inquired why, in the absence of specific RPs coming from the NC, ISC could not use the MSY RPs found in WCPFC's Convention, Article 5(b), and provide concrete management advice accordingly. Other CCMs suggested that consideration of northern stocks should be included within the broader context of the SC's work to develop RPs for WCPFC stocks.

238. After a lengthy discussion, ISC Chair, per the request of the SC, agreed to provide SC6 with tables indicating the status of northern stocks relative to RPs, based upon the most recent assessments for each stock.

239. The SC recommended to the NC that they consider advising ISC that scientific advice provided by ISC to the SC contain information on the performance of a range of fishery indicators against appropriate RPs. Until the Commission identifies and formally adopts appropriate RPs, the SC suggested that this information should detail, at a minimum, the performance of the fishery against MSY-based RPs.

240. The SC suggested that ISC, where feasible, provide information on stock status and management advice on northern stocks to the SC in a more timely manner.

[2] Pacific bluefin tuna

4.9.1 North Pacific albacore

a. Status and trends*

241. J. Holmes, Chair of the ISC Working Group on Albacore, summarized the results of the albacore stock status. The latest stock assessment was completed in 2006 using data through 2005. No new stock assessment has been conducted since then, and a full stock assessment is planned for 2011. A qualitative analysis with fishery data for 2008 and 2009 was undertaken this year to determine recruitment levels and to assess the continued existence of historical high levels of recent adult biomass identified in the 2006 assessment. This analysis proved to be inconclusive; hence, ISC has no new information on stock status and no new conservation advice to offer. ISC, however, recognizes that the lack of a more recent stock assessment than 2006 increases the uncertainty about the stock status.

242. J. Holmes also reported that ISC completed work on determining $F_{SSB\text{-}ATHL}$ associated with the average level of the 10 historically low spawning stock biomasses for the albacore stock. The $F_{SSB\text{-}ATHL}$ is 0.75/yr. This work was requested by the NC, which has adopted this parameter as an interim BRP.

b. Management advice and implications*

243. The conservation and management advice provided by ISC7 was as follows.

244. 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 IATTC and WCPFC are based on maintaining population levels that produce MSY. Due to updating, and improvements and refinements in data and models used in the 2006 stock assessment, it is now recognised that $F_{current}$ (0.75) is high relative to most of the F RPs commonly used in fisheries management (see Table 5a in Annex 5 of ISC7's plenary report).

245. On the other hand, the same analysis indicates that the current SSB estimate is the second highest in history but that keeping the current F would gradually reduce SSB to the long-term average by the mid-2010s. Therefore, the recommendation of not increasing F from the current level ($F_{current(2002\text{-}2004)}$ = 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.

DISCUSSION

246. Concerns were raised that the draft CMM put forward by the USA for North Pacific albacore last year at WCPFC5 did not address the advice that mortality needs to be reduced. Accordingly, some participants suggested that NC5 should make recommendations on ways to improve that proposal if the intention is to reintroduce it at WCPFC6.

247. Comments were also made that while the SC appreciates the interim management objective established for North Pacific albacore by the NC, as was highlighted by ISC, the NC needs to clarify whether the objective is intended to serve as a target reference point (TRP) or limit reference point (LRP). The SC believes that it would be most appropriate as an LRP.

248. ISC noted that until the NC provides clarity on the intention of the BRP, the situation remains similar to that of striped marlin in that it is not possible for ISC to make specific recommendations on how much F should be reduced.

249. The status, trends and management advice provided by ISC were adopted by the SC without modification.

4.9.2 Pacific bluefin tuna

250. N. Miyabe presented activities of the Pacific Bluefin Tuna Working Group (PBFWG) on behalf of the working group convener, Y. Takeuchi. The first full stock assessment of Pacific bluefin tuna was conducted by ISC's PBFWG in May 2008. Assessment results were provided to ISC's plenary meeting in July 2008. At this meeting, the PBFWG was requested to review the results, especially in relation to the unrealistically large B0 and implausible yield per recruit (YPR) and spawner per recruit (SPR) estimates. In response to this request, PBFWG held a workshop in Ishigaki, Japan in 2008 December, with the objective to review the natural mortality schedule, maturity, fecundity, age and growth, as well as the stock assessment model (Stock Synthesis). Scientists from Chinese Taipei, Mexico and USA participated in the workshop, which also included two external scientists: J. Joseph (USA) and J.M. Fromentin (France) who provided expertise. One significant outcome from this meeting was the adoption of revised natural mortality rates (M) that are lower than the original M used in the May 2008 assessment. This new natural mortality schedule was adopted from southern bluefin tuna, however, given the differences in biological characteristics (faster growth, age at maturity is younger), Pacific bluefin tuna M could be higher than southern bluefin tuna.

251. At the PBFWG meeting in July 2009, assessment results based on the revised M and application of the new version of SS3 model were provided. Estimates of SSB were larger but estimates of recruitment remained relatively similar to the original assessment. The stock-recruitment relationship was tested but again failed to indicate any relationship. Current F is higher than potential TRPs but less than or equal to commonly used LRPs.

*a. Status and trends**

252. Recruitment has fluctuated without trend over the assessment period (1952–2006), and does not appear to have been adversely affected by the relatively high rate of exploitation. Recent recruitment (2005 to present) is highly uncertain, making short-term forecasting difficult. In particular, the 2005 year-class strength may have been underestimated in this assessment.

253. SSB in 2005, estimated with the value for natural mortality (M) used in the 2008 stock assessment, was 20,000 mt based on the SS2 model and 23,000 mt based on the SS3 model. Applying the revised estimate of M from the 2009 workshops and the SS3 model, SSB was estimated at 73,000 mt. These SSB estimates for 2005 are above the median level over the assessment period (1952–2006). If the future fishing mortality rate (F) continues at the current F level, short-term projections (2009–2010) indicate that SSB will decline. In the longer term, SSB is expected to attain levels comparable to median SSB levels over the assessment period.

254. No relationship between SSB and recruitment is apparent over the range of "observed" SSB from the assessment. The assessment structure tacitly assumes that at least over the SSB levels "observed," recruitment is more environmentally driven than SSB-driven.

255. Current F (2002–2004) is greater than commonly used BRPs that may serve, in principle, as potential TRPs. This includes F_{MAX} — a BRP that, given the assessment structure and assumptions, is theoretically equivalent to F_{MSY}. But the magnitude by which $F_{current}$ exceeds target BRPs is variable. If current F is reduced to F_{MAX}, spawning potential (%SPR) is expected to increase in absolute terms by 10%, and YPR is expected to increase by 4% relative to current levels.

256. Conversely, current F is less than commonly used BRPs that may serve, in principle, as potential recruitment overfishing threshold BRPs (e.g. F_{MED}); that is, Fs above which the likelihood of recruitment failure is high.

257. Fs on recruits (age 0) and on juveniles (ages 1–3) have been generally increasing for more than a decade (1990–2005). The catch (in weight) is dominated by recruits and juveniles (ages 0–3).

258. Total catch has fluctuated widely in the range of 9,000–40,000 mt during the assessment period (1952–2006). Recent catches are near the average for the assessment period (~22,000 mt).

b. Management advice and implications*

259. ISC's plenary reached consensus to keep three of the four elements from the previous year's conservation advice, but there was disagreement on the wording of the fourth element. One Member expressed the view that the fourth element should be changed to recommend that juvenile F should be reduced to 2002–2004 levels, while other Members preferred to retain the original wording:

1. If F remains at the current level and environmental conditions remain favourable, the recruitment should be sufficient to maintain current yield well into the future.
2. A reduction in F in combination with favourable environmental conditions, should lead to greater SPR.
3. Increases in F above the current level, and/or unfavourable changes in environmental conditions, may result in recruitment levels which are insufficient to sustain the current productivity of the stock.
4. Given the conclusions of the May–June 2008 stock assessment with regard to the current level of F relative to potential TRPs and LRPs, and residual uncertainties associated with key model parameters, it is important that the current level of F is not increased.

4[bis]. Given the conclusions of the July 2009 PBFWG, the current level of F relative to potential biological reference points, and increasing trend of juvenile F, it is important that the current [sic] level of F is decreased below the 2002–2004 levels on juvenile age classes.

DISCUSSION

260. A question was raised as to whether ISC had considered interactions in Japanese coastal areas between fisheries that catch age 0 and age 1 bluefin tuna, and fisheries that target adult fish. The presenter responded that given the decline in some other tuna and tuna-like species, the Pacific bluefin fishery is very important to some coastal communities. There is some interaction between the trap net, troll and hand line fisheries, and the commercial Pacific bluefin longline fishery, and local governments have set several regulations to reduce the friction between them.

261. Korea explained that in Korea there has been no fishery directly targeting Pacific bluefin tuna, and bluefin bycatch also has not been reported in Korean coastal waters. In past years, Pacific bluefin that were more than 100 cm in length were caught as bycatch by coastal purse seiners in Korean waters. The recent bycatch of Pacific bluefin tuna by Korean coastal purse seiners is on the order of less than 5% of its annual catch. Pacific bluefin is a new species for Korean coastal fishermen. The Korean government also has a research plan to address Pacific bluefin issues. Korea's coastal fisheries are managed under the domestic fisheries law, which is fundamentally different from the distant-water fisheries law. It is difficult for Korea to accept management advice requiring limits on, or reduction to, fishing mortality unless scientific studies have been conducted and the fishery structure in Korean waters is clearly understood.

262. Some participants expressed disappointment that a CMM for Pacific bluefin tuna was not brought forward last year, and hoped that NC5 would develop recommendations on the appropriate contents of a CMM, corresponding to the management advice that F should be capped at the current level.

263. The status, trends and management advice provided by ISC were adopted by the SC without modification.

4.9.3 North Pacific swordfish

a. Status and trends*

264. ISC Chair reported on the results of ISC's 2009 stock assessment of swordfish in the North Pacific. He noted that the assessment was based on two different stock structure hypotheses. One hypothesis, a single homogeneous stock in the North Pacific, was used as a reference because previous stock assessments were based on this hypothesis. The second hypothesis, two stocks (one in the WCPO and another in the EPO) in the North Pacific with little or no mixing between them, is the preferred hypothesis because most of the stock structure evidence so far supports this hypothesis.

265. Available data for 1951–2006 were suitable for conducting the stock assessment with a Bayesian Surplus Production Model. Results using the single stock hypothesis indicate that MSY is 19,100 mt and the exploitable biomass has been well above this MSY level. The estimated harvest rate has been well below the harvest rate of 34% at MSY. The harvest rate for 2006 was 13%.

266. With the two-stock hypothesis, results for the WCPO stock indicate that MSY is 14,400 mt and the exploitable biomass has largely been above this MSY level for the entire time series of data. The estimated harvest rate at MSY is 26% and actual harvest rates have largely been below this level for the entire time series. In 2006, the harvest rate was 14%. Projecting this harvest rate to 2010 results in the exploitable biomass continuing to remain above the biomass at MSY.

267. For the EPO stock, MSY is 3,100 mt with an exploitable biomass at MSY of 24,800 mt. The estimated harvest rate at MSY is 13% and the harvest rate has remained below this level for the entire time series of data. The harvest rate in 2006 was 3%. Projecting this rate forward to 2010 results in the exploitable biomass remaining above the biomass level for MSY.

b. Management advice and implications*

268. ISC concluded that both swordfish stocks in the North Pacific are healthy and well above levels required to sustain recent catches. No management advice was provided.

4.10 Biological parameters and management related issues

269. The SC Chair introduced the following five research projects, which are funded by the Commission, for discussion by the SC. It was noted that full reports for these projects have been presented to the relevant SWGs, and that for those projects that are ongoing, progress is being tracked against milestones by the SWGs.

a. Improve existing models and explore alternative models for standardization of fishing catch and effort for construction of stock assessment indices (Project 31)

270. This project is designed to improve existing models, and explore alternative models, for standardization of catch and effort data for construction of stock assessment indices. Results were presented in the SA-SWG and are provided in WCPFC-SC5-2009/SA-WP-07.

271. SC5 considered that this method could provide a useful tool for CPUE standardization and should be considered alongside other alternative methods in WCPO stock assessments.

b. Refinement of bigeye parameters Pacific-wide: A comprehensive review and study of bigeye tuna reproductive biology (Project 35)

272. S. Nicol reported that this project on refining bigeye parameters Pacific-wide, including a comprehensive review and study of bigeye reproductive biology, is being undertaken in two phases. The first (pilot) phase — determining the sampling requirements for the broader Pacific-wide phase 2 — began in March 2009, and is being jointly implemented by Palau, FSM, SPC, IATTC, USA (University of Hawaii) and Japan (National Research Institute of Far Seas Fisheries). Phase 1 is a two-year study and is scheduled for completion in August 2010.

273. The pilot project's work plan has been finalized, with bigeye sampling expected to occur from October 2009 to January 2010; laboratory analysis from February 2010 to May 2010; data analysis and modeling in June 2010; and pilot project reporting in July 2010 with a presentation of results and recommendations for phase 2 at WCPFC6. Sampling protocols, preliminary training of technicians in Palau and FSM, and the appointment of a sampling coordinator has been completed. Protocols for laboratory analyses have been drafted and preliminary arrangements for laboratory analyses organized.

274. The SC noted the importance of this biological work for future evaluations on the status of bigeye, and its capacity building within the CCMs. The SC recommended that the Commission endorse the project's continuation.

c. Regional study of the stock structure and life history characteristics of South Pacific albacore (Project 39)

275. R. Campbell presented progress on a regional study of the stock structure and life history characteristics of South Pacific albacore in a working paper (WCPFC-SC5-2009/BI-WP-05) to the BI-SWG. This working paper reported on the first year of a three-year study that is being jointly undertaken by Australia's Commonwealth Scientific Research and Industrial Organisation (CSIRO), SPC and a number of CCMs. Continuation of this study was endorsed by the BI-SWG and further funding for it will be considered under the SC work plan and budget.

d. Technical workshop to consider suitability of MSY-based reference points as default limit reference points and how they may be operationalized (Project 57)

276. R. Campbell reported on a technical workshop to consider the suitability of MSY-based RPs as default LRPs, and how they may be operationalized (Project 57). This project was added to the SC work plan to further progress the identification of RPs in WCPFC. Originally, the workshop was planned to be held as a separate event, but ultimately it was held in conjunction with the ME-SWG at SC5, thus a cost saving of $10,000 was achieved.

277. The workshop on RPs suggested that the following issues be considered by the SC for recommendation to the Commission:

i. Endorse the short-term and medium-term work plans on RPs adopted by SC5;

ii. Hold a workshop on management objectives during 2010 as proposed by WCPFC5. The objectives of such a workshop should include:
    a. assisting managers to identify the information required to guide management decisions, and how these can be quantified;
    b. providing guidance on identifying stock specific limit and target reference points; and
    c. providing advice on how uncertainty in the estimation of performance indicators can be incorporated into management decisions.
iii. Note that SC6 will make a recommendation to WCPFC7 on appropriate provisional LRPs, both types and associated values, for the key target species in the WCPFC.

278. CCMs expressed their full support for these recommendations. The SC agreed that they should be forwarded to the Commission for consideration.

e. Revised stock assessment on southern swordfish (Project 26)

279. R. Campbell summarized the stock status assessment of southwest Pacific swordfish (Project 26). As described under Agenda Item 4.6, the study is now complete. Results are provided in WCPFC-SC5-2009/GN-IP-02 and these results supported formulation of CMM-2008-05 by WCFPC5.

280. SC5 agreed that the project had been successfully completed and had been a worthwhile use of Commission funds.

AGENDA ITEM 5 — BYCATCH MITIGATION

281. EB-SWG convenor, P. Dalzell, presented a summary of the deliberations of the EB-SWG with respect to requests from the Commission. These included ERA, seabirds, sharks and sea turtles.

5.1 Fisheries impacts (ecological risk assessment)

282. P. Dalzell, presented a summary of the work from EB-SWG deliberations on ERA, and the work of SPC-OFP, which included progress with the ERA project, a study characterizing the PNG purse-seine fishery, development of a WCPFC bycatch database, and training for in-country species specialists. The convenor also summarized the ongoing work on the SEAPODYM model that had been presented to the EB-SWG.

283. Two recommendations concerning ERA were presented by the EB-SWG for consideration by the SC. The SC recommended that:
i. Funding to support the continuation of the ERA project should be provided for the period 2010–2012; and
ii. SEAPODYM should be included as an affiliated, independently funded, project in the SC's work programme. Further, the EB-SWG encourages CCMs to cooperate with the request for data required for ongoing research using the SEAPODYM model.

284. Two CCMs, on behalf of FFA, voiced their support for the ERA project. The importance of ensuring that bycatch issues can be addressed scientifically by the Commission, and the usefulness of continued training to national scientists to engage in ERA work and conduct further ERA analysis themselves, were cited as reasons underlying the support.

a. Seabirds

285. The EB-SWG convenor provided an overview of the papers presented in relation to seabirds. These included a review of seabird mitigation measures for pelagic fisheries relative to CMM-2007-04, and consideration for modifying the CMM. Another highlighted contribution was the development of spatial risk indicators for longline–seabird interactions, identification of hot spots in the Tasman Sea and east of New Zealand. Tropical zones issues with endangered species were also discussed.

286. Three recommendations concerning seabirds were presented by the EB-SWG for consideration by the SC. The SC recommended that:

i. CCMs should be encouraged to provide information on new or existing mitigation measures on seabird interactions to the SC, consistent with para 6 of CMM-2007-04.
ii. Reviews of the effectiveness of seabird mitigation measures currently required under CMM-2007-04, and reviews of any new mitigation measures for possible incorporation into the CMM, should be conducted.
iii. Ongoing research, following from the spatial risk assessment presented in WCPFC-SC5-2009/EB-WP-6 during the intersessional period and for review at SC6, should be conducted. The EB-SWG further recommended the use of data from the ROP in order to validate spatial risk assessments so that a recommendation could be brought before SC6 to determine initial spatial zones for the differential management and monitoring of seabird bycatch. These assessments should be updated as new information becomes available. Access to observer data for these scientific purposes will be granted under the terms of the Commission's rules and procedures for access to data.

b. Sharks

287. The EB-SWG convenor provided an overview of the papers presented in relation to sharks including a north Pacific blue shark stock assessment, a feasibility study for shark stock assessments, and WCPO shark catch estimates based on shark fin trade data.

288. Four recommendations concerning sharks were presented by the EB-SWG for consideration by the SC. The SC:

i. Requested SPC-OFP to commence work on preliminary stock assessments for key shark species, and to develop a research plan to support further assessment for consideration at SC6, if possible, in collaboration with IATTC and other relevant organizations. The work should be included as a component of the 2010 service agreement for the provision of science services to the Commission.
ii. Encouraged CCMs to collect and contribute catch and effort data, observer data, and biological data toward this exercise, and to cooperate in this research.
iii. Recognized the importance of observer data for analysis of fisheries impacts on bycatch and encouraged collaboration between SPC-OFP, CCMs and other relevant organizations in the analysis of ROP data related to bycatch for use by the SC, subject to the Commission's rules and procedures for data.
iv. Consider adding silky sharks to the list of key shark species specified in CMM-2008-06.

c. Sea turtles*

289. The EB-SWG convenor provided an overview of the papers presented in relation to sea turtles. Issues discussed consisted of encounter rates between turtles, longlines and purse seines; comparison of interaction rates in different WCPO zones; establishment of a minimum sea turtle bycatch rate for

shallow-set fisheries from CMM-2008-03; and CCM turtle mitigation plans, including one presented by Australia.

290. Four recommendations concerning sea turtles were presented by the EB-SWG for the consideration of the SC. The SC recommended to:

i. Adopt the draft WCPFC Guidelines on the Handling of Sea Turtles (WCPFC-SC5-2009/GN-WP-13), and the review by the SC of further guidelines on entanglement and use of de-hookers.
ii. Specify to the Commission that in order to fulfil the requirements of para 7(b) of CMM-2008-03 by January 2010, observed mean sea turtle interaction rates must be lower than 0.019 sea turtles (all species combined) per 1,000 hooks, over the preceding three consecutive years.
iii. Encourage revision of this threshold as new data are collected and analyses are generated by SPC-OFP and the EB-SWG, particularly on the population status of the different sea turtle species and the mortality rates that can be sustained. Species-specific interaction rates should also be considered.
iv. Set a reference level for shallow-set swordfish fishery for para 7b of CMM-2008-03 is not relevant to the scientific advice that would be offered regarding a reference level of sea turtle bycatch in deep-set fisheries for tuna which are larger in scope and lower in bycatch rates by an order of magnitude.

291. D. Kirby presented WCPFC Guidelines on the Handling of Sea Turtles (WCPFC-SC5-2009/GN-WP-13). These were developed by SPC-OFP for the WCPFC Secretariat, in consultation with CCMs. The final version was distributed to CCMs at the end of June 2009, as required under CMM-2008-03. The guidelines presented in WCPFC-SC5-2009/GN-WP-13 did not include guidance on how to release turtles from entanglement, so some additional text was circulated to CCMs at the meeting. This text is given in Attachment N. The convenor sought and received approval by the SC for SPC-OFP to include this additional text in the Commission's sea turtle safe handling guidelines.

292. Australia presented its Turtle Mitigation Plan (the Plan, WCPFC-SC5-2009/EB-IP-15) with the aim of fulfilling Australia's obligations under WCPFC's CMM-2008-03, para 7a iii, with regard to the need to implement a plan designed to reduce the interaction rate of turtles in pelagic longline fisheries that target broadbill swordfish. The Australian fishery to which this measure has the most relevance is the Eastern Tuna and Billfish Fishery (ETBF).

293. The Plan highlights that it will be reviewed in five years or at such times as the:

i. criterion stipulated in the plan is exceeded;
ii. WCPFC review the relevant CMM to sea turtles; or
iii. characteristics of the fishery change and warrant a review.

294. It was indicated that observers have been deployed in the ETBF since 2003 in order to monitor 5.1% of all the effort in the fishery. In 2008, the observer coverage rate was 10.38%, compared with 5.26% in 2007. Since its inception, the ETBF Observer Programme has become an essential component of the fishery's management strategy, and forms a primary component of a number of the fisheries management arrangements and contributes substantially to a number of research programmes undertaken in the fishery.

295. In attempting to address the issue of sea turtle interactions in the ETBF, the AFMA in 2005 provided all vessels operating in the ETBF with "line cutters" and "de-hookers" to assist in the safe release of sea turtles that have interacted with pelagic longline fishing gear. This was also accompanied by several education programmes designed to inform skippers and crew members on the appropriate way to handle and treat sea turtles encountered while fishing.

296. It was noted that Australia recently introduced the Australian Tuna and Billfish Fisheries Bycatch and Discard Work Plan (B&D Work Plan), which outlines a series of management actions to address bycatch in Australia's pelagic longline fisheries. An education programme for skippers and crew members will also be carried out, and will contain components on safe handling and resuscitation techniques to employ should sea turtle interactions occur.

297. In addition, scientific evidence of some sea turtle species foraging in areas in close proximity to nesting beaches during inter-nesting periods, results in large concentrations of turtles in these areas. For this reason, Australia will implement 10-nm longline exclusion zones around known rookery sites.

298. The ETBF Turtle Mitigation Strategy requires that the fishery does not exceed the following observed sea turtle interaction trigger point values:

Interaction rate (per 1,000 observed hooks set):

green	0.0048
leatherback	0.0044
loggerhead	0.0040
Other: combination of hawksbill, flatback, Pacific (olive) ridley	0.0040
Total	**0.0172**

299. If a trigger limit for any species is exceeded in one year, then management action will take place. The action taken after the limit has been exceeded in one year will be to encourage industry to adopt best practice to minimize the interaction rate, with AFMA providing guidance through consultative mechanisms such as Management Advisory Committees and Resource Assessment Groups, and the development of a working group. Exceeding the limit in subsequent years will attract more strict AFMA-defined management measures to reduce interactions. Exceeding the limits in one year will result in AFMA establishing a Sea Turtle Mitigation Working Group to establish what measures, between AFMA and industry, can be implemented in the fishery to achieve an interaction rate less than that specified in the aforementioned criteria, by species. Should the limits be exceeded in the following year, AFMA will initiate management action to ensure that the ETBF is fully compliant with the requirements of CMM-2008-03. This will entail requiring vessels operating in the ETBF (which use the "shallow-set" pelagic longline fishing method to target broadbill swordfish) to use only whole finfish bait and large circle hooks. Should the limit be exceeded in the subsequent year, AFMA will enforce all operators to comply with a swordfish trip limit of 20 swordfish, unless the fisher applies to AFMA for an exemption under which they will be required to use whole finfish bait and large circle hooks.

300. It was indicated that Australia will report on its compliance with CMM-2008-03 to WCPFC as part of its Part 2 Report to the TCC on an annual basis. Observed sea turtle interaction rates in the ETBF will be reported as part of Australia's Annual Part 1 Report to the SC.

301. China asked whether each Australian vessel had information about the post release (fate) of the hooked sea turtle, noting that in April 2009 a seminar on sea turtle mitigation measures was held at Shanghai Ocean University with the participation of China and the USA. China is supplying vessels in all oceans with dehookers. Australia noted all vessels will be required to carry dehookers and line cutters. The fate of each sea turtle caught is recorded in logbooks, but most information is reported and recorded by the observer programme.

302. SC5 noted that the plan seems to meet the intent of the measure, and recommended that Australia's Turtle Mitigation Plan be sent to the TCC for their review and recommendation.

303. New Zealand presented WCPFC-SC5-2009/EB-IP-01, which discusses minimal sea turtle interaction rates. This paper defines shallow-set longline fisheries that fish for swordfish in New Zealand as those longline gear types that use a buoy line of 20 m or less, have 10 or fewer hooks per basket, and use snoods of no more than 40 m in length. This definition was based on the best available information regarding fishing depth and assumes that with this gear configuration, the sag in the main line will result in at least 50% of the hooks fishing above 100 m depth for more than 50% of the soak time. This definition, while based on the best available information on sink rates, will be tested experimentally within New Zealand and modified if necessary.

304. Observer coverage of this fishery in the last four years has ranged from 11.2–12.6% and as such has been over 10% during each of proceeding four years.

305. The New Zealand Ministry of Fisheries and Department of Conservation has various measures in place to manage sea turtle interactions, including reporting requirements and guidelines on handling turtles. It is expected that the Ministry of Fisheries will implement handling instructions developed by WCPFC into their domestic legislation.

306. Workshops tailored toward longline fishers were carried out in New Zealand in 2008 and early 2009, and covered the use of de-hooking gear, sea turtle identification, turtle biology and turtle conservation. At the workshops vessel skippers were supplied with de-hooking equipment and information kits.

307. In New Zealand's shallow-set swordfish fishery, the observed sea turtle catch rates are as follows: nominal CPUE: 0.00057 sea turtles per 1,000 hooks, and average 0.0013 sea turtles per 1,000 hooks.

308. Because sea turtles are caught so infrequently in New Zealand's waters, undertaking mitigation experiments will not result in data with enough statistical power to assess their effectiveness. However, New Zealand intends to experimentally test the effects of longline gear setups in determining the fishing depth of a hook. The results of this work will be reported to the SC at future meetings.

309. New Zealand considers that its shallow-set swordfish longline fisheries have had minimal observed sea turtle interaction rates over the preceding three-year period. National observer coverage rates meet the requirements of CMM-2008-03 para 7b, and existing practices and provisions in these fisheries are considered by New Zealand to adequately avoid and minimize the effects of fishing on sea turtle populations in New Zealand's fishery waters. As a result, New Zealand requested that the SC recognize New Zealand as having a minimal sea turtle interaction rate as per para 7b of CMM-2008-03.

310. SC5 recognized New Zealand as having a minimal sea turtle interaction rate as per para. 7b of CMM-2008-03.

5.2 Small tuna on floating objects*

311. In response to recommendations arising from all previous SC meetings and the FT-SWG session held during SC5, the SC reviewed research outcomes and information relevant to the reduction of fishing mortality on small tuna on floating objects (STFO). The FT-SWG provided the SC with advice and approved research priorities relating to the reduction of STFO in WCPO fisheries. The current status of research and ongoing studies related to purse-seine selectivity was also reviewed. Information considered by the FT-SWG session relevant to reducing fishing mortality on STFO is provided in the full report of the FT-SWG as Attachment I.

312. The SC provided the following advice to the Commission:

i. Explore the feasibility of registering and monitoring the status of the electronic package attached to a drifting FAD as a means to monitor and study effort by the purse-seine fishery.
ii. Regarding further studies on FAD characteristics such as depth, construction and features of the associated electronic package, the SC recommended further study and support in collecting and recording data and operational details that may be necessary to conduct these studies.
iii. Regarding technical research on bycatch mitigation, SC advised that collaborative projects with industry are a cost-effective and operationally sound approach, and requested support of the Commission in facilitating such opportunities.

313. The operational research plan for 2009–2010 and medium-term work plan of the FT-SWG as adopted under agenda item 3.1 is in the SC5 FT-SWG report.

314. The SC strongly recommended that the studies named below, which are relevant to effort standardization and documentation of fishing efficiency be advanced as soon as possible:

i. Conduct studies to help quantify changes in fishing efficiency in both longline and purse-seine fleets in the WCPO.
ii. Conduct a study (or studies) to identify and refine lists of necessary technical data inputs for effort standardization.
iii. Conduct a study to document and analyze fishing efficiency and historical changes in vessel and gear attributes in WCPO fisheries including purse-seine net information.
    a. Regarding purse-seine fishing gear characteristics, the SC recommended that the actual depth to which purse seines effectively operate be examined on a per-vessel and per-fleet basis, using time and depth recording tags on purse seines.
    b. Conduct a detailed characterization of vessels or fleets that have high catch rates of STFO and bigeye tuna in particular.

DISCUSSION

315. One participant inquired whether there has been any work on turtle entanglement in FADs. The presenter responded that he was aware of two such studies: one by the IEO (Instituto Español de Oceanografia) and another by AZTI-tecnalia. The presenter offered to provide references for both.

316. Concern was also expressed regarding lost and abandoned FADs and the potential for "ghost fishing" impacts from such gear. The presenter indicated that this is a recognized problem and that responsibility for lost fishing gear needs to be addressed, but that provisions for FAD identification and tracking will have to proceed or be developed in tandem with such efforts.

317. An inquiry was made as to whether the presented research included anchored FADs, as well as drifting FADs, and the presenter responded that the research encompassed both types.

318. The text on the direction of future work on this topic was adopted for inclusion in the SC work programme.

AGENDA ITEM 6 — DATA AND INFORMATION

6.1 Data gaps

a. Data gaps and progress towards addressing gaps

319. The ST-SWG convenor, K. Duckworth, informed the SC that the major developments over the past year with regard to filling data gaps include:

i. The Philippines provided i) operational logsheet data (for their domestic purse-seine fleet for 2004 and 2008) to WCPFC; and ii) annual catch estimates broken down by gear (for 2008);
ii. Indonesia conducted a workshop in May 2009 that resulted in the development of a set of tuna fishery logbooks, which will be implemented in their fisheries in the coming year. Indonesia also provided a considerable amount of historical tuna fishery data.
iii. Japan provided operational level catch and effort data for its purse-seine fleet for the period 2001–2004.
iv. SPC-OFP received formal authorizations from the Cook Islands, Fiji, Marshall Islands and Vanuatu for the release to WCPFC of historical operational level catch and effort data.

320. With regard to the specification of scientific data to be provided to the Commission (adopted at WCPFC4) in general, and the sections on operational level catch and effort data specifically:

i. Many data gaps remain. It is common for CCMs to not meet the specification.
ii. There seems to be some degree of misunderstanding about the status of the specification, with some CCMs believing that parts of it are optional, and other CCMs believing that it is mandatory in its entirety.
iii. The reference to "domestic legal constraints" continues to be an issue.
iv. Some CCMs want the requirement for operational level catch and effort data removed from the specification, stating that such data are not required in some other regional fisheries management organizations (RFMOs). Some CCMs oppose the proposal to remove this requirement.

321. The SC recommended that:

i. The WCPFC Executive Director resend his letter to CCMs (copied to representatives of the SC), asking them to authorize the release to WCPFC of their operational logsheet data held by SPC-OFP.
ii. The issue related to the attribution of catch under charter arrangements be referred to the TCC.
iii. The issue of obtaining aggregate distant-water longline data for the Pacific Ocean (for use in stock assessments) should be covered in the data exchange protocols in the memorandum of understanding (MOU) with IATTC.
iv. All CCMs familiarize themselves and comply with, the obligations of the Commission's data submission standards (Scientific Data to be Provided to the Commission).
v. CCMs report to the TCC on their progress in overcoming "domestic legal constraints" to providing data.
vi. The TCC consider non-compliance with data reporting obligations as a significant part of the CCMM working group.

b. Review of "A study to identify causes of data gaps in the work of the WCPFC"

322. The ST-SWG convenor recapped the history of this study. SC3 discussed the data required to support stock assessment and ecosystem and fishery management, and recommended that WCPFC conduct a study to identify causes of data gaps. The study was endorsed by WCPFC4 in December 2007. FishServe Innovations New Zealand Ltd was engaged by the WCPFC Secretariat to undertake the data gaps study. The primary tool for gathering information on the causes of data gaps was a questionnaire.

Despite numerous attempts to gain responses, over a period of several months, only half of all CCMs responded to the survey.

323. The study identified several indicative reasons for data gaps, including i) misunderstanding of what data are required and how data are to be provided; ii) translation of English language requirements for data; iii) lack of resources within CCMs to provide data; iv) CCMs are collecting data but not the specific types required by the Commission; v) domestic legal constraints limiting CCMs' ability to supply data; vi) other agreements (i.e. all data being collected and stored but authorization not given to release data); and vii) potential lack of recognition among key officials of the importance of data for stock assessment and other management tasks.

324. The study made the following recommendations:

i. In order to gain robust outcomes from stock assessment and ecological analyses, it is essential that operational level catch and effort data are provided.
ii. The Commission should investigate the employment and contract of a Data Capture Manager who would regularly contact and work with CCM data correspondents.
iii. The Commission should investigate holding workshops with CCM data correspondents (who are often not the people who attend the current range of Commission meetings), to clarify issues associated with the capture and provision of data.
iv. The Commission should continue to liaise with senior representatives of CCMs and other relevant entities to coordinate data provision.

325. CCMs largely seem to be comfortable that the study has identified the major issues, but there is some disagreement on the relative importance of each of the issues identified. Some CCMs want the Commission to become more assertive in monitoring and enforcing its requirements for data provision.

326. The SC recommended that decisions on i) employing a data capture manager and ii) the holding of a workshop for data correspondents, be deferred until after consideration of the "Independent Review of the Commission's Transitional Science Structure and Functions".

c. Species composition of purse-seine catches

327. The ST-SWG convenor presented advice and recommendations from the ST-SWG relating to Project 60 (Collection and evaluation of purse-seine species composition data). Species composition data from paired spill-and-grab samples collected during four purse-seine trips in the waters of Papua New Guinea in 2008 were analyzed. The paired samples were used to estimate the selectivity bias of the grab samples and it was determined that the grab samples tended to miss very small and very large fish. The selectivity bias was quantified with a model of the availability of fish of various length intervals to be sampled. Estimates of the bias were used to correct grab samples collected by observers from 1995–2008, and the corrected observer data were then used to adjust purse-seine catch data that are used in MULTIFAN-CL (MFCL) stock assessments. The adjusted data suggest that the proportions of skipjack and yellowfin in the unadjusted data are over-estimated and under-estimated, respectively. It was noted that estimates of the selectivity bias of grab samples presented in WCPFC-SC5-2009/ST-WP-03 are based on paired spill-and-grab samples from only four trips, during each of which only anchored FADs were fished, and that many more paired samples are required to better estimate the bias, particularly samples from other school associations.

328. An international working group on "tuna purse-seine and baitboat catch species composition derived from observer and port sampler data" was held in June 2009. The main outputs of the working group were:

i. To note that the difficulties and uncertainties inherent in most of the methods used to sample the species and size composition of purse-seine catches have been poorly described and analyzed. As a consequence, many of the changes in the species composition of historical purse-seine catches, for instance the percentage of bigeye caught, may be due to either real changes in fisheries or to improvements in species sampling.
ii. An improved overview of the major uncertainties in estimating species composition, especially bigeye catches. Bigeye is of key importance in this sampling; taking note of the frequent misidentification of small bigeye in purse-seine catches.
iii. Recommendations to the scientific bodies of RFMOs, such that they could improve the multi-species sampling, their past and present results, and their data processing.

329. One CCM stated that grab sampling biases are basically human in nature (and are not a fixed constant physical bias), and as such, they have been showing a great potential heterogeneity over time between the samplers, *inter alia* i) as a function of their training in random sampling; ii) of the individual grabbing bias of each observer; and iii) of the combination of sizes and species sampled. Then there is a danger that potential biases in the entire pool of observer data have been historically wider than in the 2008 limited sampling. It is therefore recommended to better study the potential variability and range of this human grab sampling bias (e.g. comparing port and grab sampling results simultaneously taken from the same fleets). These results should be incorporated into future retrospective correction of species composition of historical purse-seine catches.

330. Some CCMs recommended that the trials and data comparisons suggested by SPC-OFP during SWG meetings should be included in the recommendation to the Commission. In particular, it was proposed that analyses linking cannery data with sample estimates arising from the observer grab-and-spill data was necessary, specifically to compare observer grab-and-spill data to port sampling for that specific trip. It was agreed to reflect this in the recommendation.

331. The SC recommended the continuation of Project 60, including additional surveys of canneries, to try and compare the cannery data, and making full use of logbook data when available, for specific trips, with data obtained from grab-and-spill sampling for the same trips.

d. Obtaining ISC data

332. The ST-SWG convenor provided some background on the issue of obtaining data from ISC. WCPFC5 recommended that the Secretariat work with ISC, SPC-OFP and relevant CCMs to develop a strategy for the harmonization of ISC data and WCPFC data. The Secretariat prepared a draft proposal for this. The Statistics Working Group of the ISC, and the 9th Plenary (ISC9) session of the ISC, discussed the recommendations of the Independent Review and the Secretariat's proposal. ISC9 agreed that it would be appropriate for ISC and WCPFC to exchange data inventories and identify data gaps as a first step.

333. With regard to the assembly of data for stock assessments, the WCPFC and ISC use quite different operating procedures. Specifically the WCPFC pools data in a central repository (located with the Commissions data contractor in Noumea) before it is analyzed; but ISC Members do not submit operational data to a central repository. Instead each Member uses its own operational data (for CPUE standardization and other relevant studies) and brings the results to the stock assessment meeting for discussion and incorporation into model runs.

334. As a consequence of these different operating procedures, the ISC does not hold any fine scale (for example – operational catch and effort) data. The ISC does hold aggregated data, but this is the same data that CCMs should also have submitted to WCPFC; the only exception to this being that the ISC does hold some aggregated data for Mexico, which is a Cooperating Non-Member of the WCPFC.

335. Despite these issues, it was recognised that there probably is a need to reconcile the data holdings of the ISC and WCPFC.

336. The SC recommended that:

i. The Secretariat provides an inventory of Commission data holdings for North Pacific stocks to ISC by ISC10.
ii. The Secretariat, ISC, SPC-OFP, and interested CCMs complete a reconciliation of ISC and Commission data holdings for North Pacific stocks, to identify any data gaps by 1 October 2010.
iii. The Secretariat and ISC collaborate to exchange data, address data gaps for North Pacific stocks, subject to the Commission's Rules and Procedures for the Protection of, Access to, and Dissemination of Data Provided to the Commission and the rules and procedures governing data exchange that are contained within ISC's operations manual.
iv. The ISC and the Secretariat establish a mechanism for the periodic exchange of data to address gaps in the data for North Pacific stocks.
v. The Secretariat provide a report of progress on these matters to SC6.

6.2 Regional Observer Programme

a. Data management hosting and costing options

337. The ST-SWG convenor explained that CMM-2008-01 requires 100% observer coverage of the purse-seine fishery between 20°N and 20°S for the period August–September 2009 and then continuously from January 2010, while CMM-2007-01 sets a target of 5% coverage of the longline fishery within the Convention Area by June 2012. The number of observer trips associated with coverage targets given above has been estimated to be 3,036. Regional Observer Programme (ROP) data management centre costs and hosting possibilities were discussed at the third ROP Intersessional Working Group (ROP-IWG3). ROP-IWG3 recommended a comparison of estimated costs for the following three ROP data hosting options: i) SPC at Noumea, New Caledonia; ii) SPC at Suva, Fiji; iii) Commission Secretariat office, at Pohnpei, Federated States of Micronesia.

338. There are many other possible ROP data hosting options, but these were the three specifically identified at ROP-IWG3. Some CCMs may be able to enter their own observer data and then provide this to the Commission. This would reduce ROP data management centre costs. The comparison of data management centre hosting options demonstrates that personnel costs will almost certainly have the highest impact on total costs.

339. The location of the ROP data management centre is an issue of significant interest to CCMs, and this issue has some overlap with future decisions on providing general data management services to the Commission.

340. The SC noted the paper on data management hosting and costing options.

b. Data fields contained in the FAD form

341. The ST-SWG convenor explained that ROP-IWG3 developed an Interim FAD Form for use during the FAD closure period in August–September 2009. This form (Interim Form PS-4) contained the minimum data standards that ROP-IWG3 considered were required to collect FAD information for both science and monitoring purposes. The form developed by ROP-IWG3 is an interim solution to be used for

the August-September 2009 FAD closure. The list of fields is a starting point that should be built on for future years.

342. The SC supported the list of fields contained in Appendix 2 of the ST-SWG report as an interim list for use in 2009.

343. The SC recommended that the following fields be added to this interim list of FAD fields if this is practical:

i. Describe the floating object when first found by the vessel.
ii. Describe any changes or additions to the floating object prior to the vessel departure.
iii. Depth of netting and/or other materials hanging from the floating object.
iv. FAD markings or numbers.

344. The SC recommended that an "investigate floating object" be added to the list of FAD activity codes if this is practical.

c. Definition of a FAD set

345. The ST-SWG convenor summarized that ROP-IWG has previously agreed that, in relation to CMM-2008-01, ROP observers onboard purse seiners will carry out their usual functions with the additional roles of monitoring the FAD closure and catch retentions. Because the focus will be on the FAD closure, the Secretariat was requested to provide ROP-IWG with a definition of a "FAD set", based on the definitions used by other RFMOs and PNA. WCPFC-ROP-IWG3-IP02 (Rev.1) includes a definition of "FAD set" taken from an earlier IATTC definition and the PNA 3rd Implementing Agreement draft regulations. ROP-IWG agreed that a "FAD set" for the period August–September 2009, be defined as: "A set on a FAD is a set with a purse-seine net made by a fishing vessel that is a distance of one nautical mile or less from a FAD at the moment in which the skiff is released into the water for the purposes of that set." This definition was proposed for the 2009 closure period only.

346. The application of FAD restrictions in other RFMOs has suffered from problems of compliance and monitoring. S. Harley produced a paper (WCPFC-SC5-2009/ST-WP-07) "Analysis of purse-seine set times for different school associations: A further tool to assist in compliance with FAD closures?". Operational level purse-seine catch and effort data for almost 50,000 sets was examined (in particular records of the start of set time) to see if there are any major differences in characteristics between sets on various floating objects. The study found that 94% of sets on FADs occurred prior to "official" sunrise, while only 3% of unassociated school sets occurred before sunrise, with the remainder occurring at consistent rates during daylight hours. There was general interest in this research and it may be useful for enforcing, or estimating compliance with, WCPFC FAD restrictions.

347. The SC recommended that WCPFC-SC5-2009/ST-WP-07 (Analysis of purse-seine set times for different school associations: A further tool to assist in compliance with FAD closures?) be forwarded to TCC for its consideration.

348. The SC recommended the work described in WCPFC-SC5-2009/ST-WP-07 continue.

349. SC5 recommended that the TCC clarify the definition of FAD with regard to large living marine animals.

350. The SC recommended that the TCC standardize the definition of a FAD and FAD set between high seas and in-zone fisheries.

6.3 Advice to Ad Hoc Task Group on Data

a. Scientific needs for vessel monitoring system data

351. The ST-SWG convenor recalled that SC4 had a preliminary discussion on the use of vessel monitoring system (VMS) data for scientific purposes. SC4 had proposed applying the same timeframe as applies in ICCAT to the availability of VMS for scientific purposes (i.e. no data more recent than three years old shall be released). In 2008, ICCAT revised its resolution relating to this matter as it applies to Atlantic bluefin tuna, and now VMS data can be released on request to contracting parties and cooperating non-parties with an active inspection presence in the region, and to the Standing Committee Research and Statistics (SCRS) on request.

352. The Ad Hoc Task Group (AHTG) on Data Chair noted that WCPFC is creating a less restrictive set of data rules than those of ICCAT, and that this should be taken into account when considering timeframes.

353. The SC recommended that CCMs provide any additional comments on the use of VMS data for scientific purposes, data requirements and timeframe to the AHTG on Data Chair, and copied to the Secretariat, by 1 September 2009.

b. Review of public domain catch and effort data

354. The definition of catch and effort data in the public domain contained in the current version of the "Rules and Procedures for the Protection, Access to and Dissemination of Data Compiled by the Commission" is "catch and effort data aggregated by gear type, flag, year/month and, for longline, 5° latitude and 5° longitude, and, for surface gear types, 1° latitude and 1° longitude — and made up of observations from a minimum of three vessels". The three-vessel rule creates some problems, including i) the relevance of number of vessels to raised aggregated catch and effort data, given that aggregated data are almost always raised from operational data; ii) the lack of data held by the Commission on the number of vessels covered by the operational data used to derive aggregated data; and iii) potential bias in CPUE determined from filtered aggregated catch and effort data.

355. The three-vessel rule does not apply to "Staff of the Secretariat, the WCPFC Science Services Providers, and Officers of the Commission and its Subsidiary Bodies", and likewise it does not apply to CCMs accessing data for purposes of the Convention. As such the three-vessel rule does not introduce any bias into analyses performed for WCPFC.

356. One perspective is that it is essential for all tuna RFMOs to be fully transparent in the availability, by gear and country, of aggregated catch and effort data, and that there is a need for scientists outside of the Commission, the public and NGOs, to have access to basic fishery data.

357. The alternate perspective is that the Commission's priority should be data provision, and that the removal of the three-vessel restriction may serve to discourage some CCMs from the voluntary provision of data.

358. With some careful rewording of the Rules and Procedures for the Protection, Access to and Dissemination of Data Compiled by the Commission it should be possible to find an appropriate balance between both of these perspectives.

359. The SC recommended that the Commission task the AHTG on Data with investigating changes to the Rules and Procedures (with regard to public domain data and the three-vessel rule) to protect

confidentiality requirements of individual CCMs, while allowing those CCMs that wish their aggregate data to be made available without restriction to do so.

6.4 Indonesia and Philippines Data Collection Project and Global Environment Facility project

360. WCPFC's Executive Director advised that a transitional steering committee for the WCPFC Indonesian Philippine Data Collection Project (IPDCP) and the West Pacific East Asia Oceanic Fisheries Management Project (WPEAOFMP) was convened in the margins of SC5 on 13 August 2009 (WCPFC-SC5-2009/GN-WP-06). He reported on progress to develop a project for funding submission to the Global Environment Facility (GEF) to continue work on improving fishery monitoring and institutional strengthening of the Philippines, Indonesia and Vietnam in the work of the Commission. He noted that IPDCP, which had originally been designed to address data gaps for WCPO tuna fisheries, had been financially supported by voluntary contributions by WCPFC CCMs since 2002, and that at SC3 in 2007, the SC requested the Secretariat to increase efforts to secure a more stable funding base for work in this western region. The SC was advised that, following baseline work in the three countries in late 2008, GEF had committed to provide USD 1 million to the WPEAOFMP, subject to finalization of annual work plans by Indonesia, the Philippines and Vietnam, for the period mid-2009 to mid-2011. He reported on related activities supported by the Secretariat during the last 12 months, including a workshop in Indonesia to assist with logbook harmonization to assist Indonesia in meeting its data submission obligations to the Indian Ocean Tuna Commission (IOTC) and WCPFC. He advised that support from GEF would not have been possible without the formal involvement of several significant partners in the project. In addition to significant in-kind and cash contributions by participating countries, the project secured co-financing or funding in-kind partnership arrangements with the Australian International Development Assistance Agency (AusAID), the US National Marine Fisheries Service, the Government of Japan (though the WCPFC Japan Trust Fund), the Pacific Islands Forum Fisheries Agency (FFA), the Australian Centre for International Agriculture Research (ACIAR), and the Commission.

6.5 Tagging initiatives

361. The report of the Third Pacific Tuna Tagging Programme (PTTP) Steering Committee meeting was tabled as WCPFC-SC5-2009/GN-WP-05. The SC:

i. Expressed its appreciation to the Government of Korea for its recent funding commitment to PTTP;
ii. Noted the excellent progress achieved by the PTTP over the past 12 months;
iii. Endorsed the 2009–2010 work plan as presented in WCPFC-SC5-2009/GN-IP-15;
iv. Noted the complementary tagging programmes underway in Hawaii, the EPO and the coastal and offshore areas off Japan; and
v. Endorsed the initiative to seek funding through the Coral Triangle Initiative to undertake continued tagging in the waters of the Philippines, Indonesia, PNG and Solomon Islands.

362. SC5 noted the progress to date and recommended the continuation of further work.

6.6 Data verification

363. The ST-SWG convenor described a review of the data fields listed in the draft CMM on transhipment (WCPFC-SC5-2009/ST-WP-05 — Annex 1), which was undertaken to ensure they satisfied the requirements for science. The suggested revisions are provided in WCPFC-SC5-2009/ST-WP-12. Major conclusions of this review were:

i. The data fields required for scientific purposes from unloading and transhipment are basically the same.

ii. Unloaded target and by-product catch by species in number is fundamental for the longline fishery.
iii. The unit of catch in weight should be specified.
iv. Future scientific (and other) requirements for the unloaded catch broken down by geographic area. However, the link to logsheets for the fishing trip will be the most efficient way to satisfy the wide range of scientific requirements for geographic location of the unloaded/transhipped catch.

364. Discussion by the SC confirmed support for the use of the data fields in WCPFC-SC5-2009/ST-WP-05 for the purposes of transhipment monitoring, although it was noted that the process of matching logsheet and transhipment data is expected to be a difficult one.

365. However, there was no consensus on the need for unloading reports, or the minimum fields to be used for unloading reporting. Some participants felt that unloading data were no different from transhipment data and were important from a scientific perspective to provide robust, verifiable data. Some CCMs already collect these data and do not see the task as overly onerous.

366. In contrast, other CCMs expressed concern about the need to collect unloadings data. It was noted that the "scientific data to be provided to the Commission" covers certain categories of data that are required for stock assessments (e.g. aggregate and operational data), and there was an indication that these are sufficient for scientific purposes. It was also noted that the presence of observers in the fishery provides a degree of independent verification.

367. The SC recommended that, with regard to transhipments, the list of fields to be collected for scientific purposes described in Annex 1 of WCPFC-SC5-2009/ST-WP-05 be forwarded to the TCC for its consideration.

368. The SC noted that the Marshall Islands is leading the development of a CMM on transhipment, and encouraged CCMs to provide comments to the Marshall Islands on the discussion paper, preferably in advance of TCC5.

369. The SC was unable to provide a recommendation on future collection of unloading data.

AGENDA ITEM 7 — COOPERATION WITH OTHER ORGANIZATIONS

7.1 Review of existing MOU and relations with other organizations

370. WCPFC's Executive Director introduced a discussion of the existing MOUs between WCPFC and other organizations. Three issues were highlighted for consideration by the SC:

i. A recommendation of the "Independent Review of the Commission's Transitional Science Structure and Functions" for the Commission to enter into three-year agreements with SPC-OFP as the science services provider as adopted by WCPFC5;
ii. A recommendation of the Independent Review to revise the existing MOU between WCPFC and ISC in order to allow the SC to directly request advice from ISC on the status of North Pacific stocks as adopted by WCPFC5 (WCPFC5 Summary Report, para 266(c), 271); and
iii. a Draft memorandum of cooperation on the "Exchange and Release of Data" with IATTC developed by the WCPFC Secretariat on the basis of Appendix 4 of the Commission's Rules of Procedures for the Protection of, Access to, and Dissemination of Data compiled by the Commission, with comments provided by IATTC contracting parties when the draft was considered at the 80th session of IATTC in June 2009.

371. SC5 endorsed revisions to the MOU with SPC to provide for a three-year arrangement as directed by the Commission (Attachment O).

372. In relation to the memorandum of cooperation with IATTC, the SC noted the proposed revisions by IATTC contracting parties and referred the draft to TCC5 for further consideration.

373. While all non-ISC CCMs supported the proposed changes to the MOU with ISC, most ISC Members of the SC did not support the proposal, advising that ISC Members are currently considering the implications of the proposed change and that the NC would be asked to also provide comments. Several CCMs considered that the issue of the MOU with ISC was linked to broader discussion to take place under the review of the Independent Review under Agenda Item 10.3.

7.2 Development of new MOUs*

374. WCPFC's Executive Director noted that a MOU with the North Pacific Anadromous Fisheries Commission (NPAFC) had been prepared by the Secretariats of NPAFC and WCPFC. The draft (WCPFC-SC5-2009/GN-WP-10, Attachment M) was presented to SC5, NC5 and TCC5 prior to forwarding to WCPFC6 for formal adoption.

375. SC5 had no comments on the draft and endorsed its submission to NC5 and TCC5 before being considered by WCPFC6.

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

8.1 Review of 2008/2009 Activities

a. Special Requirements Fund

376. The SC was informed that the balance of the Special Requirements Fund (SRF) is currently just over USD 150,000, which includes in 2009, a voluntary contribution of USD 15,000 from the USA. It was noted that since the establishment of the fund in 2004, only two CCMs have voluntarily contributed to the SRF: Federated States of Micronesia and the USA.

377. Niue noted that in 2009 funds from the SRP were used to cover travel expenses of Rhea Moss, who consulted on behalf of the WCPFC Secretariat with some FFA Members on the development of a WCPFC Charter Scheme for consideration at WCPFC6. Niue expressed its thanks to the WCPFC Secretariat for progressing this matter, noting that further discussions will take place at TCC5.

378. The Cook Islands, on behalf of FFA Members, proposed some suggestions of activities arising from SC5 discussion, which could be funded from the SRF. These might include: travel expenses for several scientists from Pacific Island CCMs to participate in future pre-stock assessment workshops; and funds to assist with training of Pacific Islands fishing industries in the application of sea turtle mitigation measures and sea turtle handling, and for purchase and dissemination of de-hookers and circle hooks for use in sea turtle mitigation trials. Such activities would require additional funds to those that are currently available in the SRF, and it should be noted that the SRF has application to monitoring, control and surveillance (MCS)-related capacity building activities as well.

379. The USA noted that there are alternative sources of assistance for sea turtle mitigation materials and training that could be accessed by developing CCMs. PNG expressed its appreciation to the USA for

assistance that has allowed the dissemination of sea turtle mitigation tools, and for trials of circle hooks in PNG.

b. Japan Trust Fund

380. Cook Islands, Fiji, FSM, Kiribati and Niue all expressed (on behalf of their governments) their appreciation to the Japan Trust Fund (JTF) for funding the 2009 SPC Tuna Data Workshop and the SPC Tuna Stock Assessment Training Workshop. These CCMs noted that their participation in these workshops has been instrumental in assisting them with meeting their data reporting obligations to the Commission, completing Annual Reports Part 1, and improving their understanding of stock assessment analyses.

381. With regard to 2009 JTF-funded activities:

i. FSM noted that their project, "Development and improvement on fisheries data collection and data base for Pohnpei artisanal and semi-artisanal tuna catch in the coastal waters" was approved for JTF funding in 2009. This project is an important one as it will assist with tuna data collection in Pohnpei State, which will complement national tuna data collection efforts. It is hoped that the success of this project will be expanded to the other FSM states in the future.

ii. Kiribati noted that they had received over USD 12,000 to support the artisanal tuna data collection workshop that is currently earmarked to be implemented in early October this year. This workshop will be implemented with assistance from SPC-OFP staff. This in-country training workshop is part of a capacity building programme to provide fisheries staff stationed in outer islands with the necessary skills to collect quality artisanal tuna fisheries data, including reef fish resources. This will enable better catch estimates and management regimes so that coastal resources can be effectively developed and enhanced.

382. Japan noted that the paramount purpose of the JTF is capacity building in Pacific Island countries and territories. While most projects so far have been carried out with assistance from SPC-OFP, Japan hopes that Pacific Island countries and territories will nominate their own individual projects for 2010 funding by JTF. Such projects can be submitted to Z. Suzuki, JTF Coordinator at the WCPFC Secretariat.

383. SPC-OFP noted that it is extremely appreciative of funding from all sources. SPC is very pleased to observe the tremendous development in understanding of stock assessment methodology and analysis by Pacific Island scientists who have participated in the Tuna Stock Assessment workshops.

384. SC5 expressed its appreciation to FSM, USA and Japan for their voluntary contributions to the SRF and JTF, respectively, which have assisted small island developing States, particularly in the areas of science and data.

385. SC5 urged other CCMs and organizations to also voluntarily contribute funds to SRF.

AGENDA ITEM 9 — FUTURE WORK PROGRAMME AND BUDGET

9.1 Process of implementing the work programme of the Scientific Committee

386. WCPFC's Science Manager introduced working paper WCPFC-SC5-2009/GN-WP-04 (Rev), which outlines the process for formulating the work programme and budget of the SC as adopted at SC4. He also outlined the draft Template for Research Proposals and suggested revisions to the Research

Proposal Assessment Criteria. These revisions suggested the removal of two criteria and the revision of a third.

387. The meeting discussed the suggestion to delete the Likelihood of Success criterion from the table of Research Proposal Assessment Criteria. It was pointed out that this criterion served a useful purpose and was not covered by any of the other criteria in the table. The meeting was informed of several reasons for retaining this criterion, including identifying if a project was overly-ambitious, could not achieve its objectives for certain reasons, or that the reviewer may have knowledge unknown to the applicant as to why the project may not succeed. Based on this discussion there was support to retain this criterion in the Table. In relation to a question as to why the other criterion had been deleted, the meeting was informed that the intent of this criterion had been included in the revision of the first criterion in the Table. The meeting also noted that due to the varying scope of research proposals, there may be a need to use only a sub-set of the criteria to assess any given proposal.

388. The FT-SWG convenor noted that based on the experience of reviewing the research proposals received earlier this year, that it is important to solicit from applicants all the information required to adequately review any proposal. The meeting noted that the Template for Research Proposals was designed to address this issue and that to further inform applicants the meeting agreed that the Table of Research Proposal Assessment Criteria should also be placed at an appropriate place on the Commission's website (Attachment P). A comment to have applicants attach the CVs of project staff was also supported.

9.2 Strategic Research Plan of the Scientific Committee

389. The Strategic Research Plan for 2007–2011 will be reviewed SC6. CCMs are requested to provide comments on this plan by 31 March 2010 so that a working paper can be prepared by the Secretariat for discussion at SC6. In addition to review of this existing Strategic Research Plan, the Secretariat is preparing a research plan for 2012–2016 which will be evaluated at SC7.

390. The SC did not provide any comments on the Commission's strategic research plans.

9.3 Progress of 2009 work programme, 2010 work programme and budget, and 2011–2012 provisional work programme and indicative budget*

391. The SC reviewed the 2009 work programme, and noted that four projects had been completed and removed from the work programme. The remaining projects, and three projects (SEAPODYM simulation modelling, identifying provisional decision rules, and stock assessment of southwest Pacific striped marlin), which were added, now form the 2010 work programme. The SC work programme and budget for 2010, and indicative budget for 2011–2012 are shown in Table 2.

392. The SC recommended that:

i. Project 60 (the collection and evaluation of purse-seine species composition data) be funded for its second year (2010);
ii. Project 56 (underwater videos) be supported in 2010 with an allocation of USD 2,000;
iii. Consideration of funding support for the ERA project beyond 2010 be postponed to SC6;
iv. An increase in funding of USD 150,000 (to support the science and data management services provided by SPC-OFP) to USD 700,000 (includes ERA funding) to accommodate a new stock assessment and data management post.

Table 2. List of SC work programme titles and budget for 2010 and indicative budget for 2011–2012, which require funding from the Commission's core budget (in USD). Table 6 in the SC4 Summary Report includes a detailed description of each project.

Strategic Research Activity or Project with priority identified at SC3	2010		2011		2012	
	Core	Other	Core	Other	Core	Other
Project 14. (Priority = High) Indonesia and Philippines Data Collection Project (IPDCP)	75,000		25,000		25,000	
Project 35. (Priority = High) Refinement of bigeye parameters Pacific-wide: A comprehensive review and study of bigeye tuna reproductive biology	30,000		62,000		50,000	
Project 39. (Priority = High) Regional study of the stock structure and life history characteristics of South Pacific albacore	25,000	500,000				
Project 42. (Priority = High) Pacific-wide tagging project	10,000	2,500,000	10,000			
Project 56. (Priority = Medium) Extended use of underwater videos and other tools to characterize species, size composition and spatial distribution of tunas aggregating around floating objects	2,000					
Project 57. (Priority = High) Identifying Provisional Limit Reference Points for the key target species in the WCPFC	20,000		20,000		20,000	
Project 60. (Priority = High) Collection and evaluation of purse-seine species composition data	*54,500*					
SUB-TOTAL	216,500		117,000		95,000	
UNALLOCATED BUDGET	12,050		280,050[a]		318,556	
SPC-OFP BUDGET	700,000		720,000		792,000[b]	
GRAND TOTAL BUDGET	928,550	3,000,000	1,117,050		1,205,556	

[a] Annual budget for completed ERA was incorporated for new project(s).
[b] An annual increase of 10% from the previous year.

393. The SC requested that the science services provider conduct assessments of WCPO bigeye and skipjack tuna for consideration at SC6.

394. There was discussion about the overall SC budget, with some CCMs noting that the existing Commission's science budget should be expanded. The SC noted that the value of the fisheries was approximately USD 4.8 billion, and that the science component of Commission's budget equated to only 0.014% of this amount.

395. The SC also noted that because only USD 12,050 remains unallocated in the 2010 science budget, essentially no funds remain to support a call for expressions of interest to progress the scientific work programme.

396. Given the extensive scientific research that needs to be untaken to support the provision of good scientific advice to the Commission, as identified in the Commission's scientific work programme, the SC recommends that the Commission consider increasing the science budget significantly.

397. The SC recommended the 2010–2012 budget in Table 2 to the Commission.

AGENDA ITEM 10 — ADMINISTRATIVE MATTERS

10.1 Rules of Procedure

398. No issues were raised with regard to the WCPFC Rules of Procedures.

10.2 Peer review of stock assessments

399. SC5 agreed on the following points with regard to the Independent Review's recommendation on peer reviews stock assessments undertaken by the SC for consideration by the Commission:

i. A periodic peer review was seen as strengthening assessments and their outcomes, improving transparency, building understanding and confidence, and helping to ensure best practice in the delivery of stock assessments to the Commission
ii. The results or absence of a peer review may not be used as an excuse to delay conservation and management actions.
iii. The SC recommended to undertake a peer review of a single stock assessment initially, and use the outcomes of this review to determine the scope and resource demands that would be considered in formulating subsequent reviews.
iv. The SC recommended that an SPC-OFP assessment be selected for the initial review, in particular, the bigeye assessment undertaken for the WCPO;
v. Given the perceived difficulties in completing the assessment by May for the review to be undertaken in June and the report made available in July (as recommended by Marine Resource Assessment Group–MRAG), the SC proposed the following process for undertaking the review:
    a. undertake a detailed review of the selected stock assessment considered by the SC the previous year;
    b. provide an interim report to the Preparatory Stock Assessment Workshop;
    c. undertake a short review of the completed stock assessment report;
    d. provide the report on completed review to SC;
    e. stock assessment group to provide comments on interim report provided to the Preparatory Stock Assessment Workshop.
vi. Participation by reviewer(s) in the SC (and possibly the Preparatory Stock Assessment Workshop) was seen to be possibly beneficial but would have additional cost implications.
vii. In the selection of reviewers, the need to consider the independence and expertise of reviewers would need to be balanced against costs.
viii. As range of options for selecting reviewers were noted. These included:
    a. CCMs
    b. other RFMOs (e.g. IATTC)
    c. the Center for Independent Experts — a group affiliated with the University of Miami (USA) that provides independent peer reviews of the US National Marine Fisheries

Service science nationwide, including reviews of stock assessments for fish and marine mammals

d. MRAG.

ix. A recommendation on a specific reviewer is difficult to make at this time until the costs associated with each of these options are more fully understood. However, the SC saw considerable benefit in the independence of the selected reviewer.

400. SC5 noted that if the review of the SPC-OFP assessment was undertaken during 2010, there may be additional cost implications.

401. SC5 requested that the proposal for peer reviewing an SPC-OFP assessment be passed to the NC and ISC as an information paper for their consideration.

10.3 Future operation of the Scientific Committee

a. Independent Review of the Commission's Transitional Science Structure and Functions

402. SC5 considered several topics relating to improving the efficiency and effectiveness of the future SC operations. These topics were discussed based on the experiences of previous SC meetings, feedback from the Commission and other subsidiary bodies, and a review of the recommendations contained in the "Independent Review of the Commission's Transitional Science Structure and Functions".

403. A table of recommendations arising from the Independent Review was discussed and CCMs comments were noted (Attachment Q). It was evident that further discussion would be needed to develop clear SC5 recommendations for some items. In other cases, it was suggested that it would be more appropriate for either the Commission or its subsidiary bodies to provide advice.

404. SC5 recommended that issues from Attachment Q that require further discussion be raised with WCPFC and its subsidiary bodies at subsequent meetings.

405. SC5 also discussed terms of reference for the pre-stock assessment working groups. Efforts will be made to agree to terms of reference intersessionally by a group composed of the SC Chair and Vice-Chair, the SWG convenors, and the science services provider, with revisiting this issue for agreement at SC6. Until new terms of reference are agreed on the existing terms of reference will apply.

406. Several CCMs recommended that the structure of the SC meetings be streamlined. Proposals included scheduling meetings of the BI-SWG, ME-SWG and FT-SWG on a biennial, ad hoc, or other basis; or dissolving these SWGs as formal working groups but holding the discussions that would normally occur in these SWGs as thematic sessions within a single SC plenary meeting with each thematic session convened by an expert in a similar way to the current convenor arrangement works within the SWGs. Suggestions were also made to revise the structure so that the SA-SWG, EB-SWG and ST-SWG meetings were also not held as separate, pre-plenary meetings, but rather are incorporated into a single SC plenary meeting.

407. SC5 agreed to task R. Campbell (Australia), the Secretariat, the SC Chair and Vice Chair, and SWG convenors with developing a proposal for re-structuring SC meetings. This proposal will be distributed to the SC well in advance of SC6, and if acceptable will be trialled at SC6.

10.4 Next meeting*

408. SC6 will be held in Tonga, and is provisionally scheduled for 9–20 August 2010.

10.5 Election of the Vice-Chair of the Scientific Committee*

409. SC's Vice-Chair, Keith Bigelow (USA), will conclude his term at the end of WCPFC6 in December 2009. The SC expressed its sincere appreciation to K. Bigelow for his invaluable contributions. A new Vice-Chair, Pamela Maru (Cook Islands), was nominated and recommended to the Commission for endorsement. K. Bigelow (USA) agreed to assist P. Maru until the conclusion of SC6. This arrangement was forwarded to the Commission for endorsement.

AGENDA ITEM 11 — OTHER MATTERS

11.1 Meeting of the five tuna RFMOs: Science issues

410. The Executive Director summarized WCPFC-SC5-2009/GN-WP-15 concerning the outcomes of the second meeting of tuna RFMOs at San Sebastian, Spain held 28 June to 3 July 2009. He drew the SC's attention to the science-related outcomes of the meeting reflected in a Course of Actions adopted for the period 2009-2011. Items identified for Immediate Action included a proposal to convene four international consultations before September 2010 to focus on i) management of tuna fisheries, ii) MCS-related matters, iii) RFMO issues relating to by-catch, and iv) best practice on the provision of scientific advice in RFMOs. In addition, the San Sebastian meeting adopted a proposal for RFMOs to consider presenting stock assessment results in a Strategy Matrix that presents management targets for tuna stocks.

411. SC5 had no comments on the science-related outcomes of the second Joint Meeting of Tuna RFMOs. The Executive Director suggested that it would be useful for those involved in the 2010 pre-stock assessment workshop consider the Strategy Matrix recommended by the San Sebastian meeting and consider presenting the workshop results in this common format.

AGENDA ITEM 12 — ADOPTION OF THE REPORT OF THE FIFTH REGULAR SESSION OF THE SCIENTIFIC COMMITTEE

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

412. The SC adopted the Summary Report for the Fifth Regular Session. The Secretariat was requested to prepare an Executive Summary to assist with presentation of this report to other subsidiary bodies and to the Commission.

AGENDA ITEM 13 — CLOSE OF MEETING

413. The SC Chair thanked all participants for their contributions to the meeting and for supporting him in his first session as SC Chair.

414. On behalf of the Chair of the FFC, V. Marsh from Niue acknowledged the government of Vanuatu, and particularly the Department of Fisheries for their generous support of SC5. Support staff from the Department of Fisheries and from Le Lagon Hotel were thanked for the assistance they provided both to the meeting and to FFC Members during their stay in Vanuatu.

415. The representative of Vanuatu, R. Jimmy, noted that Vanuatu was very pleased to have hosted SC5. Sincere appreciation was expressed to all staff who contributed their efforts to the meeting. A token of appreciation was presented to SC's Chair.

416. WCPFC's Science Manager, on behalf of the Secretariat, expressed his thanks to the government of Vanuatu for their financial and logistical contributions, and his appreciation to all of the individuals who helped make SC5 a success. CCMs, SPC, FFA, and observer delegations' contribution were greatly appreciated. Tokens of appreciation were presented to several key support staff from Vanuatu.

417. The meeting closed at 17:20 on Friday, 21 August 2008.

Attachment A

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

Scientific Committee
Fifth Regular Session

Port Vila, Vanuatu
10–21 August 2009

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Attachment B

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

Scientific Committee
Fifth Regular Session

Port Vila, Vanuatu
10–21 August 2009

KEYNOTE ADDRESS AND WELCOME
HON. HAM LINI, VANUA ROROA, DEPUTY PRIME MINISTER, VANUATU

- Executive Director of the Western and Central Pacific Fisheries Commission, Mr Andrew Wright and staffs of the WCPFC,
- Chairman of the WCPFC Science Committee meeting,
- Director General for the South Pacific Forum Fisheries Agency, Mr Su'a Tanielu and the staff of FFA,
- Distinguished delegates representing Cooperating Members and Cooperating Non-Members of the WCPFC,
- Observers,
- Members of the media,
- Representatives of the Vanuatu Tuna Industry,
- Officials from respective Vanuatu Government Institutions,
- Representative from the Vanuatu Christian Council,
- Ladies and Gentlemen.

First, let me take this opportunity as Deputy Prime Minister and Acting Minister for Fisheries on behalf of the Government and people of Vanuatu to officially welcome you to Vanuatu. I trust that you have all arrived safely and have managed to find a comfortable place to stay in Port Vila.

It is indeed a great honor for me to be here this morning to officiate the opening of the fifth Scientific Committee meeting of the WCPFC, taking place in Port Vila starting today. During your deliberation in the next 13 days you will be discussing major issues relating to the conservation and management of tuna stocks in the western and central Pacific Ocean. This is an area which covers the EEZs of the Pacific Island nations, including Vanuatu, and tunas are important resources in sustaining the livelihood of the Pacific Island nations.

Distinguished delegates, I wish to remind this meeting that the western and central Pacific Ocean holds the last healthy tuna stocks in the world and the call for sustainable use of these resources rests within your hands as managers of these resources. In recent years, science has already been warning us of the decline in stock of some of the key tuna species such as bigeye and yellowfin tunas. Therefore, serious management consideration are necessary in the way we implement our fishery today most importantly our role as parties to this Commission.

With the growing global demand for fish, economic benefits to derive from fishery, impacts on climate change affecting fishery, increases in population growth and so forth are some of the key factors to consider on the management of our fishery to ensure sustainability of the tuna stocks.

I wish to remind this Commission of the difficulties faced by Small Island Developing States that depend on fish in sustaining national economies and food security that special requirements of small island developing states particularly on national development aspiration as provided for under the Commission's Convention are crucial, and it is important that these issues continue to be considered by this Commission.

As a party to this Commission, and equally as an active member of other tuna commissions worldwide, the hosting of this fifth WCPFC Science Committee meeting in Port Vila this year is timely for Vanuatu as I believe as a senior government leader, this meeting further strengthen the national development aspirations for the Vanuatu Government in the primary sector particularly fisheries. The government policy on primary sector led development has enabled development of two domestic fishing bases in Port Vila and we are proud to see that one of the fishing bases has already started operation in exporting fresh tuna to Japan. We believe such national developments will further improve the economic benefits derived from fisheries sector as well as strengthen Vanuatu's compliance with this Commission's Conservation and Management Measures of the tuna stocks.

However, having a stable government with a safe and secure environment and a sound policy direction are no doubt some of the qualities which Vanuatu offers that would lead to a greater sustainable development of our fishery resources.

I wish to acknowledge the Commission, the regional partners particularly the FFA, the SPC, FAO and our donor partners for their on-going assistance to Vanuatu and other Pacific Island nations in meeting their national management obligations required by the Commission.

On a similar note, I urge all Cooperating Members and Cooperating Non-Members of the Commission to take serious consideration on status of tuna stocks in this region and to recommend appropriate management measures to be in place to safe guard the tuna stocks of the western and central Pacific region.

Distinguished delegates, I wish you all the success in your deliberations in the next two weeks and trust that you would find some time to experience rich diverse culture of Vanuatu and we do hope that you would enjoy your stay here in Port Vila.

Having said so, I now have the pleasure on behalf of the Vanuatu Government to declare the Fifth Scientific Committee Meeting of the Western and Central Pacific Fisheries Commission OPEN.

THANK YOU LADIES AND GENTLEMEN.

Attachment C

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

Scientific Committee
Fifth Regular Session

Port Vila, Vanuatu
10–21 August 2009

OPENING STATEMENT
WCPFC EXECUTIVE DIRECTOR

Distinguished officials representing the government and people of Vanuatu
Director of the Fisheries Department, Vanuatu and his staff
In-coming chair of the Scientific Committee, Dr Naozumi Miyabe
Director General and staff of the Pacific Islands Forum Fisheries Agency
Manager and staff of the SPC-Oceanic Fisheries Programme,
Representatives of Members, Cooperating Non-Members and Participating Territories of WCPFC
Observers, ladies and gentlemen.

On behalf of the Chairman of the Western and Central Pacific Fisheries Commission, Ambassador Satya Nandan from Fiji, I am honored to present these short opening remarks at the start of our fifth regular session of the Commission's Scientific Committee. Ambassador Nandan will join us for the second week of this Session.

If you haven't read all the documents already shortly you will learn that the 2008 catch of tuna from the western and central Pacific was 2.426 million tonnes, the highest annual catch for this Ocean region on record — although only 26,000 mt higher than the previous record in 2007. This harvest represents 81% of the total catch of tuna from the entire Pacific Ocean with WCPO tuna fisheries currently contributing more than 56% of the world's demand for canning grade tuna. These are exciting statistics — if this production is sustainable.

During the next two weeks this Committee has the responsibility to review assessments of the status of the tuna resources supporting this production in the WCPO. We will review information that suggests that South Pacific albacore is moderately exploited; that yellowfin tuna is nearing the limits of sustainable exploitation and that bigeye tuna is over-exploited.

Of course, not all of this is new news. Last year's meeting of the Commission in Busan accepted that there was a need to reduce fishing mortality on bigeye tuna by 30% over the next three (3) years and not increase fishing mortality on yellowfin. Just a gentle reminder, the Conservation and Management Measure adopted in Busan set a target of reducing bigeye fishing mortality by 30% — from the average levels of 2001–2004 — not current levels. I would note that the average annual catch is up 13% in the period 2005–2008 relative to the average annual catch for the period 2001–2004 — which gives us a broad indication of the task we've set ourselves.

This week, facilitated by some valuable work undertaken by our colleagues at SPC-OFP, we will have an opportunity to appraise the measure adopted at Busan. We will also need to consider advice and recommendations to the Commission this coming December in the event that we agree the Busan measure requires refinement.

It is accepted now, I think, that there is no such thing as a "light" agenda for any WCPFC meeting. All of the Commission's subsidiary bodies are supporting an enormous work load and, despite best efforts to prioritize, we still set very high expectations for what we want to accomplish in an inadequate amount of time. I am not sure that this results in best possible outcomes — but, in the absence of constructive suggestions regarding better management of the Commission's work programme we continue to move forward, with some frustrations perhaps, but mostly in a positive manner.

This Scientific Committee meeting here in Port Vila is no exception. In addition to considering the outcomes of several stock assessments and an appraisal of CMM 2008-01, we have a dedicated session on reference points, to take place in the Methods Specialist Working Group, ongoing consideration of data issues — particularly data gaps and means to address those gaps, consideration of the recommendations from last year's Independent Review of Interim Arrangements for Science Structure and Function, relations with other organizations — including our special relationship with IATTC, the need for each Specialist Working Group to respond to a significant body of work requested of the Scientific Committee by the Commission and the convening of several side sessions associated with the high achieving Pacific Tuna Tagging Project and the new initiative in Indonesia, Philippines and Vietnam known as the West Pacific East Asia Oceanic Fisheries Management Project.

As usual, the organization of a meeting such as this requires the assistance and goodwill of a large number of people and organizations. Although we still have 2 weeks to decide if the hard work and effort will have been worth it or not, before closing I would like to acknowledge the commitment of several people or groups have worked hard to get us to this stage.

Firstly, to Robert Jimmy, William Naviti and the staff of the Vanuatu Fisheries Department. Thank you very much for all the logistical support, on-site preparations and liaison in the lead up to, and now, during this meeting. These meetings are extremely demanding on small relatively under-resourced administrations such as Vanuatu's Fisheries Department, and Robert and his staff have responded admirably. Thanks on behalf of us all Robert.

To Chairman Miyabe and Vice-Chairman Bigelow, and the conveners of the SWGs — thanks for the hard work, expert advice and active engagement — which, for most of you, extends back to April this year! Again, it would be impossible to bring this meeting together in a structured and effective way without the efficient input and significant preparatory work by these officers of the Committee.

To John Hampton and all the staff at the OFP. Yet again John and his team have completed an enormous amount of work, certainly beyond that described in our agreed schedule, to support this Committee. We are all fortunate to have such a dedicated and committed team at the OFP — it would be a very different Scientific Committee without the considerable lead up work they collectively undertake in terms of data assimilation, and then assessment, to help support our discussions in this Committee. For that we are all grateful.

To the staff of the Secretariat — both here and in Pohnpei — thanks also for a sustained and committed effort. To SungKwon in particular, who has probably had his busiest year yet since joining the Commission, thanks for the long hours and dedication that you have put into the arrangements for this meeting.

On behalf of the Chairman and all members of the Commission, I take this opportunity to pass on our deepest condolences to the government and people of the Kingdom of Tonga in relation to the recent maritime tragedy that claimed so many lives.

Thank you for this opportunity to provide these brief remarks. We all look forward to the next two weeks of discussions.

Attachment D

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

Scientific Committee
Fifth Regular Session

Port Vila, Vanuatu
10–21 August 2009

AGENDA FOR THE FIFTH MEETING OF THE SCIENTIFIC COMMITTEE

AGENDA ITEM 1 OPENING OF THE MEETING

1.1 Welcome address
1.2 Adoption of agenda
1.3 Meeting arrangements
1.4 Reporting arrangements
1.5 Intersessional activities of the Scientific Committee

AGENDA ITEM 2 REVIEW OF FISHERIES

2.1 Overview of western and central Pacific Ocean fisheries*
2.2 Overview of eastern Pacific Ocean fisheries
2.3 Annual Reports (Part 1) from Members, Cooperating Non-Members and Participating Territories (CCMs)
2.4 Reports from regional fisheries bodies and other organizations

AGENDA ITEM 3 SPECIALIST WORKING GROUPS (SWGs)

3.1 SWG reports

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 Requests from CMM-2008-01
- a. High Seas Vessel Day Scheme
- b. FAD management plans
- c. Fishing effort for bigeye and yellowfin tuna from other commercial tuna fisheries
- d. Review of CMM-2008-01
- e. Capacity measuring and monitoring (Paragraph 44 of CMM-2008-01)

4.4 WCPO skipjack tuna
- a. Status and trends*

b. Management advice and implications*

4.5 South Pacific albacore

a. Status and trends*
b. Management advice and implications*

4.6 South Pacific swordfish

a. Status and trends*
b. Management advice and implications*
c. Requests from CMM-2008-05:

4.7 Southwest Pacific striped marlin

a. Status and trends*
b. Management advice and implications*

4.8 North Pacific striped marlin

a. Status and trends*
b. Management advice and implications*

4.9 Northern stocks

4.9.1 North Pacific albacore

a. Status and trends*
b. Management advice and implications*

4.9.2 Pacific bluefin tuna

a. Status and trends*
b. Management advice and implications*

4.9.3 North Pacific swordfish

a. Status and trends*
b. Management advice and implications*

4.10 Biological parameters and management related issues

a. Improve existing models and explore alternative models for standardization of fishing catch and effort for construction of stock assessment indices (Project 31)
b. Refinement of bigeye parameters Pacific-wide: A comprehensive review and study of bigeye tuna reproductive biology (Project 35)
c. Regional study of the stock structure and life history characteristics of South Pacific albacore (Project 39)
d. Technical workshop to consider suitability of MSY-based reference points as default limit reference points and how they may be operationalized (Project 57)
e. Revised stock assessment on southern swordfish (Project 26)

AGENDA ITEM 5 BYCATCH MITIGATION

5.1 Fisheries impacts (ecological risk assessment)

a. Seabirds*
b. Sharks*
c. Sea turtles*

5.2 Small tuna on floating objects*

AGENDA ITEM 6 DATA AND INFORMATION

6.1 Data gaps

a. Data gaps and progress towards addressing gaps
b. Review of "A study to identify causes of data gaps in the work of the WCPFC"
c. Species composition of purse-seine catches
d. Obtaining ISC data

6.2 Regional Observer Programme

a. Data management hosting and costing options

b. Data fields contained in the FAD form
c. Definition of a FAD set

6.3 Advice to Ad Hoc Task Group on Data
a. Scientific needs for VMS data
b. Review of public domain catch and effort data

6.4 Indonesia and Philippines Data Collection Project and Global Environment Facility project

6.5 Tagging initiatives

6.6 Data verification

AGENDA ITEM 7 COOPERATION WITH OTHER ORGANIZATIONS

7.1 Review of existing MOUs and relations with other organizations
a. Cooperation with ISC
b. Three-year arrangement with SPC

7.2 Development of new MOUs*
a. Develop a formal relationship with NPAFC

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

8.1 Review of 2008/2009 Activities
a. Special Requirements Fund
b. Japan Trust Fund

AGENDA ITEM 9 FUTURE WORK PROGRAMME AND BUDGET

9.1 Process of implementing the work programme of the Scientific Committee

9.2 Strategic Research Plan of the Scientific Committee

9.3 Progress of 2009 work programme, 2010 work programme and budget, and 2011-2012 provisional work programme and indicative budget*

AGENDA ITEM 10 ADMINISTRATIVE MATTERS

10.1 Rules of Procedure

10.2 Peer review of stock assessments

10.3 Future operation of the Scientific Committee
a. Independent Review of the Commission's Transitional Science Structure and Functions

10.4 Next meeting*

10.5 Election of the Vice-Chair of the Scientific Committee*

AGENDA ITEM 11 OTHER MATTERS

11.1 Meeting of the five tuna RFMOs: Science issues

AGENDA ITEM 12 ADOPTION OF THE REPORT OF THE FIFTH REGULAR SESSION OF THE SCIENTIFIC COMMITTEE

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

AGENDA ITEM 13 CLOSE OF MEETING

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

Scientific Committee
Fifth Regular Session

Port Vila, Vanuatu
10–21 August 2009

ABBREVIATIONS AND ACRONYMS USED BY THE WCPFC

ACAP	Agreement for the Conservation of Albatross and Petrels
AFMA	Australian Fisheries Management Authority
AHTG on Data	Ad Hoc Task Group on Data
ALB	albacore (*Thunnus alalunga*)
$B_{current}$	average biomass over the period 2004–2007
B_t	biomass at year t (used in projections)
BET	bigeye tuna (*Thunnus obesus*)
BFAR	Bureau of Fisheries and Aquatic Resources (Philippines)
BI-SWG	Biology Specialist Working Group
B_{MSY}	biomass that will support the maximum sustainable yield
c&f	cost and freight
CCM	Members, Cooperating Non-members and participating Territories
CCMM working group	Compliance with Conservation and Management Measures working group
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 for the Conservation and Management of Highly Migratory Fish Stocks in the Western and Central Pacific Ocean
CPUE	catch per unit of effort
CSIRO	Commonwealth Scientific and Industrial Research Organization (Australia)
EB-SWG	Ecosystems and Bycatch Specialist Working Group
EEZ	exclusive economic zone
EPO	Eastern Pacific Ocean
ERA	ecological risk assessment
ETBF	Eastern Tuna and Billfish Fishery (Australia)
EU	European Union
F	fishing mortality rate
FAD	fish aggregating device
FAO	United Nations Food and Agriculture Organization
$F_{current}$	Average fishing mortality rate over the period 2004–2007
FFA	Pacific Islands Forum Fisheries Agency
F_{MSY}	fishing mortality that will support the maximum sustainable yield
FSM	Federated States of Micronesia

$F_{SSB-ATHL}$	spawning stock biomass (SSB) above the average level of its ten historically lowest points (ATHL)
FT-SWG	Fishing Technology Specialist Working Group
GEF	Global Environment Facility
GLM	general linear model
GRT	gross registered tonnage
GSI	gonad somatic index
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
ISG	Informal Small Group
ISSF	International Sustainable Seafood Foundation
IUCN	International Union for the Conservation of Nature
JTF	Japan Trust Fund
LRP	Limit reference point
m	meters
ME-SWG	Methods Specialist Working Group
MFCL	MULTIFAN-CL (a stock assessment modeling approach)
MIMRA	Marshall Islands Marine Resources Authority
MOU	memorandum of understanding
MRAG	Marine Resource Assessment Group
MSE	management strategy evaluation
MSY	maximum sustainable yield
mt	metric tons
NFRDI	National Fisheries Research and Development Institute (Korea, Philippines)
NPAFC	North Pacific Anadromous Fisheries Commission
PFRP	Pelagic Fisheries Research Program (Hawaii, USA)
PNA	Parties to the Nauru Agreement
PNG	Papua New Guinea
PTTP	Pacific Tuna Tagging Programme
RFMO	regional fisheries management organization
RMI	Republic of the Marshall Islands
ROP-IWG	Regional Observer Programme – Intersessional Working Group
SA-SWG	Stock Assessment Specialist Working Group
SB	Spawning biomass
SEAPODYM	spatial ecosystem and population dynamics model
SIDS	small island developing State
SKJ	skipjack tuna (*Katsuwonus pelamis*)
SPC-OFP	Oceanic Fisheries Programme of the Secretariat of the Pacific Community
SPTT	South Pacific Tuna Treaty
SPR	Spawning stock biomass per recruit
SRP	Special Requirements Fund
SSB	spawning stock biomass
SST	sea surface temperature
STFO	small tuna on floating objects
ST-SWG	Statistics Specialist Working Group
SWG	Specialist Working Group
TCC	Technical and Compliance Committee of the WCPFC

TDR	time and depth recorder
TRP	Target reference point
TUFMAN	Tuna Fisheries Management Database
USA	United States of America
VDS	Vessel day scheme
VMS	vessel monitoring system
WCPFC	Western and Central Pacific Fisheries Commission
WCPO	western and central Pacific Ocean
WPEAOFMP	West Pacific East Asia Oceanic Fisheries Management Project (funded by GEF)
WWF	World Wildlife Fund
YFT	yellowfin tuna (*Thunnus albacares*)
YPR	Yield per recruit

Attachment F

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

Scientific Committee
Fifth Regular Session

Port Vila, Vanuatu
10–21 August 2009

LIST OF DOCUMENTS (SC5)

MEETING INFORMATION

WCPFC-SC5-2009/01	Meeting notice and information
WCPFC-SC5-2009/02	Provisional agenda for the meeting
WCPFC-SC5-2009/03	Provisional annotated agenda for the meeting
WCPFC-SC5-2009/04	Indicative schedule for the meeting
WCPFC-SC5-2009/05	Registration form
WCPFC-SC5-2009/06	Guidelines in submitting Specialist Working Group (SWG) papers
WCPFC-SC5-2009/07	List of documents
WCPFC-SC5-2009/08	Provisional agenda and schedule of the Steering Committee [IPDCP/WPEA] Meeting
WCPFC-SC5-2009/09	Provisional agenda and schedule of the Steering Committee [PTTP] Meeting
WCPFC-SC5-2009/10	Methods-SWG: Notice of special arrangements for SC5 to accommodate workshop on reference points
WCPFC-SC5-2009/11	Provisional agenda and schedule of the Steering Committee [JTF Project] Meeting
WCPFC-SC5-2009/12	Provisional agenda for head of delegation (HOD) meeting (1600-1700, 9 August 2009)

GENERAL PAPERS

Working Papers

GN-WP-1	Williams, P. and P. Terawasi. **Overview of tuna fisheries in the western and central Pacific Ocean, including economic conditions – 2008.** SPC and FFA
GN-WP-2	IATTC. **The fishery for tunas and billfishes in the Eastern Pacific Ocean in 2008**
GN-WP-3	Secretariat. **Scientific and Data Management Services: Revising the Agreement with SPC-OFP.**

GN-WP-4 Secretariat. **Guidelines outlining the process for formulating the work programme and budget of the Scientific Committee (Revision of Attachment M, SC4 Summary Report)**

GN-WP-5 Steering Committee [PTTP]. **Summary Report of the Third PTTP Steering Committee**

GN-WP-6 Steering Committee [IPDCP/WPEA]. **Summary report of the Sixth IPDCP/WPEA Steering Committee**

GN-WP-7 MRAG. **Final project report on Independent Review of the Commission's Transitional Science Structure and Functions**

GN-WP-8 Secretariat. **Summary of issues arising from Independent Review**

GN-WP-9 Secretariat. **Fishing effort for bigeye and yellowfin tuna from other commercial tuna fisheries**

GN-WP-10 Secretariat. **Cooperation, Consultation and Collaboration with Other RFMOs and Rational Agencies**

GN-WP-11 Secretariat. **Draft revision of Memorandum of Understanding (MOU) between WCPFC and ISC**

GN-WP-12 Secretariat. **Paragraph 44 of CMM-2008-01 – Capacity measuring and monitoring.**

GN-WP-13 **Secretariat. WCPFC Guidelines for the Handling of Sea Turtles.**

GN-WP-14 **Secretariat. WCPFC Guidelines for the Handling of Sea Turtles – Graphics**

GN-WP-15 Secretariat. **Second Meeting of the Five Tuna RFMOs: Science Issues**

GN-WP-16 Secretariat. **High Seas Vessel Day Scheme: High Seas Purse-Seine Fishing Effort**

GN-WP-17 J. Hampton and S. Harley. **Assessment of the potential implications of application of CMM-2008-01 for bigeye and yellowfin tuna.** SPC, Noumea, New Caledonia.

GN-WP-18 FAO. **The Fishery Resources Monitoring System (FIRMS)**

GN-WP-19 Steering Committee [JTF]. **Summary Report of the First JTF Steering Committee Meeting**

Information Papers

GN-IP-1 Secretariat. **Intersessional activities of the Scientific Committee**

GN-IP-2 Dale Kolody, Robert Campbell, and Nick Davies. **Final project report on South-West Pacific Swordfish (*Xiphias gladius*) Stock Assessment 1952-2007**

GN-IP-3 Indonesia. **Progress report on the IPDCP in Indonesia (Refer to SC5-GN-IP-18)**

GN-IP-4 Philippines. **Progress report on the IPDCP in Philippines (Refer to SC5-AR-CCM-19)**

GN-IP-5 Secretariat. **Summary of 2008/2009 IPDCP/WPEA activities supported by the Secretariat**

GN-IP-6 Secretariat**. IPDCP/WPEA Financial Report**

GN-IP-7 SPC. **Report of the 2009 Tuna Stock Assessment Training Workshops (No document)**

GN-IP-8 **No document**

GN-IP-9	Secretariat. **Strategy for the Incorporation of the ISC data into WCPFC Data Holdings**
GN-IP-10	Secretariat. **A Proposal for the Peer Review of ISC and SC stock assessments**
GN-IP-11	Secretariat. **West Pacific East Asia Oceanic Fisheries Management Project – Inception Workshop Report**
GN-IP-12	Secretariat. **Summary report on the project history funded by Japanese Trust Fund**
GN-IP-13	B. Leroy[1], J. Hampton[1], B. Kumasi[1], A. Lewis[2], D. Itano[3], T. Usu[4], S. Nicol[1], V. Allain[1], Sylvain Caillot[1]. **PTTP Summary Report: Review Phase 2**. [1]Oceanic Fisheries Programme, SPC, Noumea, New Caledonia. [2]WCPFC Consultant. [3] Pelagic Fisheries Pelagic Fisheries Research Program, University of Hawaii, Honolulu, USA. [4] National Fisheries Authority, Port Moresby, PNG.
GN-IP-14	David Itano[1]**,** Kim Holland[2]**,** Kevin Weng[1]. **Hawaii Tuna Tagging Project 2 – progress report.** [1]Pelagic Fisheries Research Program, University of Hawaii, Honolulu, USA, [2]Hawaii Institute of Marine Biology, University of Hawaii, Honolulu, USA.
GN-IP-15	S. Nicol[1], J. Hampton[1], B. Leroy[1], B. Kumasi[1], A. Lewis[1], D. Itano[2]. **PTTP work plan 2009-2010.** [1]Oceanic Fisheries Programme, SPC, Noumea, New Caledonia. [2] Pelagic Fisheries Pelagic Fisheries Research Program, University of Hawaii, Honolulu, USA.
GN-IP-16	A. Williams, S. Nicol, J. Hampton, S. Harley, S. Hoyle. **South Pacific albacore tagging – progress report.** Oceanic Fisheries Programme, SPC, Noumea, New Caledonia
GN-IP-17	IATTC. **Proposal for a regional tuna tagging project in the Eastern Pacific Ocean.**
GN-IP-18	WCPFC and SPC. **Report of the Third Eastern Indonesia Tuna Fishery Data Collection Workshop (EITFDC-3).**
GN-IP-19	FAO. **State of Selected Stocks of Tuna and Billfish in the Pacific and Indian Oceans.**

BIOLOGY SPECIALIST WORKING GROUP (BI-SWG)

BI-SWG Working Papers	
BI-WP-01	R. Keller Kopf[1], Julian Pepperell[2], and Peter S. Davie[3]. **Age, Growth, and Reproductive Dynamics of Striped Marlin (*Kajikia audax*) in the Southwest Pacific Ocean**. [1]Charles Sturt University, School of Environmental Sciences, Australia. [2]Pepperell Research & Consulting Pty. Queensland, Australia.; [3]Massey University, Palmerston North, New Zealand.
BI-WP-02	Hiroshi Ashida[1], Toshiyuki Tanabe[2], Nobuhiro Suzuki[1]. **Recent progress on reproductive biology of skipjack tuna in the tropical region of the Western and Central Pacific Ocean.** [1]Graduate School of Bioscience, Tokai University, Shimizu, Japan. [2] National Research Institute of Far Seas Fisheries, Fisheries Research Agency, Shimizu, Japan
BI-WP-03	S. Hoyle[1], S. Nicol[1], and D. Itano[2]. **Revised biological parameter estimates for application in yellowfin stock assessment**. [1]Oceanic Fisheries Programme, Secretariat of the Pacific Community, Noumea, New Caledonia. [2]Pelagic Fisheries Pelagic Fisheries Research Program, University of Hawaii, Honolulu, USA.
BI-WP-04	S. Nicol[1], K. Sisior[2], S. Retalmai[3], D. Itano[4], K. Schaefer[5], J. Farley[6]. **Bigeye tuna age and reproductive biology – progress report.** [1]Oceanic Fisheries Programme, SPC, Noumea, New Caledonia. [2]Bureau of Marine Resources, Ministry of Natural Resources, Palau. [3]National Oceanic Resource Management Authority, Pohnpei, FSM. [4]Pelagic Fisheries Pelagic Fisheries Research Program, University of Hawaii, Honolulu, USA.

	[5]Inter-American Tropical Tuna Commission, La Jolla, USA. [6]CSIRO Marine and Atmospheric Research, Hobart, Australia.
BI-WP-05	Jessica Farley[1], Ashley Williams[2], Campbell Davies[1], and Simon Nicol[2]. **Regional study of South Pacific albacore population biology: Year 1 - biological sample collection.** [1]CSIRO Marine and Atmospheric Research, Hobart, Australia, [2]Oceanic Fisheries Programme, Secretariat of the Pacific Community, Noumea, New Caledonia.

ECOSYSTEM AND BYCATCH SPECIALIST WORKING GROUP (EB-SWG)

EB-SWG Working Papers	
EB-WP-01	P. Kleiber, S. Clarke, K. Bigelow, H. Nakano, M. McAllister, and Y. Takeuchi. **North Pacific Blue Shark Stock Assessment.**
EB-WP-02	S. Clarke. **An Alternative Estimate of Catches of Five Species of Sharks in the Western and Central Pacific Ocean based on Shark Fin Trade Data.**
EB-WP-03	BirdLife International, Global Seabird Programme. **Seabird bycatch mitigation measures**. BirdLife International, UK
EB-WP-04	Stephen Brouwer[1] and Ian Bertram[2]. **Setting bycatch limits for sea turtle in the western and central Pacific Oceans shallow-set longline fisheries**. [1] Ministry of Fisheries, Wellington, New Zealand. [2] Ministry of Marine Resources, Rarotonga, Cook Islands.
EB-WP-05	D. Kirby. **Ecological Risk Assessment Implementation Report.** SPC-OFP, Noumea, New Caledonia.
EB-WP-06	D. Kirby, S. Waugh, D. Filippi. **Spatial risk indicators for seabird interactions with longline fisheries in the western and central Pacific.**
EB-WP-06 (Appendix)	Susan Waugh[1], Ben Lascelles[2], Phil Taylor[2], Ian May[2], Mark Balman[2], Steve Cranwell[3]. **Range distributions of seabirds at risk of interactions with longline fisheries in the western and central Pacific Ocean**. [1] BirdLife Global Seabird Programme, Wellington, New Zealand. [2]BirdLife International, United Kingdom. [3]BirdLife Pacific Secretariat, Suva, Fiji.
EB-WP-07	P. Williams, D. Kirby, S. Beverly. **Encounter rates and life status for marine turtles in WCPO longline and purse-seine fisheries**. SPC-OFP, Noumea, New Caledonia.
EB-WP-08	Michael J. Manning, Donald B. Bromhead, Shelton J. Harley, Simon D. Hoyle, and David S. Kirby. **The feasibility of conducting quantitative stock assessments for key shark species and recommendations for providing preliminary advice on stock status in 2010.** Oceanic Fisheries Programme, Secretariat of the Pacific Community, Noumea, New Caledonia
EB-WP-09	David Seán Kirby. **Monitoring the effectiveness of Conservation and Management Measures for bycatch.** Oceanic Fisheries Programme, Secretariat for the Pacific Community, Noumea, New Caledonia.
EB-WP-10	Patrick Lehodey, and Inna Senina. **An update of recent developments and application of the SEAPODYM model.** Marine Ecosystems Modeling and Monitoring by Satellites, CLS, Space Oceanography Division, Ramonville, France.
EB-SWG Information Papers	
EB-IP-01	Stephen Brouwer and Lynda Griggs. **Description of New Zealand's shallow-set**

	longline fisheries.
EB-IP-02	Hsiang-Wen Huang. **Bycatch of Taiwanese Tuna Longline Fisheries in the Pacific Ocean**. National Taiwan Ocean University, Keelung, Taiwan.
EB-IP-03	Doo-Hae An, Doo-Nam Kim, Dae-Yeon Moon, Seon-Jae Hwang and You-Jung Kwon. **A Summary of the Korean Tuna Fishery Observer Program for the Pacific Ocean in 2008.** National Fisheries Research and Development Institute, Busan, Korea.
EB-IP-04	T. Morato, V. Allain, S. Hoyle, S. Nicol. **Tuna longline fishing around West and Central Pacific seamounts.**
EB-IP-05	ALLAIN Valérie, SANCHEZ Caroline, DUPOUX Cyndie. **Pelagic ecosystem trophic dynamics – progress report.** Secretariat of the Pacific Community, Oceanic Fisheries Programme, Ecosystem Monitoring and Analysis Section, Noumea, New Caledonia
EB-IP-06	K. Briand, J. J. Molina, X. Couvelard, V. Faure, P. Marchesiello, C. Menkes, S. Nicol, P. Lehodey, I. Senina, R. Leborgne, M. Rodier. **Implementation of SEAPODYM model for the South Pacific albacore stock; focus on the New Caledonia EEZ.**
EB-IP-07	Steven E. Campana[1], Warren Joyce[2], Michael J. Manning[3]. **Bycatch and discard mortality in commercially caught blue sharks *Prionace glauca* assessed using archival satellite pop-up tags**. [1]Bedford Institute of Oceanography, Nova Scotia, Canada; [2]National Institute of Water and Atmospheric Research Ltd (NIWA), Wellington, New Zealand; [3]Current address: Oceanic Fisheries Programme, Secretariat of the Pacific Community, Noumea, New Caledonia.
EB-IP-08	William Walsh, Keith Bigelow and Karen Sender. **Decreases in Shark Catches and Mortality in the Hawaii-based Longline Fishery as Documented by Fishery Observers.** Pacific Islands Fisheries Science Center, National Marine Fisheries Service, Honolulu, U.S.A.
EB-IP-09	ACAP. **Mitigation Measures For Pelagic Longline Gear: A Report On The Work Of The Seabird Bycatch Working Group, Agreement On The Conservation Of Albatrosses And Petrels**. Agreement on the Conservation of Albatrosses and Petrels
EB-IP-10	A. Ramos-Cartelle, B. García-Cortés, J. Fernández, J. Mejuto. **Scientific Estimations Of Bycatch Landed By The Spanish Surface Longline Fleet Targeting Swordfish (*Xiphias gladius*) In The Pacific Ocean With Special Reference To The Years 2006, 2007 And 2008. (**Not submitted)
EB-IP-11	Christofer Boggs[1], Paul Dalzell[2], and Russell Ito[3]. **Low level of sea turtle bycatch continues in the Hawaii longline fishery.** [1]Pacific Islands Fisheries Science Center, NOAA Fisheries, Honolulu, USA; [2]Western Pacific Regional Fishery Management Council, Honolulu, USA.
EB-IP-12	Sue Waugh. **Analysis of Seabird Measures**. BirdLife International Global Seabird Programme.
EB-IP-13	Patrick Lehodey and Inna Senina. **A USER MANUAL FOR SEAPODYM VERSION 2.0: application with data assimilation (draft version).** Marine Ecosystems Modeling and Monitoring by Satellites, CLS, Space Oceanography Division, Ramonville, France.
EB-IP-14	FAO. **Expert consultation on best practice technical guidelines for IPOA/NPOA – Seabirds**.
EB-IP-15	Australian Government Department of Agriculture, Fisheries and Forestry. **Eastern Tuna and Billfish Fishery Sea Turtle Mitigation Plan (TMP).** International Fisheries (Pacific) Australian Government Department of Agriculture, Fisheries and Forestry, Canberra, Australia.

EB-IP-16	Ludwig Kumoru, Thomas. C. Usu, Luanah Koren Yaman, and Leontine Baje. **Species composition and length frequency of Papua New Guinea purse-seine catch from the 2008 independent tuna port sampling.** National Fisheries Authority, Port Moresby, Papua New Guinea.

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FT-SWG Working Papers	
FT-WP-01	Secretariat. **PARA. 24 of CMM 2008-01: FAD MANAGEMENT AND MONITORING.**
FT-WP-02	Doo-Hae An, You-Jung Kwon, Doo-Nam Kim, Dae-Yeon Moon and Seon-Jae Hwang. **Catch of small-sized tuna by set type of Korean tuna purse-seine fishery in the WCPO**. National Fisheries Research and Development Institute (NFRDI), Busan, Korea.
FT-WP-03	Itano, D.[1], K. Schaefer[2] and D. Fuller[2]. **Update on the use of underwater video to characterize the species, size composition and vertical distribution of tunas around floating objects.** [1]PFRP, University of Hawaii, Honolulu, Hawaii, USA, [2]IATTC, La Jolla, California, USA.
FT-SWG Information Papers	
FT-IP-01	Beverly, S. **Longline terminal gear identification guide**. Nearshore Fisheries Development and Training Section, Coastal Fisheries Programme, Secretariat of the Pacific Community, Noumea, New Cadedonia.
FT-IP-02	David Itano. **The use of underwater video to characterize the species, size composition and vertical distribution of tunas and non-tuna bycatch around floating objects**. PFRP, University of Hawaii, Honolulu, Hawaii, USA.

METHODS SPECIALIST WORKING GROUP (ME-SWG)

ME-SWG Working Papers	
ME-WP-01	Wez Norris. **The Application of Reference Point Management in WCPO Tuna Fisheries: An Introduction to Theory and Concepts.** Pacific Islands Forum Fisheries Agency, PO Box 629, Honiara, Solomon Islands
ME-WP-02	S. Harley, S. Hoyle, J. Hampton, and P. Kleiber. **Characteristics of potential reference points for use in WCPFC tuna stock assessments**.
ME-WP-03 (SC4-GN-WP-10)	Campbell Davies and Marinelle Basson. **Approaches for identification of appropriate reference points and implementation of MSE within the WCPO**.
ME-SWG Information Papers	
ME-IP-01	Robert Campbell. **The use of Reference Points in Fisheries Management: A short review**. CSIRO Marine Research, Australia.

STATISTICS SPECIALIST WORKING GROUP PAPERS (ST-SWG)

ST-SWG Working Papers	
ST-WP-01	SPC-OFP. **Scientific data available to the Western and Central Pacific Fisheries Commission.** SPC, Noumea, New Caledonia.
ST-WP-02	Jones, M. and B. Shallard**. A study to identify causes of data gaps in the work of the WCPFC.** FishServe Innovations New Zealand Ltd, Wellington, New Zealand.
ST-WP-03	Lawson, T. **Selectivity bias in grab samples and other factors affecting the analysis of species composition data collected by observers on purse seiners in the Western and Central Pacific Ocean.** SPC, Noumea, New Caledonia.
ST-WP-04	SPC-OFP. **Review of the WCPFC transhipment reporting form for collecting data for scientific purposes (Rev. July 2009).** SPC, Noumea, New Caledonia.
ST-WP-05	WCPFC. **Draft conservation and management measure on regulation of transhipment (WCPFC5-2008/DP02)**
ST-WP-06	John Hampton. **Implications for scientific data collection by observers of new requirements for 100% observer coverage of purse seiners.** SPC, Noumea, New Caledonia.
ST-WP-07	Harley, S., P. Williams, J. Hampton. **Analysis of Purse-seine set times for different school associations: A further tool to assist in compliance with FAD closures?** SPC, Noumea, New Caledonia.
ST-WP-08	Timothy Lawson and Peter Williams. **Status of public domain catch and effort data held by the Western and Central Pacific Fisheries Commission.** SPC, Noumea, New Caledonia.
ST-WP-09	Secretariat. **Regional Observer Programme – Data administration and management options**.
ST-WP-10	Secretariat. **VMS Data for Scientific Purposes.**
ST-WP-11	Secretariat. **Fish Aggregating Device (FAD) Information Record.**
ST-WP-12	SPC. **Fields to be collected from transhipments/unloading for scientific purposes**.
ST-SWG Information Papers	
ST-IP-01	SPC-OFP. **Estimates of annual catches in the WCPFC Statistical Area.** SPC, Noumea, New Caledonia.
ST-IP-02	S.K. Chang[1], T.T. Lin[2], and C.L. Hsieh[3] **A photographic method of obtaining length measurements for Pacific Yellowfin Tuna**. [1]College of Marine Sciences, National Sun Yat-Sen University, Kaohsiung, Taiwan. [2]Department of Bio-Industrial Mechatronics Engineering, National Taiwan University. Taipei, Taiwan. [3]Department of Biomechatronics Engineering, National Pingtung University of Science and Technology, Pingtung, Taiwan.

STOCK ASSESSMENT SPECIALIST WORKING GROUP (SA-SWG)

SA-SWG Working Papers	
SA-WP-01	S. Hoyle. **CPUE Standardization for bigeye and yellowfin tuna in the western and central Pacific Ocean**. SPC, Noumea, New Caledonia.
SA-WP-02	Chang, S-K.[1], S. Hoyle[2] and H-I Liu[3]. **Yellowfin CPUE standardization for Taiwanese distant-water longline fishery in the WCPO - with emphasis on target change.** [1]Institute of Marine Affairs, Kaohsiung, Taiwan, [2]SPC, Noumea, New Caledonia. [3]Fisheries Information Department, the Overseas Fisheries Development Council, Taipei, Taiwan.
SA-WP-03	Langley, A.[1], S. Harley[2], S. Hoyle[2], N. Davies[2], J. Hampton[2] and P. Kleiber[3]. **Stock assessment of yellowfin tuna in the western and central Pacific Ocean**. [1]SPC consultant, [2]SPC, Noumea, New Caledonia. [3]NOAA Fisheries, PIFSC, Hawaii, USA.
SA-WP-04	Harley, S.[1], S. Hoyle[1], A. Langley, A.[2], J. Hampton[1] and P. Kleiber[3]. **Stock assessment of bigeye tuna in the western and central Pacific Ocean**. [1]SPC, Noumea, New Caledonia, [2]SPC consultant, [3]NOAA Fisheries, PIFSC, Hawaii, USA.
SA-WP-05	Bigelow, K.[1] and S. Hoyle[2], **Standardized CPUE for distant–water fleets targeting south Pacific albacore**. [1]NOAA Fisheries, PIFSC, Hawaii, USA. [2]SPC, Noumea, New Caledonia.
SA-WP-06	Hoyle, S. and N. Davies. **Stock assessment of albacore tuna in the south Pacific Ocean**. SPC, Noumea, New Caledonia.
SA-WP-07	Zhang, Z. and J. Holmes. **Generalized Linear Bayesian Models for Standardization of CPUE with Incorporation of Spatial-Temporal Variations**. Pacific Biological Station, British Columbia, Canada.
SA-WP-08	Ann Preece, Dale Kolody, Campbell Davies and Jason Hartog. **Management strategy evaluation for Australia's east coast tuna and billfish fishery: progress update**. CSIRO Marine and Atmospheric Research, Hobart, Australia.
SA-SWG Information Papers	
SA-IP-01	Harley, S., N. Davies, and S. Hoyle. **Report from the SPC pre–assessment workshop**, Noumea, April 2009. SPC, Noumea, New Caledonia.
SA-IP-02	Harley, S. **Spatial distribution measures for the analysis of longline catch and effort data**. SPC, Noumea, New Caledonia.
SA-IP-03	Harley, S., S. Hoyle, F. Bouyé. **General structural sensitivity analysis for the yellowfin tuna stock assessment**. SPC, Noumea, New Caledonia.
SA-IP-04	Nick Davies, Simon Hoyle and Fabrice Bouyé. **General structural sensitivity analysis for the albacore tuna stock assessment in the south Pacific Ocean**. SPC, Noumea, New Caledonia.
SA-IP-05	Don Bromhead[1], Simon Hoyle[1], Ashley Williams[1], Shyh-Bin Wang[2] and Shui-Kai Chang[3]. **Factors influencing the size of albacore tuna sampled from the South Pacific albacore longline fisheries**. [1]SPC, Noumea, New Caledonia. [2]Institute of Marine Affairs and Resource Management, National Taiwan Ocean University, Taiwan, [3]College of Marine Science, National Sun Yat-sen University, Kaohsiung, Taiwan.
SA-IP-06	Robert Campbell. **Distribution of albacore tuna size by depth within the Australian eastern tuna and billfish fishery**. CSIRO Marine and Atmospheric Research, Hobart,

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SA-IP-07	Simon Hoyle[1], Dave Fournier[2], Pierre Kleiber[3], John Hampton[1], Fabrice Bouyé[1], Nick Davies[1], and Shelton Harley[1]. **Update of recent developments in MULTIFAN–CL and related software for stock assessment.** [1]Oceanic Fisheries Programme, Secretariat of the Pacific Community, Noumea, New Caledonia. [2]Otter Research Ltd. [3]Islands Fisheries Science Center, National Marine Fisheries Service, Honolulu, Hawaii, USA.

ANNUAL REPORT – PART 1

Symbol	CCMs	Symbol	CCMs
AR-CCM-01	**Australia**	AR-CCM-18	**Papua New Guinea**
AR-CCM-02	**Canada**	AR-CCM-19	**Philippines**
AR-CCM-03	**China**	AR-CCM-20	**Samoa**
AR-CCM-04	**Cook Islands**	AR-CCM-21	**Solomon Islands**
AR-CCM-05	**European Union**	AR-CCM-22	**Chinese Taipei**
AR-CCM-06	**Federated States of Micronesia**	AR-CCM-23	**Tokelau**
AR-CCM-07	**Fiji**	AR-CCM-24	**Tonga**
	France	AR-CCM-25	**Tuvalu**
AR-CCM-08	**French Polynesia**	AR-CCM-26	**United States of America (*American Samoa, Guam, Northern Mariana Islands*)**
AR-CCM-09	**Japan**	AR-CCM-27	**Vanuatu**
AR-CCM-10	**Kiribati**	AR-CCM-28	**Wallis and Futuna**
AR-CCM-11	**Korea**	AR-CCM-29	**Belize**
AR-CCM-12	**Marshall Islands**	AR-CCM-30	**El Salvador**
AR-CCM-13	**Nauru**	AR-CCM-31	**Indonesia**
AR-CCM-14	**New Caledonia**	AR-CCM-32	**Mexico**
AR-CCM-15	**New Zealand**	AR-CCM-33	**Senegal**
AR-CCM-16	**Niue**		
AR-CCM-17	**Palau**		

NGO and Others

Greenpeace	**End The High Seas Heist**

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

Scientific Committee
Fifth Regular Session

Port Vila, Vanuatu
10–21 August 2009

REPORT OF THE BIOLOGY SPECIALIST WORKING GROUP

1. Opening of meeting

1. The convener of the Biology Specialist Working Group (BI-SWG), Miki Ogura (Japan), opened the meeting and thanked participants for their attendance on a Saturday morning.

2. Selection of rapporteur

2. Keisuke Satoh, Keller Kopf and Simon Nicol were appointed rapporteurs for the meeting.

3. Adoption of agenda

3. The agenda circulated for the meeting was accepted with no modification (Appendix 1).

4. Research

a. Age, growth, and reproductive biology

BI-WP-1: R. Keller Kopf, Julian Pepperell, and Peter S. Davie. Age, Growth, and Reproductive Dynamics of Striped Marlin (Kajikia audax) in the Southwest Pacific Ocean

4. Keller Kopf presented paper BI-WP-1: Age, Growth, and Reproductive Dynamics of Striped Marlin (*Kajikia audax*) in the Southwest Pacific Ocean. Striped marlin are the most commercially valuable species of billfish in the family Istiophoridae and are an important recreational resource throughout their distribution in the Indo-Pacific region. Age estimates and reproductive condition were examined from a sample of 489 striped marlin that were collected from five exclusive economic zones (EEZ's) in the southwest Pacific Ocean (0–45°S latitude, 145°E–145°W longitude) between 2006 and 2008. Ages were indirectly validated using otolith micro-increment counts, fin spine annuli counts, and a marginal increment analysis. Ages ranged from 130 estimated days in a 4kg whole weight (1120 mm, lower jaw fork length, LJFL) male to eight estimated years in a 168 kg (2871 mm, LJFL) female. Growth of young striped marlin was rapid, with both sexes attaining 70–75% of their maximum body length during the first two years of life. Striped marlin showed significant subregional differences in age-structure and spawning condition with the oldest fish common at higher latitudes and increased relative abundance of juveniles in tropical and equatorial waters. Histological examination of gonad tissue showed that females matured at between 1.5 and 2.5 years while males matured about six months earlier. Females released multiple batches of up to 4.1 million hydrated oocytes with a spawning interval ranging from one to four days between events. Spawning occurred between 15–30°S extending from the east coast of Australia to Fiji with ripe females observed as far east as French Polynesia (144°W) during the fourth quarter of the year.

Discussion

5. BI-SWG noted that the sample size for size classes of striped marlin >2600mm was low and acknowledged that additional efforts will be required to reduce uncertainty in growth estimates in these older size classes and to validate age estimates. These size classes are influential in billfish stock assessment. Encouragingly, BI-SWG was able to confirm that the analysis showing spawning aggregation location was consistent with historical records of targeting by fishermen. Spawning condition fish are targeted as the fish quality is highest during this period.

6. Clarification was sought by BI-SWG on causes of annulus formation. Environmental variation associated with water temperature rather than spawning events was considered the most plausible explanation as juveniles are observed to deposit an annulus at the same time. Clarification was also sought on whether an alternative method to validate the growth rate had been applied (eg tagging or growth in captivity). BI-SWG was advised that this independent information is not available. The feasibility of using micro-increments to estimate seasonal growth was discussed. This was considered feasible but would require use of higher resolution microscopes.

7. BI-SWG noted sex ratio differences with size and suggested that future research activities should examine whether this sex ratio data can be used to examine differences in growth rate between males and females.

BI-WP-2: Ashida H., T.Tanabe, and N. Suzuki. Recent progress on reproductive biology of skipjack tuna in the tropical region of the Western and Central Pacific Ocean.

8. BI-SWG was encouraged by this important work on skipjack.

b. Biological parameter on the assessment model

BI-WP-3: S. Hoyle, S. Nicol, and D. Itano. Revised Biological Parameter Estimates for Application in Yellowfin Stock Assessment

9. Simon Hoyle presented the paper BI-WP-3: Revised Biological Parameter Estimates for Application in Yellowfin Stock Assessment. Previous WCPO yellowfin stock assessments assume that the reproductive potential is proportion to the spawning stock biomass, with maturity at age the only explicitly reproduction-related factor taken into account. Recruitment to maturity for yellowfin is affected by a number of intrinsic factors, including size-related, age-related, and spatial changes in sex ratio, fecundity per kg, spawning fraction, and egg viability. Parameterizations of these factors for consideration in future yellowfin stock assessments were provided. The analysis specifically examined assumptions that sex ratio is constant for all age classes and spatial locations, alternate fecundity and length relationship, and potential spatial variation in maturity at age in the WCPO. Differences in the estimates of the maturity at length by longitude were observed, with L50 for yellowfin sampled from Indonesia smaller than that observed elsewhere in the WCPO. Alternative growth curves influenced maturity at age estimates with the region 3 growth curve resulting in older maturing individuals than that observed when the standard WCPO wide growth curve was applied. This influence was also detected when calculating the maturity schedule for each of the alternative growth curves. Regional differences in sex ratio were detected, with the yellowfin sampled from region 3 more male biased at sizes above 130 cm than was observed in other regions. Natural mortality at age was influenced by the sex ratio data used and by the growth curve applied, with region 3 sex ratio and growth curve lowering the estimate of aggregate natural mortality for age classes between 2.5-5 yrs. Similarly region 3 sex ratio and growth curve influenced the estimate of male bias in comparison to the WCPO-wide parameterization. Different relationships for fecundity at age and spawning fraction at age for the full model and for region 3 were also observed. These alternative parameterizations of the intrinsic factors that describe reproductive potential for yellowfin in the WCPO

indicate that more explicit modelling of these processes and variances may be warranted for future stock assessments of yellowfin. A sensitivity analysis to identify the influence that these alternatives have on the reference points used to assess yellowfin stock status is recommended as a first step. Similarly consideration of alternative or complementary explanations for the observed trend in sex ratio with size, other than increased natural mortality of mature females, is warranted. Models based on such alternative structural assumptions may result in different stock status estimates.

Discussion

10. The influence of sex ratio on reproductive potential was noted by the BI-SWG and acknowledged that further work is required to validate the hypotheses that explain the trends observed. BI-SWG also noted that some of the revised estimates (maturity schedule, fecundity at length) should be considered provisional as further analysis is required to understand the influence of gear and spatial bias in the sampling regime. It was also acknowledged that the explicit approach to estimating reproductive potential improves the structural assumptions of stock assessment models.

11. BI-SWG identified that further work on reproductive biology is warranted, particularly its applications for stock assessment. The potential for changes in age, growth and reproductive parameters in response to exploitation may be useful as indicators of stock status and may provide additional reference point information. It was noted that the change in reproductive parameters had little influence on the main YFT reference points this year however growth was influential. Critical to this issue was the need to ensure that methods are comparable. Understanding the influence of older females on the reproductive potential ogive was identified as an important area of future work.

12. BI-SWG also noted that whilst the information on tuna reported concentrated on Region 3 of the YFT stock assessment, research was equally required in the other regions.

General Discussion

13. BI-SWG discussed the importance of age, growth and reproductive study and strongly encourages and supports this type of research. It was acknowledged that this research should be targeted to matters that restrict the application or interpretation of stock assessment models.

14. BI-SWG also noted that sampling design is critically important for reducing uncertainty in stock assessments.

15. Differences in sex ratio with size and region were discussed for yellowfin tuna, bigeye tuna, and striped marlin. Further research focused on identifying the biological and non-biological (gear selectivity, sampling design) effects on sex ratio was noted by the BI-SWG. The potential benefit of making use of existing data sets on sex ratio of yellowfin and bigeye tuna was noted.

c. Review of the research project on reproductive biology

BI-WP-4: S. Nicol, K. Sisior, S Retalmai, J. Farley. Bigeye tuna age and reproductive biology – progress report

16. Simon Nicol presented the paper BI-WP-4: Bigeye tuna age and reproductive biology – progress report. The Fifth Regular Session of the Commission in December 2008 endorsed funding for phase 1 of this project, "a 2 year pilot study in the EEZs of Palau and Micronesia to determine the sampling requirements for the broader Pacific-wide phase 2 component of the plan". The paper outlines progress. The work plan for the pilot project has been finalized with sampling of bigeye expected to occur in the period October 2009 to January 2010, laboratory analysis in February 2010 to May 2010, data analysis and modeling in June 2010 and pilot project reporting in July 2010 with presentation of results and

recommendations for phase 2 at the 6th Regular Session of the Western and Central Pacific Scientific Committee. Sampling protocols, preliminary training of technicians in Palau and Federated States of Micronesia and the appointment of a sampling coordinator has been completed. Protocols for laboratory analysis have been drafted and preliminary arrangements for laboratory analysis organized.

Discussion

17. Sample collections of biological tissues from bigeye tuna was supported by the BI-SWG and encouraged to continue in 2010. The importance of training observers to collect gonad samples was noted and emphasis was placed on increasing the capacity of observer programmes to collect samples for biological studies supported by the BI-SWG.

BI-WP-5: J. Farley (CSIRO), A. Williams. South Pacific albacore age and reproductive biology – progress report

18. Robert Campbell presented the paper BI-WP-5: South Pacific albacore age and reproductive biology – progress report. This paper described the results of the first year of a regional study of South Pacific albacore population biology. The main objective of the study was to develop a biological sampling programme for the southwest Pacific region to ensure that unbiased estimates of biological parameters (age, growth and reproduction) can be obtained. These parameters are required inputs for regional stock assessment models and Australia's Eastern Tuna and Billfish Fishery (ETBF) harvest strategy. Existing biological data for albacore from the ETBF were analyzed to estimate the minimum sample size required for reliable estimates of growth and maturity. Although this length-age data set was small (n=83), the results indicated that size-at-age data from 100 individuals (~7 fish per age class for ages 1+ to 14+ years) should provide acceptable levels of precision (i.e. coefficients of variation <0.2) for estimating growth parameters, provided the samples cover the same size and age ranges used in the analysis. Given this is the first study of this nature for albacore in the South Pacific and that the maximum age of albacore could be older than 14 years, we suggest that at least 200 size-at-age estimates are obtained by year/sex/region in the first instance, and that this estimate is updated as additional otoliths are read. Approximately 100 individuals were found to be sufficient to estimate the size at 50% maturity (by year/sex/region), although it is recommended that this analysis also be updated as more data becomes available. A sampling programme was developed, based the results of the above analysis, with the aim of sampling 500 albacore from the ETBF, 160 from the New Zealand troll fishery and 240 from each of seven Pacific Island Countries and Territories (PICTs) each year for two years. Biological sampling of albacore in the ETBF (otoliths, spines, gonads, muscle tissue) for the current FRDC/WCPFC-funded project was initiated in November 2008 and 469 fish have been sampled so far. Sampling of the New Zealand troll fishery was initiated in 2008 (Jan-April 2008 n=160 and Jan-Mar 2009 n=67) and will be undertaken again in 2010. Biological sampling of the PICTs (otoliths and gonads), as part of the EU-funded SCIFISH project, was initiated in 2009 and 136 fish have been sampled to date. All biological material sampled will be sent to CSIRO Marine laboratories (Hobart) for archiving and laboratory processing.

Discussion

19. The extent of damage to fish caused by sample collection of otoliths, fin spines, and gonads was noted by the BI-SWG and it was asked if fishermen were being financially compensated. The BI-SWG was informed that at this point in time, no problems with damaging the value of albacore had been identified and that there was no need to compensate fishermen.

d. Other studies

20. There were no specific working papers nor comments related to these research fields:

- Early life history and recruitment strategy

- Stock structure
- Behavior and movement
- Trophic study
- Others

5. Research planning

21. There were no new research proposals discussed.

6. Recommendation

22. Recommendations include:
- Support second year pilot study on the bigeye reproductive biology
- Support the last year's (2010) funding support for the South Pacific albacore age and reproductive biology study
- Support further research on biological parameters of striped marlin to support stock assessments of this species
- Promote biological studies of species of interest in the convention to improve stock assessment.

7. Administrative matters

23. The BI-SWG supported the nomination of Miki Ogura to convene the Biology Working Group in 2010.

8. Adoption of report

24. This report was adopted by SC5 on 17 August 2009

8. Close of meeting

25. In closing the meeting, the convener thanked SWG participants, presenters and rapporteurs 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
Fifth Regular Session

Port Vila, Vanuatu
10–21 August 2009

AGENDA FOR THE
BIOLOGY SPECIALIST WORKING GROUP

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1. **Opening of the Meeting**
2. **Selection of Rapporteurs**
3. **Adoption of Agenda**
4. **Research**
   - **a. Age, growth, and reproductivebiology**
     BI-WP-1: R. Keller Kopf, Julian Pepperell, and Peter S. Davie. Age, Growth, and Reproductive Dynamics of Striped Marlin (Kajikia audax) in the Southwest Pacific Ocean
     BI-WP-2: Ashida H., T.Tanabe, and N. Suzuki. Recent progress on reproductive biology of skipjack tuna in the tropical region of the Western and Central Pacific Ocean.
   - **b. Biological parameter on the assessment model**
     BI-WP-3: S. Hoyle, S. Nicol, and D. Itano. Revised Biological Parameter Estimates for Application in Yellowfin Stock Assessment
   - **c. Review of the research project on reproductive biology**
     BI-WP-4: S. Nicol, K. Sisior, S Retalmai, J. Farley. Bigeye tuna age and reproductive biology – progress report
     BI-WP-5: J. Farley (CSIRO), A. Williams. South Pacific albacore age and reproductive biology – progress report
   - **d. Other studies**
     - **Early life history and recruitment strategy**
     - **Stock structure**
     - **Behavior and movement**
     - **Trophic study**
     - **Ohters**
5. **Research Planning**
6. **Recommendation**
7. **Administrative Matters**
8. **Adoption of Report (including a one page summary)**
9. **Close of the meeting**

Attachment H

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

Scientific Committee
Fifth Regular Session

Port Vila, Vanuatu
10–21 August 2009

REPORT OF THE ECOSYSTEM AND BYCATCH SPECIALIST WORKING GROUP

1. Opening of the meeting

1. Paul Dalzell, the Ecosystem and Bycatch Specialist Working Group (EB-SWG) convener, opened the meeting. Rapporteurs for the session were Pierre Kleiber and Brad Wiley. The meeting agenda is attached as Appendix 1.

2. Selection of rapporteurs

3. Adoption of Agenda

4. Ecosystem effects of fishing

a. Ecological Risk Assessment Implementation Report

Summary of the Presentation

2. David Kirby presented EB-WP-5**,** a progress report on the SPC's Ecological Risk Assessment Implementation project. The Ecological Risk Assessment (ERA) project covers a range of research and associated activities on bycatch. SPC-OFP provided an overview of work that they had carried out, collaborated on or commissioned during 2008/9.

3. The list of papers presented to SC5 by SPC is as follows:

a) EB-WP-02 S. Clarke. An Alternative Estimate of Catches of Five Species of Sharks in the Western and Central Pacific Ocean based on Shark Fin Trade Data.
b) EB-WP-05 D. Kirby. Ecological Risk Assessment (ERA) Implementation Report
c) EB-WP-06 D. Kirby, S. Waugh, D. Filippi. Spatial risk indicators for seabird interactions with longline fisheries in the western and central Pacific.
d) EB-WP-07 P. Williams, D. Kirby, S. Beverly. Encounter rates and life status for marine turtles in WCPO longline and purse-seine fisheries
e) EB-WP-08 M. Manning, D. Bromhead, S. Harley, S. Hoyle, D. Kirby. The feasibility of conducting quantitative stock assessments for key shark species and recommendations for providing preliminary advice on stock status in 2010.
f) EB-WP-09 D. Kirby. Monitoring the effectiveness of Conservation and Management Measures for bycatch.
g) FT-IP-01 S. Beverly. Longline terminal gear identification guide.

4. In addition to the activities detailed in those papers, SPC-OFP carried out a characterization of the purse-seine fisheries of Papua New Guinea that included ecological risk assessment for bycatch. This work was commissioned and part-funded by the Australian Centre for International Agricultural Research (ACIAR). SPC-OFP has also been developing the WCPFC Bycatch and Bycatch Mitigation Information System (BBMIS) for the WCPFC Secretariat. In 2007/8 the work was primarily in database development but in 2009 this work has focused on compiling and inputting the information content. This has included literature review and correspondence with relevant experts in order to have access to current information on bycatch biology and bycatch mitigation methods. This database will be available to users through the WCPFC website in 2010 with appropriate acknowledgements and disclaimers. CCMs are requested to nominate experts to help the WCPFC Secretariat to keep the information content of this database up-to-date.

Discussion

5. In the discussion it was noted that the database will be made available on the WCPFC website and that it would contain both literature and biological data, or links to where this kind of information could be found. The project would require Member country contacts or 'gate-keepers' that would ensure the accuracy of the information to be included on the website. The representative from ACAP indicated that ACAP would be happy to contribute data held by that organization on seabirds.

b. Monitoring the effectiveness of Conservation and Management Measures for bycatch — workshop report

Summary of the Presentation

6. David Kirby presented EB-WP-9, a review of the CMMs for sharks, seabirds and turtles which was carried out by participants from the Pacific Islands plus Indonesia and Philippines at a workshop in June 2009. The theme of the workshop was on scientific monitoring and analysis of the effectiveness of CMMs, which involves identifying what outcomes result from implementation of the CMMs, and comparing these outcomes with the intended outcomes. This is not the same as monitoring compliance, although it is recognized that overall effectiveness of CMMs will also depend on compliance. Participants recognized various shortcomings in the CMMs that had the potential to render them ineffective. In general, CMM objectives are not well stated in terms that would allow their effectiveness to be easily assessed.

7. In the sharks (CMM 2008-06), the explicit objective is to require full utilization, through a 5% fin to carcass ratio. The implicit objective of the CMM is to reduce fishing mortality. The 5% fin to carcass ratio itself was not reviewed, but it was recognized that using a ratio that was not species-specific meant that twice as many sharks could actually be killed than there are carcasses on board, i.e. if fins are kept from one species (e.g. blue shark) while carcasses are kept from other species (e.g. mako sharks). This would not be the case if fins are required to be landed while naturally attached to their respective carcass. The difficulty of monitoring the effectiveness of the CMM in terms of its implicit objective was noted and it was recommended that the CMM explicitly state an objective to reduce fishing mortality by comparison to some reference year(s). This is possible to monitor through catch and mortality rates (see EB-IP-8 and EB-IP-7).

8. For seabirds (CMM 2007-04), the effectiveness of any technical mitigation measures must be monitored as there is simply no point using mitigation measures that are ineffective. The spatial zoning under the measure needs to be monitored in order to ensure that zones with the potential for seabird interactions and for adverse effects on seabird populations are correctly identified so that mitigation measures can be used in these locations (see EB-IP-6). There is a general need for observers to be well trained in seabird species identification and to have the necessary resources (identification guides, digital cameras) to correctly identify seabirds that are caught. North of 23ºN, the CMM has an exemption for

fishing vessels with length <24m. Workshop participants did not believe that this was likely to be scientifically justified, as observer data has not been presented to SC showing minimal seabird interactions by these vessels. Participants felt that best practice mitigation measures should be adopted by all vessels that have a risk of causing fishing mortality on seabird populations.

9. For turtles (CMM 2008-03), participants felt that much of the language was too flexible to really allow its effectiveness to be monitored. Qualifying phrases such as 'where appropriate' or "if practicable" may well be justified in certain circumstances but the CMM does not detail what is or isn't appropriate or practicable in the cases where these phrases are used. It therefore makes the task of monitoring the effectiveness of the CMM much more difficult. The focus of the requirements under the measure to use circle hooks or fish bait is on shallow-set swordfish fisheries. These fisheries have the highest encounter rates for turtles but deep-set longlines also catch turtles (see EB-WP-7), so it is not appropriate to exempt such fisheries from all possible measures designed to minimize fishing-induced mortality on turtles. Finally, participants reviewed the draft WCPFC Guidelines for the Handling of Sea Turtles. Edits were suggested and incorporated into the final draft (GN-WP-13).

Discussion

10. There were supportive comments on the workshop conducted by SPC, which besides reviewing the effectiveness of the Conservation and Management Measures for bycatch, also provided institutional strengthening for Member countries. There was some discussion about the feasibility of monitoring bycatch of sharks. Observer data can be used to monitor reduction of catch rates but further assessment would be required to monitor stock status.

c. Biology of high risk species

11. There were no presentations under this topic.

d. Fishery impacts on ecosystem

An update of recent developments and application of the SEAPODYM model

Summary of the Presentation

12. An update of recent developments and applications of the SEAPODYM model was provided in EB-WP 10 and information paper EB-IP 13 by Patrick Lehodey. An enhanced version of the model has been developed that includes data assimilation techniques to calibrate the model parameters, using spatially disaggregated catch and length-frequency data. Though there are a small number of parameters, achieving a plausible set of biological parameters requires many simulations with different environmental forcing data sets.

13. Results for skipjack showed general good agreement with MULTIFAN-CL biomass estimates, though SEAPODYM predicted lower amplitude variations, likely due to underestimated environmental variability. Estimates diverge temporarily during post-El Niño conditions. A strong correlation between recruitment and the El Niño-Southern Oscillation (ENSO) Index suggests that the trend in abundance of the adult stock is predictable 8 months in advance using this index. Therefore, if the El Niño event forecast for the end of 2009 is confirmed, skipjack biomass should increase in the second half of 2010.

14. Optimization of the bigeye application provided reasonable values of the biological parameters which are consistent with existing knowledge. Results suggest that ENSO has an impact on larvae recruitment and spatial dynamics of young fish, but has fewer impacts on the spatial dynamics of adult fish. This may be due to adults foraging on deeper meso-pelagic organisms and seasonal production in subtropical regions that are less influenced by ENSO. The simulation also suggests a relatively isolated

stock in the Coral Sea. Estimates of adult bigeye biomass converge with those of MULTIFAN-CL, though there are differences in the recruitment time series.

15. The yellowfin application was conducted with two different environmental data sets leading to substantial differences in ocean conditions. These simulation experiments did not include detailed size frequency data for the EPO, a key area for yellowfin, and will thus need to be updated. The comparison with MULTIFAN-CL estimates showed similar or even less biomass levels in the tropical regions (3 and 4) which are the core habitat of the species, but higher biomass in subtropical regions may be due to the coarse resolution used in the model and lack of realistic meso-scale activity.

16. Despite the low resolution of fishing data (5 degrees) used for South Pacific albacore, the SEAPODYM simulations provided a reasonable fit to data with a plausible spatial population dynamics. A natural separation of the population emerged at the equator due to the prediction of habitats by the model. The predicted distribution of larvae is consistent with existing knowledge, and a clear seasonal migration pattern of adult fish was predicted with a concentration of adult fish north of 25°S peaking in October to November, a movement of fish to the feeding grounds in the southern convergence during austral summer (January to May), and the northern migration starting in June to July.

17. Future tasks include the development of a Pacific swordfish application and further simulation experiments to improve the model calibration for tuna species, using higher resolution of fishing data, and more realistic oceanic environment at higher resolution. The model calibration for albacore could be facilitated by a basin-scale application including both north and south populations. New developments have been initiated recently to incorporate conventional and archival tagging data in the model calibration. Finally, projection of the impact of global warming has been tested for bigeye using the IPCC A2 scenario. The simulation suggests improving conditions for bigeye in the EPO but less favorable condition in the WCPO. The issue of climate change requires a large international collaboration and the accessibility by the research community (e.g. CLIOTOP) to a global public tuna fishing data set.

Discussion

18. There was strong support from the EB-SWG participants for the SEAPODYM modeling conducted by Lehodey and his collaborators. There was a lengthy discussion about the model and about how the results from SEAPODYM compared and contrasted with those of the MULTIFAN stock assessments. It was noted that the inclusion of environmental factors in SEAPODYM may provide further insights into the underlying stock-recruitment relationship of the key tuna stocks.

19. Discussion on the concentration of bigeye tuna in the Coral Sea was of interest and there was discussion on whether this may be influenced by the large volume of tagging of bigeye in this location.

20. The calibration of the SEAPODYM model was discussed together with the reliability of the model predictions versus observed data. Lehodey noted that the model was calibrated with observed data in a given time window then checked for the full time series used in the model. The potential for the model to provide management advice was discussed, including the potential impacts of fishing effort changes including area closures.

21. There was discussion of the model to predict fish movement patterns with SEAPODYM. Lehodey explained that the model predicts spawning habitat using a number of parameters such as sea surface temperature, primary production and forage, and presence/absence of predators. These were given varying weights in the model. Model runs predicted how tuna larvae move passively with the currents, but active vertical migrations of larvae were not included in the model.

22. The potential of SEAPODYM to investigate the potential changes in tuna distribution with global warming were discussed, as were the potential to generate recruitment predictions. Finer resolution of fishing data and tagging data may permit further investigations of recruitment.

23. There was discussion about the relatively poor performance of the SEAPODYM model for size predictions for the EPO bigeye tuna. This was thought to be due to the different length-frequency distributions in the EPO versus the WCPO and issues concerning the resolution of the data.

24. CCMs were encouraged that the model may be able to predict fish abundance spatially and to provide early warnings of potential changes, such as the response of tunas to global warming. Lehodey noted that tuna population response to global warming was as yet unknown and may depend on genetic diversity, which may be reduced through fishing. It was also noted that SEAPODYM may be able to assist in determining the range contraction of stocks in response to increasing catch and effort.

25. It was noted that the model does not predict extensive juvenile big eye habitat in the west where Indonesia and the Philippines are catching large volumes of bigeye. Lehodey responded that this needs further investigation.

26. In response to how targeted research might assist further development of the model, Lehodey noted that the key was high resolution fishing data over small time periods. Lehodey had contacted the WCPFC requesting data and the EB-SWG chair suggested that this may be a recommendation from the Working Group for collaboration with Lehodey.

5. Sharks

a. Shark catch reporting and mitigation

27. There were no presentations under this agenda item but the EB-SWG was referred to two information papers: EB-SWG IP7 and EB-SWG IP 8

b. Shark stock assessments

North Pacific blue shark stock assessment

Summary of the Presentation

28. Pierre Kleiber presented EB-WP-01, a stock assessment of the blue shark (*Prionace glauca*) population in the north Pacific. This assessment was conducted using catch and effort data from commercial longline and large mesh driftnet fisheries from 1971 through 2002 as well as small mesh driftnet fisheries operating primarily in the 1980s. Because reporting of shark catch has not been required in these fisheries, which target primarily tunas, a system for identifying the more reliable longline catch reports was utilized and the magnitude of total catch estimates verified against independent estimates of catch based on the shark fin trade.

29. Two different assessment models were utilized, a surplus production model, and an integrated age and spatial structured model tested with a variety of structural assumptions. The two models were found to be in general agreement. The trends in abundance in the production model and all alternate runs of the integrated model show the same pattern of decline in the 1980s followed by recovery to above the level at the start of the time series. The integrated model analyses indicated some probability (around 30%) that biomass at the end of the time series was less than Bmsy (overfished) and that there was a lower probability at that time that fishing mortality was greater than Fmsy (overfishing occurring). There was an increasing trend in total effort expended by longline fisheries until year 2002 -- the end of the time series. This trend has continued thereafter in the Hawaii longline fishery and perhaps so in other longline

fisheries in the region. It would be prudent to assume that the population is at least close to MSY level and fishing mortality approaching the MSY level.

Discussion

30. The discussion opened with a statement from FFA noting that WCPFC5 requested in identification of key shark species. It is now hoped that SPC can develop and undertake a programme of work for assessments of these species. It was also noted that the SPC, FFA and SPREP were developing a regional plan of action for sharks.

31. In response to a question regarding further analysis of data on blue shark since 2002, Kleiber responded that no further analysis had been conducted. Kleiber elaborated further on the difficulties in conducting the assessment with disparate sources of data and the filters that need to be applied to commercial catch data. A reporting rate filter of 80% was applied to logbooks from cruises which did not report sharks for at least 80% of all sets. Further, the stock assessment incorporates samples from training vessels and research vessels, which do not operate in the same area as the harvesting fleet.

32. Kleiber noted that catches of sharks by longliners are poorly reported, so more effort was needed to improve catch reporting requirements by CCMs, plus observer data since most sharks taken are not brought to shore.

33. The increase in fishing effort in the Hawaii longline fishery in terms of numbers of hooks deployed had doubled, but the prohibition on shark finning had reduced fishery impacts since few sharks were now retained, and likely had a high survival rate when released.

34. The steepness of the stock recruitment relationship and its influence on stock assessments was a continuing theme during various Working Group discussions. Discussion on the steepness of the relationship focused on constraining this parameter in the model. Movement and tagging was also discussed, and Kleiber noted that the model did estimate movement between regions. Some research by Japanese researchers suggests that there may be different migrations patterns in the North Pacific by sex, and Kleiber's model did not account for that.

Feasibility of conducting shark stock assessments

Summary of the presentation

35. Michael Manning of the SPC OFP presented paper EB-WP-08 addressing a request made by the Fourth Regular Session of the Western and Central Pacific Fisheries Commission Scientific Committee (WCPFC-SC4) in 2008. The Scientific Committee tasked the Oceanic Fisheries Programme of the Secretariat of the Pacific Committee (SPC-OFP) to review the general feasibility of undertaking single-species stock assessments of key shark species in the Western and Central Pacific Ocean (WCPO) in order to provide preliminary advice on stock status. The SPC-OFP was also requested to provide a recommended approach for undertaking these assessments and for developing a Shark Research Plan to meet the requirements of Western and Central Pacific Fisheries Commission (WCPFC) conservation and measurement measure CMM-2008-06. The conclusions of the review were as follows:

36. Sufficient basic biological and fishery data exist to provide preliminary stock status advice on the key shark species (blue, oceanic whitetip, short- and longfin mako, silky, and bigeye, common, and oceanic thresher sharks). This advice will be almost entirely based on observer data held by SPC and Member countries and territories, not the WCPFC.

37. A hierarchical or stepwise approach to the development of preliminary stock status advice is recommended: (step one) beginning with a revised productivity-susceptibility and resilience analysis;

(step two) followed by an evaluation of stock-status indicators outside a population model fit; and then by (step three) an evaluation of stock-status indicators calculated from the results of a series of simple population model fits.

38. It is not expected that construction of simple population models (step three above) will be feasible for all species, in particular the rarer longfin mako and some or all of the three species of thresher sharks listed. The data available for these species may be too sparse to proceed past steps one and two. However, it should be possible to identify the precise nature of the data gaps, any other information needs, and how these might be filled or met in the future.

39. Construction of catch histories (i.e., total removals or the sum of the landed or retained catch and the dead discarded catch) will be a large and complex job and is likely to require a number of structural assumptions about the data that may not be immediately testable. The uncertainties in the data are likely to be heavily species-dependant, perhaps reflecting historic reporting practices.

40. Calculation of several alternative catch histories for each species that are functions of different sets of structural assumptions is recommended.

41. Estimating biomass and yield with statistical confidence and providing a precise picture of stock status is unlikely to be possible without considerable investment in shark fishery data collection and reporting systems in the future. However, the process suggested here (i.e. the one-year preliminary assessment project), should produce sufficient information to guide the development of the WCPFC Shark Research Plan.

42. Key tasks in the provision of preliminary advice include:

a) developing collaboration, as appropriate, with the IATTC and other partners, including national scientists from WCPFC Members, Cooperating Non-Members, and Participating Territories (CCMs);
b) updating biological information where necessary and possible and identifying other potentially important data sets (e.g. data held by CCMs and not currently available to the WCPFC) that may be required;
c) developing alternative catch histories;
d) analysis of standardized CPUE and size data;
e) application of different stock assessment modelling methodologies; and
f) developing a draft Shark Research Plan, in collaboration with CCMs for approval by SC, based on the lessons learned in undertaking the preliminary assessments.

43. In order to undertake this task properly, it will require the full-time work of one person starting as soon as possible after WCPFC-SC5.

Discussion

44. Initial discussion focused on the availability of data and access to data. The largest observer database is from the Hawaii longline fishery, where finning has been banned for a decade. It was noted that data collection on shark catches needs to be increased otherwise the limitations and problems found in historical data will continue to confound assessments. However historic data exists so assessment work could begin immediately.

45. There was concern expressed that silky sharks were not included in CMM 2008-06, and this was thought to be simply an oversight.

c. Catches and catch rates of non-target species

An alternative estimate of catches of five species of sharks in the western and central Pacific Ocean based on sharkfin trade data

Summary of the presentation

46. Shelley Clarke presented EB-WP-02, which contains an alternative estimate of catches of five species of sharks in the western and central Pacific Ocean (WCPO) based on shark fin trade data. This method was previously applied to the Atlantic Ocean by ICCAT, and in this application to the WCPO provides minimum estimates of shark removals using shark fin trade data. It is based on a four-step methodology: estimates by species in number and biomass from Hong Kong shark fin auctions are extrapolated to represent the entire Hong Kong shark fin trade, the global trade, and the portion of the supply from the WCPO from 1980-2007. Because these estimates capture only a portion of the potential shark mortality (i.e. only those sharks' whose fins are traded), the value of these estimates lies mainly in comparison to other WCPO records of total shark mortality in order to identify potential under-reporting. There is reasonable agreement between SPC catch-based estimates and the trade-based estimates during the period 1998–2000 but after that time the median trade-based estimates are up to two to three times higher than the catch-based estimates. Given that there are important uncertainties in both catch-based and trade-based estimates which cannot be resolved on the basis of existing data, further study of these and other methods was strongly encouraged.

Discussion

47. There was discussion of the differences in the estimates of shark catch generated by SPC and by Clarke. The SPC methodology uses CPUE data which excludes the distant-water longline vessels which has the potential to create statistical artefacts. Clarke was asked about the anchor points used in her estimates, which all came from one year and whether additional years could be added. Clarke confirmed that the data exists but would likely be unavailable to her.

48. It was noted in discussions that the extrapolation to catch could be made more precise, especially using target data, because the catch is very heavily affected by the fishing strategy. The decline in fin volume after 2003, may have been a result of longline boats changing their fishing strategy around this time period.

49. Clarke noted that Hong Kong is no longer a closed system with respect to shark fins, as the trade has spread to other areas of China following 1997. She also added that a recent paper last year suggested that shark catches and shark trade started to drop after 2003. The reasons for this remain unknown, but a decline in shark populations cannot be excluded.

d. Sharkfin to body weight ratios

50. There was no presentation under this agenda item.

e. Update of CMM-2008-06

51. This agenda item was covered in part by EB-WP-09. The need for the measure to specify a desired reduction in fishing mortality was identified. The importance of including silky shark as a key shark species was recognized, as was the pressing need to conduct research in order to provide the Commission with the preliminary advice on stock status of sharks that it has requested by 2010.

6. Seabirds

a. Technical specifications of seabird mitigation measures

Summary of the presentation

52. Dr Waugh (BirdLife International) presented a series of best-practice specifications for mitigation measures developed though a review of published literature and primary research on seabird mitigation (WCPFC-SC5-EB-WP3). Six fact sheets related to pelagic longline fisheries and are also available from www.birdlife.org or hard-copies are available on request from BirdLife. The fact sheets set out a compilation of the most recent information on seabird mitigation efficacy, and include those studies previously submitted to WCPFC. The fact sheets provide technical specifications for each of the measures currently in use. The presenter drew attention to the IP-09 and IP-12 which further reviewed scientific research on mitigation and measures in vigor in other RFMOs. The need for best practice specifications was set out by the FAO (EB-IP-14) as a necessary part of management of incidental mortality of seabirds in RFMOs. The research indicated differences between the WCPFC CMM2007-04 and current international best practice. To this end, a key finding of the research was that CMM2007-04 needed to be revised, in particular to improve the specifications for streamer lines, blue-dyed bait, offal management, and to remove line-shooters from the list of available mitigation options.

Discussion

53. Several CCMs expressed reluctance to revise CMM 2007-04, indicating that it had only recently been adopted, and that there appeared to be small-scale regional differences in bird bycatch such that some mitigation measures worked better than others in certain areas. However, additional research and trials, which would potentially lead to the modification of current technical specifications for mitigation measures or the development of new mitigation measures, was welcomed. It was suggested that this is an area where most benefit in achieving the objective of extending further protection to vulnerable species of seabirds can be achieved.

54. The Solomon Islands made the following statement on behalf of FFA. Following the revision of the Seabird CMM at WCPFC4, FFA Members are not aware of any developments to suggest that the current seabird mitigation measures need to be updated or modified. However FFA Members would continue to encourage research and trials on new mitigation measures that are practical and effective in extending further protection to seabirds. In relation to the application of the seabird mitigation measures, it should be noted that in the table of mitigation measures in the CMM, provision exists to use “weighted branchlines” twice, which was never the intent of the CMM. Therefore, to remove the capacity to use “weighted branchlines” twice, FFA recommends that advice be provided to WCPFC 6 to remove “weighted branchlines” from column B of the mitigation measures in table in the CMM.

55. ACAP expressed support for the revision of the CMM 2007-04, and the adoption of international best practice measures in WCPFC fisheries for mitigation seabird mortality.

56. The EB-SWG thanked Dr Waugh for the material provided and noted that it will be a useful tool for future management considerations.

b. Seabird identification guides

57. There was no presentation under this agenda item. However, a proposal will be developed by SPC-OFP and BirdLife International to progress this work in 2009/2010.

c. Review of CMM-2007-04 and CCM estimates of seabird mortality presented in Part 1 of Annual Report

58. This agenda item was covered in part by EB-WP-09.

d. Review of research on seabird interactions and mitigation measures

Spatial risk indicators for seabird interactions with longline fisheries in the western and central Pacific

Summary of the presentation

59. David Kirby presented paper, EB-WP-6, which assessed the risk of interactions between longline fisheries and seabirds in the WCPFC Convention Area. Efforts to reduce fishing-induced mortality are especially important for Procellariiform seabirds, such as albatrosses and gadfly petrels, which are at particularly high risk of extinction. A spatially explicit productivity susceptibility analysis (PSA) was used to determine (a) the probability of seabird-fisheries interactions occurring, by comparing fishing effort and species range distributions, and (b) the risk of adverse effects of fishing-induced mortality on populations of seabirds. Areas of high seabird diversity were also identified, as well as areas with the potential for fisheries interactions if fishing effort were to increase in those areas. The combined bird distributions showed a very important area for seabird diversity in the Tasman Sea and east of New Zealand, and this area also has the potential for high numbers of birds to be caught. When the risk of population impacts of fishing was examined (including species ranges, population growth rates, and fishing effort), these areas were again identified, as were several areas in the tropical pacific. The tropical zones fell within the ranges of several threatened species of petrel, some of which have very small population sizes and are therefore at significant risk of extinction. On the basis of the analysis, recommendations for future research and for future refinement of management measures were made. These recommendations include the inclusion of catchability and the effect of mitigation measures in the analysis, and the refinement of spatial zoning under the seabird CMM, such that more effective mitigation methods are required in high risk areas.

60. Dr Waugh presented information on the appendix to EB-WP-06 noting that the paper comprised maps of the distribution of albatrosses and petrels within the WCPO, and was compiled using all available distributional and demographic information for 64 species which overlapped in range with WCPFC fisheries. Paper WP-06 had details of methods of how different datasets were combined. The Appendix provides an encyclopedia of current bird data for species of relevance to WCPFC bycatch, and will likely remain relevant for several years to come. However, it was noted that as remote tracking and survey data are continuing to be collected, the paper will need updating periodically. The paper allows CCMs to see which species occur in the regions they are fishing in. Dr Waugh noted that many of species co-occurring with WCPFC fisheries are threatened with extinction. Of the 64 species included in the study, 34 were listed as threatened with extinction by the IUCN, of these 4 were Critical, 10 Endangered and 20 Vulnerable to extinction. Ten further species had been included in the study, but were found to not overlap with WCPFC fisheries, thus were not included in the appendix. It was noted that all species in the analysis are long-lived and slow-breeding, and therefore demographically vulnerable to effects of fishing. The study included several species which have very small population sizes, of importance were Fiji and Becks' petrels, with population sizes estimated to be <50, <300 individuals respectively. These species had been shown to be among the most vulnerable to fisheries risk in WP6, and occurred exclusively in the tropical Pacific. Although they have not yet been observed captures in WCPFC fisheries, their small population sizes means that observed captures are statistically unlikely, but the species are known to be attracted to vessels discharging offal. The paper shows the ranges of species occurring in both tropical and temperate areas. In tropical areas, recently identified as of potential risk to seabird populations, breeding species include 17 petrels, of which 14 were considered threatened species.

Discussion

61. The EB-SWG was supportive of this study. The presenter noted, however, that the current level of observer coverage in the area south of 30^0S and north of 23^0N is not sufficient to ensure mitigation measures are being used and applied correctly to prevent interactions, although it was further noted that with the limited observer resources, improving observer coverage in these areas in the short term would be difficult. It was observed, however, that only one CCM that has observed seabird interactions is reporting these interactions consistent with the part 1 reporting requirements and this was considered a positive step. However, information was not necessarily provided at the species level, as required under the CMM-2007-04. CCMs are encouraged to report as required in future.

62. There were comments that there were a few birds that may not be encountered by tuna longline fisheries because they are too small. Further, there was more information needed on seasonality and migrations. BirdLife International noted that some birds had been removed from the study, while others that had been mentioned remained in the study as they or closely related species in their genera have been caught in fisheries, including around NZ. BirdLife International added that it would be productive to re-run the analysis with the inclusion of a catchability coefficient by species.

63. Waugh was asked what other CCMs are doing in-zone to mitigate bird bycatch and whether the effectiveness of these measures would be taken into account. She also supported comments about adding some sort of seasonality component to this research. Conceptually the analysis could be conducted by flag state, but the measures that flag states are using and whether they are effective would need to be known.

64. The analysis provided a mechanism to identify areas where increased observer coverage is desirable in order to determine the effectiveness and compliance with mitigation measures. The analysis suggested possible hot spots in which mitigation measures might be refined, and also increased observer coverage in areas where high bird interactions occur or where endangered species such as the Fiji Petrel are present.

65. It was suggested that the accuracy of the analysis could be tested using observer data. NZ and USA have some of the highest levels of observer coverage, so would be logical starting points. The analysis might be conducted both before and after mitigation measures were introduced.

7. Sea turtles

Encounter rates and life status of marine turtles in WCPO longline and purse-seine fisheries

Summary of the Presentation

66. David Kirby (SPC-OFP) presented paper EB-WP-7, which provided a brief overview of interaction rates with marine turtles, in order to inform discussion on what encounter rates should be considered "minimal" for the purposes of applying certain provisions of the turtle CMM. Encounter rates and life status were determined for 3 latitudinal zones of the western Pacific, based on observer data held by SPC. Between 30% and 70% of turtles are "alive and healthy" or "alive and injured/stressed" at the time of landing; between 5% and 40% are "dead" or "barely alive". Tropical areas have higher incidence of turtle encounters, for all species combined, than temperate areas (3% vs. <1%). However, leatherback and loggerhead turtle encounters are more prevalent in sub-tropical to temperate waters. Leatherbacks, in particular, are also observed in deep-set longline fisheries. Of the various factors affecting marine turtle encounter rates in WTP longline fisheries, the depth of set appears to be the most important. Although shallow sets are usually made at night while deep sets are usually made during the day, the data show that the incidence of marine turtle encounters is higher for all shallow sets than for any deep sets (>4.5% vs. <2.4%) and nominal CPUE for shallow sets is up to an order of magnitude higher than for deep-setting

vessels. The data for deep-setting vessels also show that encounters are likely to be on the shallowest hooks.

Discussion

67. It was noted that the results presented by Kirby were similar and consistent with the data submitted for the Hawaii longline fishery.

a. Safe FAD designs to reduce sea turtle entanglement

68. There were no presentations under this agenda item. EB-SWG recognized that it would be worthwhile to review this topic further.

b. CCM turtle mitigation plans or activity for review by SC & TCC

69. Australia was the only CCM that had submitted a mitigation plan for review by the Scientific Committee (Eastern Tuna and Billfish Fishery Sea Turtle Mitigation Plan (TMP) WCPFC-SC5-2009/EB-IP-15). These plans are one of the mitigation alternatives required by January 1 2010 in accordance with paragraph 7(a) of CMM 2008-03. Time constraints prevented a discussion of the plan by the EB-SWG. Further, it was noted that there is no process for the review of such plans by the Scientific Committee and Technical and Compliance Committee, and this should be taken up by the Scientific Committee in the following week. The EB-SWG recommended both the development of a review process and subsequent review of the plan submitted by Australia be conducted by SC5.

70. It was also noted that there was also a need some form of process to review information from CCMs reporting have minimal observed interaction rates of sea turtles over a three-year period with a level of observer coverage of at least 10% during each of those three years, according to paragraph 7b of CMM 2008-03.

c. Setting minimum sea turtle bycatch rates in the Western and Central Pacific Fisheries Commission's shallow-set longline fisheries

Summary of the presentation

71. Steve Brouwer presented EB-WP 4 on setting minimum sea turtle bycatch rates in the WCPFC's shallow-set longline fisheries. All sea turtle species found within the western and central Pacific Ocean (WCPO) are considered by the IUCN to be threatened. In the context of the concerns surrounding sea turtle populations, and the extent of the Western and Central Pacific Fisheries Commission's longline fleets, the Commission has recognised that mitigation measures may reduce sea turtle captures. The Commission has attempted to reduce sea turtle capture in the fisheries managed under its jurisdiction, through Resolution 2005-04 which was subsequently replaced by Conservation and Management Measure CMM 2008-03.

72. The Commission, through CMM 2008-03, requested that the Scientific Committee assess and make recommendations on an acceptable "minimal" sea turtle interaction rate for shallow-set longline swordfish fisheries, in order for CCM's to use paragraph 7b of CMM2008-03. The minimal sea turtle interaction rate is required to be determined by SC5. This paper outlined some of the issues that need to be considered when developing this standard and proposed a "minimal sea turtle interaction rate" for the Scientific Committee's consideration.

73. The paper reviewed the available data from the WCPO to provide guidance as to what the proposed "minimal sea turtle interaction rate" should be. Due to a lack of information on population dynamics, mortality rates and the low level of observer coverage, the paper recommends using: catch

rates rather than a total catch; a global rate for all species; and a single WCPO wide rate. The paper proposed to standardize the units of catch and effort for sea turtle reporting and for use in the Measure to sea turtles per 1,000 hooks. Using published work undertaken in Hawaii the paper shows that catch rates can be reduced significantly through gear changes. The paper proposes to use the lower rate than the Hawaiian fishery achieved as a minimum standard for a reference in paragraph 7b of CMM 2008-03.

74. The paper proposed the following recommendation to the Scientific Committee. The Scientific Committee should recommend to the Commission that in order to fulfil the requirements of paragraph 7(b) of CMM 2008-03, observed mean sea turtle catch rates must be lower than 0.019 turtles per 1,000 hooks over the preceding three consecutive years.

Discussion

75. Initial discussion on this paper considered the virtues of a single minimum standard for all species combined but that the possibility should be left open for species specific designations, which are all threatened, since some turtle populations are in worse shape than others. Further, some EB-SWG participants questioned the appropriateness of applying the rate from the Hawaii fishery, which was very strictly regulated, to other shallow set longline fisheries in the WCPO. It was noted in response that if your base encounter rates were low enough, additional measures would not have to be taken. Further, the Hawaii rate is appropriate to aim for as it had already been achieved.

76. Philippines noted the work of WWF in the Coral Triangle on plotting areas of high fisheries-turtle interactions based on tagging and onboard observers, where capacity building for crew members on species identification and safe handling practices are provided.

77. There were questions about the Hawaii shallow set fishery interaction rate and whether this was influenced by the hard cap for loggerhead and leatherback turtles used in this fishery. It was noted that the hard cap had only been exceeded once for loggerhead turtles, and even if the fishery had not closed in that year, it is unlikely to have impacted the average to increase it above 0.02 per thousand 1,000 hooks. Nevertheless, there continued to be concern that the Hawaii shallow set swordfish longline fishery turtle interaction rate may be inappropriate for other shallow set longline fisheries in the WCPO. There were concerns that this was too high a standard for other shallow set fisheries in the WCPO. It was noted in response that fishery managers and scientists in the US were still engaged in trying to lower the current interaction rate.

78. There was some discussion about having separate minimum interaction rates for hard-shell and leatherback turtles, given the parlous state of leatherbacks in the Pacific. Further, the implementation of a minimum interaction rate may be premature, given that there would soon be a Regional Observer Programme, which would provide observer data which could be used to conduct assessments on individual fisheries. It was noted, however, that CMM 2008-03 tasked the SC to define what a “minimal” interaction would be. It was noted that a minimal interaction rate would have to be decided by SC5, as CMM 2008-03 also called for Turtle Mitigation Plans to be submitted, that would contain a minimal interaction rate, and that these needed to be considered by SC5, the TCC and approved by the Commission before 1 January 2010. In response it was noted that more information would be needed to establish hard numbers by species, but using the Hawaii rate for the present was simply a step forward, and the value would be reviewed periodically to see if it was still appropriate as a target.

79. The Hawaii shallow-set fishery experience was interesting because experimental measures taken from the Atlantic were applied in the shallow set longline fishery in Hawaii and achieved a 90% reduction for all turtles. It achieved a leatherback reduction that was greater than was expected, and it is unclear if this success with leatherbacks was entirely due to the implemented measures. It might not be possible to achieve similar results elsewhere with these measures.

80. There was continued discussion among the EB-SWG with some voicing support for the suggested minimum rate and others expressing concerns about whether this should be reviewed further or that it might establish a precedent for other longline fisheries. It was noted that any recommendation sent forward to the Scientific Committee should make it abundantly clear that this rate applied only to shallow set longline fisheries targeting swordfish, with the understanding the rate is interim and subject to future reviews.

d. Review of circle hook trials

81. There were no presentations under this agenda item. However, research has recently been carried out in collaboration between SPC-OFP, Cook Islands and US PIFSC, and this work will be reported to SC6.

e. WCPFC sea turtle safe handling guidelines

Summary of the presentation

82. David Kirby addressed GN-WP-13, the WCPFC Guidelines for the Handling of Sea Turtles. These guidelines were developed by the WCPFC Secretariat based on earlier SPC guidelines. They were reviewed by CCMs earlier in 2009 and comments were reconciled into the draft presented to SC5. The only significant change by comparison with earlier guidelines is the advice not to de-hook turtles in cases where they have deeply ingested the hook. Some research has shown that deeply ingested hooks may either pass through the turtle or become encysted within, and the turtle's chance of survival may be better if this is allowed to take place rather than by risking further damage by attempted de-hooking.

83. There were positive comments made by the EB-SWG in support of the sea turtle safe handline guidelines, which as required in paragraph 13 of CMM 2008-03, had been developed by the Commission. Some guidance on entanglement should be discussed by SC5.

f. Review of CMM-2008-03

84. This agenda item was covered in part by EB-WP-09.

8. Recommendations

85. The following recommendations to the Scientific Committee were drafted by the EB-SWG. Text in square parentheses indicates that no consensus on this wording was reached during the EB-SWG session.

EB-SWG recommends that SC:

1) Recommends to the Commission that funding to support the continuation of the ERA project be provided for the period 2010–2012.

2) Include SEAPODYM as an affiliated, independently funded, project in the Scientific Committee's programme of work. Further, the EB-SWG encourages CCMs to cooperate with the request for data required for ongoing research using the SEAPODYM model.

3) Encourage CCMs to provide information on new or existing mitigation measures on seabird interactions to the SC consistent with paragraph 6 of CMM 2007-04.

4)

a. Request SPC-OFP to commence work on preliminary stock assessments for key shark species, and to develop a research plan to support further assessment for consideration at SC6, if possible, in collaboration with IATTC and other relevant organizations. The work should be included as a component of the 2010 service agreement for the provision of science services to the Commission.

b. CCMs are encouraged to collect and contribute catch and effort data, observer data, and biological data towards this exercise, and to cooperate in this research.

c. Recognizes the importance of observer data for analysis of fisheries impacts on bycatch and encourages collaboration between SPC-OFP, CCMs and other relevant organizations in the analysis of ROP data related to bycatch for use of the SC, subject to the Commission's rules and procedures for data.

d. consider adding silky sharks to the list of key shark species specified in CMM 2008-06.

5) Recommends reviewing the effectiveness of mitigation measures for seabirds currently required under CMM 2007-04, and reviewing any new mitigation measures for possible incorporation into the CMM.

6) Recommends the adoption by SC5 of the draft WCPFC Guidelines on the Handling of Sea Turtles (GN-WP-13), and the review by SC5 of further guidelines on entanglement and use of de-hookers.

7)

a. The Scientific Committee should recommend to the Commission that in order to fulfil the requirements of paragraph 7(b) of CMM2008-03 by January 2010, observed mean sea turtle interaction rates must be lower than 0.019 sea turtles (all species combined) per 1,000 hooks, over the preceding three consecutive years.

b. Revision of this threshold is encouraged as new data are collected and analyses are generated by SPC-OFP and the EB-SWG, particularly on the population status of the different sea turtle species and the rates of mortality that can be sustained. Species-specific interaction rates should also be considered.

c. Setting a reference level for shallow-set swordfish fishery for paragraph 7b of CMM-2008-03 is not relevant to the scientific advice that would be offered regarding a reference level of sea turtle bycatch in deep-set fisheries for tuna, which are larger in scope and lower in bycatch rates by an order of magnitude.

8) Recommends ongoing research, following from the spatial risk assessment presented in EB-WP-6, during the inter-sessional period and for review at SC6. The EB-SWG further recommends the use of data from the Regional Observer Programme in order to validate spatial risk assessments so that a recommendation can be brought before SC6 to determine initial spatial zones for the differential management and monitoring of seabird bycatch. These assessments should be updated as new information becomes available. Access to observer data for these scientific purposes will be granted under the terms of the Commission's rules and procedures for access to data.

9) Develop a process to review CCM sea turtle mitigation plans, provided in accordance with CMM 2008-03, paragraph 7a (iii), by the Scientific Committee and the Technical and Compliance Committee.

10) Recommends that the Scientific Committee consider the Australia Turtle Mitigation Plan (EB-IP-15) in accordance with CMM 2008-03, paragraph 7a (iii), and the issue of minimal interaction rates, in accordance with paragraph 7b.

9. Adoption of report

10. 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
Fifth Regular Session

Port Vila, Vanuatu
10–21 August 2009

PROVISIONAL AGENDA FOR THE ECOSYSTEM AND BYCATCH SPECIALIST WORKING GROUP

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1. **Opening of the meeting**
2. **Selection of rapporteurs**
3. **Adoption of agenda**
4. **Ecosystem effects of fishing**
   a. Ecological Risk Assessment Implementation Report
   b. Monitoring the effectiveness of Conservation and Management Measures for bycatch - workshop report
   c. Biology of high risk species
   d. Fishery impacts on ecosystem
5. **Sharks**
   a. Shark catch reporting and mitigation
   b. Shark stock assessments
   c. Catches and catch rates of non-target species
   d. Shark fin to body weight ratios
   e. Update of CMM-2008-06
6. **Seabirds**
   a. Technical specifications of seabird mitigation measures
      i) Tori line design
      ii) Other technical measures
   b. Seabird identification guides
   c. Review of CMM-2007-04 and CCM estimates of seabird mortality presented in Part 1 of Annual Report
   d. Review of research on seabird interactions and mitigation measures
7. **Sea Turtles**
   a. Safe FAD designs to reduce sea turtle entanglement
   b. CCM turtle mitigation plans or activity for review by SC & TCC
   c. Shallow set longline fisheries with minimal seas turtle interaction rates as determined by SC
   d. Review of circle hook trials
   e. WCPFC sea turtle safe handling guidelines
   f. Review of CMM-2008-03
8. **Recommendations**
9. **Adoption of Report**
10. **Close of the meeting**

Attachment I

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

Scientific Committee
Fifth Regular Session

Port Vila, Vanuatu
10–21 August 2009

REPORT OF THE FISHING TECHNOLOGY SPECIALIST WORKING GROUP

PRELIMINARIES

1. The meeting was opened by D. Itano who convened the session. The agenda was adopted as set out in Appendix 1. Session rapporteur was identified as S. Nicol.

REVIEW OF INFORMATION AND RELATED STUDIES

2. Three working papers and two information papers were made available to the Fishing Technology (FT) SWG for consideration by SC5. The working papers described research on the influence of FAD depth on catch characteristics in a distant-water purse-seine fishery and a response to paragraph 24 of Conservation and Management Measure 2008-01 (CMM 2008-1). The meeting was also informed on the objectives of the International Sustainable Seafood Foundation (ISSF) in regard to supporting bycatch reduction studies for large-scale tuna fisheries and FAD related studies of the IATTC.

Agenda item 4.1: Gear effects and the influence of FADs and FAD design on target and non-target species

SC5 FT-WP-02: Effects of set type on catch of small-sized tuna by the Korean tuna purse-seine fishery in the WCPO

3. D.H. An (NFRDI – Korea) described research on the effect of set type and FAD depth on the catch of small bigeye and yellowfin tuna in the Korean purse-seine fishery that was initially described to SC4. To investigate the effect of set type on the catch of small-sized tuna, onboard observers monitored fishing operation of two Korean tuna purse seiners in the WCPO. Twenty-eight experimental FADs with hanging net of various lengths were deployed for comparison of the effect of underwater structure on the catch of bigeye and yellowfin tuna during June to October in 2008. Of 208 observed sets, 180 sets were from unassociated schools of tuna and 28 sets from FAD-associated schools, accounting for 13.5% of the total sets. Bigeye and yellowfin tuna with fork length less than 60 cm were taken in FAD sets. There was no significant differences in catch (number) of bigeye ($P=0.20$) and yellowfin ($P=0.10$) tuna between associated and unassociated sets, but fork length of both tunas by associated and unassociated ($P < 0.001$) was significant. The difference in fork length of yellowfin tuna by each depth of FAD was not significant, but a significant difference was shown for bigeye tuna. The spatial variable of longitude was the paramount factor influencing small-sized yellowfin tuna, while bigeye tuna abundance was more influenced by the temporal variable of month. The depth of FAD was the second most important factor for yellowfin tuna. FAD depth was not found to be significantly correlated with bigeye catch in this study.

Discussion

4. The FT-SWG reviewed WP2. Clarification was sought on the aggregated weight of the large YFT taken in the associated sets versus catch of small yellowfin tuna observed, however the data were not available to address this clarification. Clarification was also sought on the protocols used for estimating species composition and it was noted that standard Korean observer programme methods were used. The FT-SWG noted that when conducting this type of study observer sampling methods must be consistent between CCMs and as unbiased as possible. It was clarified that unloading data was not collected to validate the onboard sampling data and that mesh size of the purse seines was consistent throughout the experiment.

5. It was suggested by the FT-SWG that future studies of this type should compare catch characteristics of FADs with no or very little subsurface structure vs. FADs with significant subsurface netting. FT-SWG also noted that it is difficult to obtain clear results from these types of experiments due to the confounding issues of relatively low bigeye abundance, spatio/temporal variability, net depth variability and the vagaries of fishing efficiency. The convener noted that these experiments depend on the fishing success and efficiency of the purse-seine vessel and that the pursing depth of the seine net should be documented throughout the experiment.

6. FT-SWG noted that a clear definition of what constitutes a "small" yellowfin or bigeye tuna should be developed. It was clarified that this task needs to be conducted on a regional basis and based on the stock condition and science based parameters. It was further clarified that small tuna on floating objects (STFO) is an acronym introduced at SC3 that describes juvenile yellowfin and bigeye but also includes commercially under-sized tuna of any species and small tuna-like species that are taken as bycatch in the purse-seine fishery.

7. There was agreement that work on gear and FAD effects is important for managing the impacts of fishing mortality on STFO and collaborations between industry and scientists should be encouraged and supported. FT-SWG emphasized that this work has been occurring for some time but had yet to define a practical method to reduce STFO catch. It was noted that establishing these methods is necessary for effective management of the fishery and required to provide industry guidance on this matter. It was strongly advised that a wide range of data inputs should be considered and documented to facilitate meaningful comparisons between studies. Physical oceanographic parameters, net depth verified by TDR, FAD descriptions (how long deployed, etc) and information on vessel efficiency should be considered among other data parameters

8. Japan informed the FT-SWG of their ongoing research projects on inter-specific behavior of bigeye, yellowfin, and skipjack to develop a method for reducing small tuna catch in FAD fisheries. Collaborative studies with research vessels and a commercial purse-seine vessel have been conducted that will monitor fish near FADs using tagging and acoustic tracking methods. In addition to this field research in WCPO tropical fishing grounds, an experiment is being conducted to observe the behavior of tuna held in net pens in coastal areas.

Agenda item 4.2: Improvements in targeting and avoidance of STFO and non-target species

SC5 FT WP-03: Update on the use of underwater video to characterize the species, size composition and vertical distribution of tunas around floating objects

9. The convener presented SC5 FT WP-3, which updates information presented to SC4 (FT-WP-03) regarding the use of underwater video to visually identify images of fish aggregated to floating objects. The system consisted of a hard-wired drop camera capable of displaying and recording color video images in real time onboard a vessel positioned over the aggregation. It was noted that this type of system can be used to: assess species and size frequency composition of tuna and bycatch species;

simultaneously compare echo sounder images with video images for training purposes and; as a means to test and refine the ability of fishermen to interpret acoustic images of floating object aggregations useful for the pre-set avoidance of bycatch and STFO.

10. The presentation focused on video and still images (derived from the video) of a floating object aggregation of tuna recorded during a PTTP tagging cruise to the equatorial central Pacific. Despite the replacement of the video camera head following difficulties experienced during 2008 trials, the images remained of relatively low resolution. However, images were generally sufficient to identify and differentiate juvenile bigeye from yellowfin tuna using pectoral fin characteristics. It was noted that pectoral fin characters were reliable only for middle sized bigeye tuna greater than approximately 45 cm in FL. It was further noted that the field testing was hindered by a lack of diversity in tuna and bycatch species encountered during the cruise. While morphological characters of tuna can be used as a way to estimate size, it was suggested that the study suffered from the lack of a means to verify actual lengths of recorded images. It was recommended that further trials be conducted on floating object aggregations consisting of a variety of bycatch and sizes of STFO and the testing of laser measuring devices in future trials.

Discussion

11. There was general consensus that this study should continue and be included in the FT-SWG work plan for 2009–2010 period.

12. Two research initiatives related to the agenda item were briefly noted. An EU-supported project on acoustic selectivity and pre-set estimation of purse-seine catch was described to SC4 and documented in SC4-FT-WP-02. It was noted that this study had been delayed due to funding issues but was currently scheduled to proceed with renewed funding support. This project would conduct acoustic selectivity experiments onboard two large commercial purse-seine vessels in areas of the EPO characterized by high bigeye abundance.

13. A similar research initiative by IATTC was described to the FT-SWG. This pilot project was designed to test the ability of EPO purse-seine captains to predict the species composition, species quantities and fish size prior to setting based upon acoustic imaging electronics and other techniques. Only four vessels were willing to participate with two vessels providing credible data from 40 sets. Data have not yet been formally analyzed but preliminary results indicate that captains are able to consistently predict bigeye, yellowfin and skipjack composition and quantities. This project has been put on hold awaiting results from the EU project noted above.

14. It was recommended that given 100% observer coverage and spill sampling taking place in the WCPO that a catch prediction study is feasible and could be implemented. IATTC has designed sampling forms specific to this study that are available to the WCPFC if such a project was to be implemented.

Agenda item 4.3. FAD monitoring, marking and data collection for scientific purposes

SC5 FT WP-1. FT-WP-01: Para. 24 of CMM 2008-01 FAD management and monitoring

15. FT-SWG reviewed FT-WP-01 compiled by the Secretariat in response to para 24 of CMM 2008-01 requiring the preparation of a report on FAD management options for consideration by the SC, the TCC and the Commission in 2009 to include: i) marking and identification of FADs; ii) electronic monitoring of FADs; iii) registration and reporting of position information from FAD-associated buoys; and iv) limits to the number of FADs deployed or number of FAD sets made.

16. A brief review of FAD-related issues was communicated to the FT-SWG. It was noted that FADs are compatible with the definition of fishing gear described in various international instruments and as

such should be marked in accordance with national legislation in order that the owner of the gear can be identified (FAO Code of Conduct for Responsible Fisheries, Article 8.2.4) and that such fishing gear should be marked for identification in accordance with uniform and internationally recognizable vessel and gear marking systems, such as the United Nations Standard Specifications for the Marking and Identification of Fishing Vessels (UN Fish Stocks Agreement at Article 18(3)d). Suggestions for the marking of FADs have been made for various oceans but no attempt has been made to date in the WCPO.

17. The electronic monitoring of FADs by their owners within the fishing industry was noted as being highly sophisticated utilizing radio or satellite linked GPS positioning buoys that can transmit several parameters (position, SST, course, speed, biomass estimates) to ship or land-based receivers. However, RFMOs or managing agencies do not currently have any ability to electronically monitor FAD data or FAD positions.

18. Regarding limits to the number of FADs deployed or number of FAD sets made, it was noted that there are currently no estimates of the number of FADs in use in the WCPO, the number of FAD deployments or FAD retrievals per year or the number of individual FADs used per fishing vessel. FAD Management Plans may address some of these issues but it was noted by the Secretariat only 8 CCMs out of 20 have submitted FAD Management Plans to date which were judged to be highly variable in their scope and content.

Discussion

19. The FT-SWG was invited to provide advice and recommendations to the SC and hence the Commission on science related research needs in relation to FADs. The FT-SWG suggested that two primary scientific objectives of FAD-related research were to provide data inputs to: a) improve stock assessments, and b) improve targeting while reducing purse-seine bycatch levels and fishing mortality on juvenile bigeye tuna.

20. It was suggested that the marking of FADs within the SC framework be aligned with the scientific objectives and benefits of FAD marking. It was noted that the individual marking of FADs in conjunction with data collection to track the fate of individual FADs was a valid scientific data input necessary to allow the enumeration of FADs and quantification of their fishing power to individual vessels or fleets. While noting that it may be an issue for TCC rather than TC, PNA CCMs noted that they are considering a range of options for in-zone FAD management, which may include assignation of property rights. PNA therefore noted the need for flexibility to develop options for national or subregional FAD marking schemes provided that minimum standards are maintained.

21. The convener noted the complexity and difficulty in maintaining individual identifying plates on drifting FADs due to the highly dynamic nature of the FAD structure and the ownership of FADs that are frequently lost, appropriated, shared, given to other vessels in a group, combined with other FADs or abandoned. The need to provide highly visible identifying labels on FADs for observer verification is completely counter to the desire by fishermen to hide their FADs from competing vessels. It was suggested that the electronic package attached to a FAD is equally important to identify as the FAD structure itself and defines the true benefit of a FAD to the parent vessel and as such should also be individually marked and monitored.

22. The FT-SWG was invited to consider the scientific objectives for FAD-related research and to advise on information relating to FAD monitoring and management that is required for scientific purposes. The group noted that the primary scientific objectives of FAD-related research were to provide data to improve stock assessments and to seek methods to minimize the impact of FAD fishing on STFO and bycatch species. Information required to support these scientific objectives are encompassed within the Medium Term research objectives of the FT-SWG and include data inputs necessary for effort standardization and characterization of WCPO fishing fleets and fishing effort. These can include the

historical and current details of fishing practices, fishing gear, electronic and FAD-specific parameters and other details necessary to allow the enumeration and identification of FAD units as effort units used on a per vessel and fleet basis.

23. The FT-SWG concluded that clarifying the objectives of the marking of FADs for scientific purposes was necessary to develop informed advice as to the type and detail of FAD related data collection required. The FT-SWG recommended that FT-WP-01 be further developed and presented to TCC5. CMMs were advised to submit comments and additional information to the Secretariat for inclusion in the paper by 1 September 2009.

24. A similar research initiative by IATTC was described. This pilot programme focuses on gathering information on EPO FADs that will include *inter alia* provisions for the marking of FADs, maintaining a record of the number of FADs onboard each vessel at the beginning and end of each fishing trip, and recording the date, time, and position of deployment of each FAD.

Agenda item 4.4: Technical assistance to port sampling and observer programmes

25. No specific working papers relating to these topics had been submitted to SC5. The convener noted the submission of SC5-FT-IP-01, which is a well illustrated identification guide describing hook types, swivels, trace, light gear and bait commonly used by WCPO pelagic longline fleets.

Discussion

26. The FT-SWG commended the author for the document noting that that the clear definition of fishing gears is essential to the work of the SC and TCC and will become more important as management actions are developed.

Agenda item 4.5: Current status and recent developments in WCPO fishing gear, practices and capacity in relation to changes in fishing effort

27. There were no specific working papers related to this topic.

Discussion

28. The FT-SWG noted that constantly increasing vessel and gear efficiency is a global concern and that opportunities exist for collaboration between RFMOs to address these issues. Clarification was sought on the status of historical documentation of gear and vessel attributes of WCPO fisheries. It was noted that whilst this information is collected on approved observer data forms it may be timely to ensure that the data being collected is verified. Compulsory vessel inspection data collected by CCMs could also provide an additional data source to evaluate historical changes in gear. However no comprehensive analysis of either dataset has been undertaken. It was noted that the net used by purse-seine vessels is the fundamental unit of gear in this fishery but remains poorly documented or studied. A study to document and analyze fishing efficiency and historical changes in vessel and gear attributes and efficiency in the major WCPO fisheries was suggested. It was also noted that changes in hook type and the use of circle hooks in particular can have a significant impact on catch levels. It was recommended that hook information be reported on vessel logbooks and by observer programmes.

Agenda item 4.6: The development of research projects with industry and observer and port sampling programmes

29. There were no specific working papers related to this topic. However, the convener noted recent initiatives of the International Seafood Sustainability Foundation (ISSF) to facilitate links between

research and the tuna industry to address data and bycatch issues. The ISSF representative J. Joseph provided a brief description of ISSF and current projects.

30. The ISSF representative noted that the organization is a global partnership among scientists, the tuna industry and the environmental non-governmental organization community. Its objectives are to undertake science-based initiatives for the long-term conservation and sustainable use of tuna stocks, reducing bycatch and promoting ecosystem health by supporting the efforts of the tuna RFMOs to implement science-based conservation programmes.

31. Current industry membership in ISSF is responsible for close to 50% of the worlds canned tuna production. In its short existence, ISSF has undertaken several measures: i) making cannery unloading weights available to RFMOs; ii) the establishment of industry tag coordinators to improve tag returns to RFMOs; and iii) the initiation of a programme to assist in the development of purse-seine gear technology and fishing methods to reduce or eliminate bycatch and discard of small tunas. With respect to this latter initiative, ISSF will be holding a meeting on purse-seine bycatch mitigation measures scheduled for late November of this year in Spain. A steering committee has been established to develop the agenda and coordinate the meeting; it will identify what research efforts to reduce bycatch are currently ongoing, which of these hold promise for success, and will set priorities for carrying them forward. ISSF is examining the possibility of making available for a two-year period a purse-seine vessel on which these experiments can be conducted. The steering committee will provide advice as to the utilization and availability of this vessel for the various research projects. In addition to the bycatch initiative for purse-seine vessels, ISSF is proposing a similar bycatch initiative for longline vessels and will establish a steering committee to coordinate activities associated with this initiative.

Agenda item 4.7: Other studies

32. There were no specific working papers related to this topic.

Agenda item 4.8: Advice to the Scientific Committee

33. The convenor requested if any particular advice should be provided to the SC arising from issues discussed by the FT-SWG. A list of items was endorsed by the meeting.

- Explore the feasibility of registering and monitoring the status of the electronic package attached to drifting FADs as means to monitor and study effort in the purse-seine fishery.

- Regarding further studies on FAD characteristics such as depth, construction and features of associated electronic package, the FT-SWG recommends that the SC encourage further study and facilitate the collection and recording of data and operational details that may be necessary to conduct these studies. Such data should include the hook type used in longline fisheries.

- Regarding technical research on bycatch mitigation, the FT-SWG advises the SC that collaborative projects with industry are a cost-effective and operationally sound approach and requests the support of the SC and Commission in facilitating such opportunities. Promote collaboration between the SC and the fishing industry to address issues of mutual concern. In particular, promote collaborative access to commercial fishing vessels to conduct scientific research studies to better utilize accumulated experience and their ability to simulate fully commercial conditions.

RESEARCH PLANNING AND COORDINATION

Agenda item 5.1: Operational research plan and tasks for 2009/2010

34. The convenor briefly reviewed the work programme for the FT-SWG for 2008–2010 as listed in the report of the SC4 as an introduction to the development of a work programme for the FT-SWG. Meeting participants suggested that video gear could be used to document and enumerate species composition data during purse-seine well loading operations. A study on marine mammal depredation in longline fisheries was suggested but deferred to the work of the EB-SWG. A suggested list of research tasks was supported with additional studies suggested by CCMs. The following operational research plan for 2009/2010 for the FT-SWG was endorsed by the meeting.

- Conduct studies to help quantify changes in fishing efficiency in both longline and purse-seine fleets in the WCPO.

- Conduct a study or studies to identify and refine lists of necessary technical data inputs for effort standardization.

- Continue field trials with underwater video gear on floating object aggregations.

- Conduct a study to document and analyze fishing efficiency and historical changes in vessel and gear attributes in WCPO fisheries including purse-seine net information.

- Regarding purse-seine fishing gear characteristics, the FT-SWG recommends that the actual depth to which purse seines effectively operate be examined on a per-vessel and per-fleet basis using time and depth recording tags on purse seines.

- Conduct studies on the behavior of target and non-target species influenced by different association types and floating objects in particular in relation to reducing effort on bycatch and small tuna.

- Examine, review and inform the SC regarding studies on the technical aspects of capacity measurement and monitoring of large-scale fisheries and long-term management options to control fishing mortality.

Agenda item 5.2: Medium-term research plan

35. A list of medium-term research objectives for the FT-SWG was proposed by the convenor for consideration by the meeting. The following medium-term research plan for the FT-SWG was endorsed by the meeting.

- Characterization of the major WCPO fishing fleets. This information, including historical and current details of fishing, electronic and FAD gear and practices, will be used in standardizing catch rates, specifically to document changes in efficiency, primarily for longline and purse-seine gear.

- In collaboration with the Methods SWG, promote, review, report and conduct effort standardization analyses using technical, biological and other data inputs.

- Work to identify and refine lists of necessary technical data inputs for effort standardization.

- 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.

- 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.

- Investigate, promote and report studies on socio-economic influences on fishing strategies, spatio-temporal fishing patterns and influences on effective fishing effort.

- Examine and review the technical aspects and scientific benefit of capacity measurement and monitoring of fisheries within the Convention Area.

- Develop collaborative research projects with industry to address issues of management concern. In particular, develop mechanisms to obtain access to commercial fishing vessels on a cost-effective basis or ways to fund vessel time to conduct scientific investigations.

OTHER MATTERS ARISING

Agenda item 6.1: Format, review and clearance procedures of the FT-SWG report

36. The convener noted that the draft report of the report of the meeting of the FT-SWG will be provided to the Secretariat on Saturday 15 August 2009 for copy and distribution to delegations for review and written comments that would be incorporated into a final draft for clearance on 17 August 2009.

Agenda item 6.2: Other matters

37. No other matters were raised

ADOPTION OF REPORT

Agenda item 7: Adoption of report

38. The report of the FT-SWG was adopted by SC5, subject to editorial formatting and editing by the Secretariat.

CLOSE OF MEETING

Agenda item 8: Close of meeting

39. The convener closed the meeting of the FT-SWG on 17 August 2009.

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
Fifth Regular Session

Port Vila, Vanuatu
10–21 August 2009

AGENDA FOR THE FISHING TECHNOLOGY SPECIALIST WORKING GROUP

1. **Opening of the meeting**
2. **Selection of rapporteurs**
3. **Adoption of agenda**
4. **Review of information and related studies**
   - 4.1. Gear effects and the influence of FADs and FAD design on target and non-target species
     - a) *FT-WP-02: Effects of set type on catch of small-sized tuna by the Korean tuna purse- seine fishery in the WCPO*
   - 4.2. Improvements in targeting and avoidance of STFO and non-target species
     - a) *FT-WP-03: Update on the use of underwater video to characterize the species, size composition and vertical distribution of tunas around floating objects*
   - 4.3. FAD monitoring, marking and data collection for scientific purposes
     - a) *FT-WP-01: Para. 24 of CMM 2008-01 FAD Management and Monitoring*
   - *4.4.* Technical assistance to port sampling and observer programmes
     - ***a)*** *Note FT-IP-1: Longline terminal gear identification guide*
   - *4.5.* Current status and recent developments in WCPO fishing gear, practices and capacity in relation to changes in fishing effort
   - *4.6.* The development of research projects with industry and observer and port sampling programmes
   - *4.7.* Other studies
   - *4.8.* Advice to the Scientific Committee
5. **Research planning and coordination**
   - 5.1. Operational Research Plan for 2009/10
   - 5.2. Medium Term Research Plan
6. **Other matters arising**
   - 6.1. Format, review and adoption of the FT-SWG Report
   - 6.2. Other matters
7. **Adoption of Report**
8. **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
Fifth Regular Session

Port Vila, Vanuatu
10–21 August 2009

REPORT OF THE METHODS SPECIALIST WORKING GROUP (WORKSHOP ON REFERENCE POINTS)

OPENING OF MEETING

1. The Methods Specialist Working Group (ME-SWG) met during the morning session on Tuesday, 11 August. Robert Campbell (Australia) served as convenor of the meeting with Anne Preece and David Wilson serving as rapporteurs.

2. Acting on a directive agreed by the Commission at WCPFC5 in December 2008, the ME-SWG was devoted to a special workshop on reference points. The aims of this workshop were to provide more capacity building on this issue and review some of the technical characteristics of reference points.

3. A provisional agenda was circulated for review prior to the meeting and adopted as attached in Appendix 1 to this report. The meeting comprised two major presentations, covered by working papers WP-1 and WP-2, after which a work programme was discussed and adopted to progress the identification of appropriate reference points for the WCPFC. An additional working paper (WP-3) and information paper (IP-1) were also noted by the SWG.

BACKGROUND TO MEETING

4. The convenor reviewed the progress made in recent years on identifying appropriate reference points for the key target species in the WCPFC.

5. The convenor noted 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 in the WCPO. In particular, Article 6 requests that stock-specific reference points be determined together with the action to be taken if they are exceeded. Currently, however, the Commission has not formally adopted any specific reference points but has largely used default MSY-based biological reference points in its evaluation of stock conditions.

6. To progress work on meeting the requirement under Article 6, SC2 adopted a work programme that included an investigation of alternative stock status reference points. A consultant's report was subsequently presented and discussed at SC3, which recommended that a draft work plan be developed on the potential costs, benefits and difficulties of alternative approaches for identification of appropriate reference points within the WCPO.

7. A second consultant's report (reproduced as ME-WP-3) was presented and discussed at SC4, which recommended that i) a technical intersessional workshop be held during 2009 to review the numerical and technical properties of candidate reference points which may be used in the WCPO; and ii) the Commission establish a parallel/joint process for establishing key management objectives for each target species including the possibility of holding an inter-sessional workshop on management objectives.

8. At WCPFC5, while CCMs stated their strong support for articulation of the Commission's fisheries management objectives and the development of reference points, several CCMs also expressed a desire for more capacity building and a more inclusive and collaborative approach to development of WCPFC management objectives and reference points.

9. The Commission therefore agreed that i) SC5 should convene a seminar under the ME-SWG on capacity building and technical issues associated with reference points, and ii) WCPFC6 should consider the possibility of holding a dedicated workshop on management objectives in 2010. This workshop was therefore held to fulfil the first of these agreements.

PRESENTATION 1: CAPACITY BUILING

10. Wez Norris presented Working Paper: ME-WP-01: The Application of Reference Point Management in WCPO Tuna Fisheries: An Introduction to Theory and Concepts.

11. The presenter noted that the presentation and working paper were intended as a capacity building exercise focused on terminology, basic theory and key concepts. The presenter also noted that several generalizations or simplifications were made throughout the paper for the purposes of generating a common understanding and building knowledge on the subject matter throughout the Commission. Key issues covered in the presentation included:

- Key terminology
- Types of reference points: limit, target and trigger
- Common reference points and indicators
- Maximum sustainable yield and maximum economic yield
- Expressing indicators as ratios
- Technical issues with setting reference points
- Brief introduction to harvest strategies

12. Given that the key target species in the WCPO are highly migratory stocks, a question was asked about how, and whether, MSY or other reference points could be calculated for each region of the fishery. It was acknowledged that although the different fisheries have different impacts on the population in different regions, in order that each stock in the WCPO remain above a biological safe limit it might be appropriate to set a single limit reference point for the entire stock. Nevertheless, it was noted that different fisheries could have different management objectives.

13. It was also noted that because MSY estimates will change as the composition of fishing effort in the WCPO changes because of differences in selectivity for different gear types, depletion estimates may make better limit reference points compared with MSY-based limit reference points.

14. It was also acknowledged that the expertise of the SC is in the biology of the stocks, and this therefore placed the SC in a good position to provide advice on what could be deemed biologically safe limit reference points.

15. It was noted that the process of identifying reference points needs to be inclusive and cooperative and as such would necessarily involve all the fishery stakeholders, especially when considering management objectives, target reference points and decision rules.

16. It was also noted that reference points for one species may also impact on other species, and therefore the multi-species aspects of the WCPO fisheries should be taken into consideration.

PRESENTATION 2: TECHNICAL CHARACTERISTICS

17. Shelton Harley presented Working Paper: ME-WP-02: Characteristics of Potential Reference Points for use in WCPFC Tuna Stock Assessments.

18. The presenter noted that the presentation described the analyzes undertaken to address the four specific requests made to SPC-OFP. The main conclusions on each topic were noted and discussed as follows:

18.1. The suitability of MSY-based reference points as default limit reference points and how they may be operationalized.

- This was considered more of a technical policy/legal issue than one for scientists to consider alone and further legal advice should be sought, including the potential for Article 5(b) to have a bearing on the selection of limit reference points;
- Conservation-based limit reference points have an explicit biological purpose and are developed to constrain harvesting within safe biological limits,[3] although it was noted by the SWG that currently there is no generally accepted definition of "safe biological limits". Consequently, spawning biomass will be a better fisheries indicator than total biomass for the development of limit reference points relating to biological risk.
- Based on the authors understanding of Annex II of the UNFSA, F_{MSY} and SB_{MSY} could be considered default limit reference points and their use would be consistent with precautionary principles. However a number of alternative limit reference points could be developed for the four main tuna stocks that would also meet the criteria in Annex II.
- Reference points need to be associated with decisions about what happens if they are approached or exceeded. Furthermore, these decisions should consider both the uncertainty and the risk to the fishery of exceeding the reference point. The identification and development of decision rules typically requires involvement from other stakeholders in the fishery (not just scientists).

18.2. Potential reference points for WCPFC assessments.

- A range of reference points can be developed that provide different information for decision makers and it is useful to consider this range when formulating management advice;
- Scientists should be engaged in discussions with fishery decision makers over reference points, particularly with respect to getting insights into the types of information that fishery managers find useful, and the types of actions they may consider in response of exceeding or approaching a reference point.

18.3. Consideration of alternative methods for assessing stock status against reference points.

- There is a need to incorporate uncertainty into the calculation of stock status and the provision of management advice;
- Current approaches rely heavily on a single model run (e.g. base case) and so-called parameter uncertainty (uncertainty within one model run). However, it is now clear that structural uncertainty is often larger and alternative plausible model runs can often give quite different results; and

[3] Notwithstanding this, fishery managers might still seek to have alternative limit reference points (e.g. reference points that they wish to avoid with high probability), that are above those required for biological purposes, for other reasons.

- The structural uncertainty analysis (SUA) provides a potential approach for incorporating many of the major sources of uncertainty, but is only at an early stage of its development.

18.4. An evaluation of the sensitivity of reference points to alternative model structures and stability over time with respect to the incorporation of new data.

- There are many possible changes to stock assessment models that can change stock status outcomes (e.g. the assumed value of the steepness of the spawner-recruitment relationship, trends in longline CPUE, and absolute levels of catches). Such differences are typically greater than those seen by simply adding another year of data to the same model.
- Higher levels of steepness lead to higher MSY and lower B_{MSY} (i.e. the biomass that supports the MSY is a much lower proportion of the overall biomass);
- Steepness is therefore very important, but reliable estimates of steepness are either difficult to estimate or not possible to obtain from the data we have for our stocks at the moment;
- Retrospective analyses suggest that i) some MSY related quantities are quite robust to the addition of new data (e.g. MSY and B_{MSY}), ii) recent recruitment and fishing mortality estimates are uncertain and this carries through into estimates of total biomass, iii) spawning biomass estimates are far more stable and it should be possible to construct reasonably robust reference points using more recent estimates than is advisable for recent fishing mortality or total biomass; and iv) stock projections should consider the uncertainty in the most recent estimates of recruitment.

GENERAL DISCUSSION

19. The meeting reviewed the recommendations made in the two consultancy reports noted earlier.

20. The first report recommended that the primary component of a future work programme should be the formal specification of limit and target reference points for target stocks, with agreed decision rules (i.e. formal management strategies) and the development of a simulation environment for their formal evaluation. However, it noted that this would take some time to complete and that decisions on the management of the fisheries would be required during this period. As such, it was recommended it would be prudent and consistent with the precautionary approach and the Convention to adopt provisional reference points and decision rules to guide management in the short term.

21. The second consultancy report agreed with this approach and recommended a future work programme for achieving these outcomes. This work programme consisted of the following two main components: i) The identification and adoption of provisional limit and target reference points and decision rules that would be used to guide management in the short term; and ii) The implementation of the MSE approach for the formal evaluation of the types and associated values of limit and target reference points for target stocks that would be used to guide management in the long term.

22. While the ME-SWG noted that due to their general use, and in lieu of alternatives not being identified, MSY-based reference points could be used as limit reference points for the key target species in the WCPFC, the SWG also discussed whether reference points other than those based on MSY would be more appropriate for the key target stocks in the WCPO.

23. The SWG reviewed the six classes of reference points mentioned in the second consultancy report. It noted that given the lack of direct observations of spawning biomass and recruitment, and the difficulty of identifying reference points based on socioeconomic factors, that candidate reference points would perhaps need to be limited to those based on indicators such as MSY, yield-per-recruit, spawner-per-recruit, or depletion.

24. In selecting appropriate indicators and associated reference points, it was also noted that a good indicator should satisfy the following criteria:

1) it be based on an understanding of what information managers need;
2) it be appropriate to the species under management;
3) we have the data and/or associated models to estimate it;
4) it can be estimated reliably;
5) it will ideally have a linear relationship with the aspect of the system it is a measure of (e.g. standardized CPUE should be linearly related to the size of the fish population available to the associated fishing gear); and
6) it can be easily implemented and is useful to guiding management of the fishery.

25. Furthermore, it was noted that reference points set for the individual species within a multi-species fisheries, such as the WCPFC fisheries, may need to vary from species to species and should be determined using the best available scientific advice. It was also noted that any reference points developed for each of the key species should ultimately be considered in a multi-species fisheries context.

26. The SWG also noted that to be part of responsible or precautionary management reference points can only be effective if appropriate management responses are pre-negotiated and effectively implemented. Towards this end, and to provide an example of this approach, the convenor outlined how the results of an assessment and the associated uncertainty could be incorporated into a hypothetical decision rule. The need to have an adequacy of separation between a limit and target reference point, so application of the decision rule has a high probably of keeping biomass around the target and away from the limit reference point, was also noted in this presentation.

FUTURE WORK PROGRAMME

27. The SWG discussed whether the SC at SC6 should aim to make a recommendation to the Commission on appropriate provisional (limit) reference points for the key target species in the WCPFC. The convenor noted that instead of choosing a single type of reference point and its associated value for each species, this recommendation should perhaps take the form of a table listing appropriate candidate reference points (both type and value: type $B_{current}/B_o$ and value: X%) together with advice on the suitability or otherwise of each. The SWG agreed that this would be both feasible and a suitable approach and that the following work programme should be undertaken over the next year to identify candidate reference points (both type and value) for each of the key target species in the WCPFC and to help SC-6 make a suitable recommendation to the Commission:

27.1. <u>Identifying Provisional Limit Reference Points for the key target species in the WCPFC</u>

- Identify candidate indicators (e.g. $B_{current}/B_o$, SB/SB_{MSY}) and related limit reference points (e.g. $B_{current}/B_o$,=X, SB/SB_{MSY}=Y), the specific information needs they meet, the data and information required to estimate them, the associated uncertainty of these estimates, and the relative strengths and weaknesses of using each type within a management framework.
- Using past assessments, evaluate the probabilities that related performance indictors exceed the values associated with candidate reference points.
- Evaluation of the consequences of adopting particular limit reference points based on stochastic projections using the stock assessment models.
- Undertake a literature review and meta-analyses to provide insights into levels of depletion that may serve as appropriate limit reference points and other uncertain assessment parameters (e.g. steepness).

27.2. <u>Articulation of Management Objectives</u>

- Support, and provide input to, the proposed Workshop on Management Objectives to be held in 2010.

- Assist managers to identify the information required to guide management decisions, and how these can be quantified.
- Provide guidance on identifying stock specific limit and target reference points.
- Provide advice on how uncertainty in the estimation of performance indicators can be incorporated into management decisions.

28. It was also noted and agreed that the following additional two tasks would need to be undertaken over the longer term to progress work on the development of candidate decision rules and appropriate harvest strategies;

28.1. Identifying Provisional Decision Rules

- For the key target species in the WCPFC, develop candidate harvest strategies (decision rules) based on present stock status.
- Define and/or quantify assessment uncertainty and articulate how this is to be incorporated within decision rules.

28.2. Evaluation of reference points and decision rules

- Undertake a formal evaluation (e.g. Management Strategy Evaluation and robustness of stock assessments) of reference points and decision rules to guide the long term management of the key target species in the WCPFC.
- The work programme recommended in the second consultancy report and at SC4 would provide some guidance on progressing this task.

29. The meeting noted a statement from FFA Members thanking the presenters for the information that had been conveyed to the meeting, noting that FFA Members had been asking for capacity building activities to help select and implement reference points. FFA Members also conveyed their support for some recommendations from the workshop and the SC to the Commission about the type of work that now needs to be progressed to allow candidate reference points to be identified. To this end, they requested that an evaluation of a range of potential reference points for each specific target species be undertaken along the lines suggested. At the same time they also noted that there will need to be long term efforts for further capacity building in the areas of harvest strategies and Management Strategy Evaluation so that the SC and the Commission will be in a position to operationalize selected reference points in the most appropriate way.

7. RECOMMENDATIONS TO THE SCIENTIFIC COMMITTEE

30. Based on the presentations and discussions summarised above, the ME-SWG made the following recommendations to the SC:

1) The project listed in para 27.1 above be added to the scientific work programme to be undertaken over the next 12 months, and that the results be presented to SC6.
2) The SC supports the proposed Workshop on Management Objectives to be held in 2010 and provide input to this workshop as outlined in the project listed in para 27.2 above.
3) Taking into account the results of the previous two recommendations and other available information, that SC6 undertake to make a recommendation to the Commission on appropriate provisional (limit) reference points, both types and associated values, for the key target species in the WCPFC.
4) The projects listed in paras 28.1 and 28.2 above, which need to be undertaken over the longer term to progress work on the development of candidate decision rules and appropriate harvest strategies, be included in the ongoing scientific work programme of the SC.

8. CLOSE OF MEETING

31. The convenor thanked all presenters and rapporteurs together with all participants in the ME-SWG.

9. ADOPTION OF REPORT

32. The meeting was informed that the draft report of the ME-SWG would be made available to participants on Friday, 14 August and would be cleared on the following Monday.

33. The report of the ME-SWG was adopted by the meeting on Monday, 17 August.

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
Fifth Regular Session

Port Vila, Vanuatu
10–21 August 2009

AGENDA FOR THE METHODS SPECIALIST WORKING GROUP

1. Opening of Meeting

2. Background to Meeting

3. Presentation 1: Capacity Building

Working Paper: ME-WP-01: Wez Norris: The Application of Reference Point Management in WCPO Tuna Fisheries: An Introduction to Theory and Concepts

4. Presentation 2: Technical Characteristics

Working Paper: ME-WP-02: Shelton Harley et al: Characteristics of Potential Reference Points for use in WCPFC Tuna Stock Assessments

5. General Discussion

6. Future Work Programme

7. Recommendations to the SC.

8. Close of Meeting

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

Scientific Committee
Fifth Regular Session

Port Vila, Vanuatu
10–21 August 2009

REPORT OF THE STATISTICS SPECIALIST WORKING GROUP

INTRODUCTION

1. The Statistics Specialist Working Group (ST-SWG) was held on the afternoon of 10 August 2009 (Monday), the evening of 12 August (Wednesday), and the afternoon of 14 August (Friday). Kim Duckworth was convenor. Danielle Ghosn (10 and 12 August) and Steve Shanks (14 August) were appointed rapporteurs.

2. The agenda was adopted as published except for:
   - The addition of an agenda item "High seas vessels days data"
   - The merging of proposed agenda items 5.1 and 5.2 (landing reports, transhipment reports) into a single agenda item

3. The agenda as adopted is attached as Appendix 1 of this report.

Data gaps

Agenda item 4.1 – Progress in addressing data gaps

Presentation(s)

4. Peter Williams (Secretariat of the Pacific Community – Oceanic Fisheries Programme, SPC-OFP) reported on the major developments over the past year with regard to filling data gaps. These included:
   - For the first time, the Philippines provided i) operational logsheet data (for their domestic purse-seine fleet for 2004 and 2008) to the WCPFC, and ii) annual catch estimates broken down by gear (for 2008). These provisions were acknowledged to be a significant step to resolving data gaps for the Philippines domestic fisheries.
   - Indonesia conducted a workshop in May 2009 that resulted in the development of a set of tuna fishery logbooks, which will be implemented in their fisheries in the coming year. The logbooks satisfy the requirements of the tuna RFMOs (e.g. WCPFC and IOTC). Indonesia also provided a considerable amount of historical tuna fishery data (under the IPDCP-funded Indonesia Data Collection Project). Some of the historical data will be compiled and included into the WCPFC databases in the coming year. Progress has also been made with the establishment of sampling in two key ports in East Indonesia and the size data collected should become available to the WCPFC in the coming year.
   - Japan provided operational level catch and effort data for their purse-seine fleet for the period 2001–2004 in accordance with para 15 and 16 of CMM-2008-1.

- Over the past year, SPC-OFP received formal authorizations from the Cook Islands, Fiji, Marshall Islands and Vanuatu for the release to the WCPFC of historical operational level catch and effort data.
- The timeliness in the provisions of annual catch estimates and data this year was not as good as last year, but there were some improvements in the quality of data provided.
- A web-based tool that shows the current status of provisions of historical and recent data to the WCPFC has been established on the WCPFC web site over the past year (http://www.wcpfc.int/StatProv.asp). CCMs were encouraged to refer to this web page to ensure the details of their data provisions have been registered, and to review where outstanding gaps in their data exist and need to be resolved.

Discussion

4b The data related issue that prevented the adoption of ongoing catch limits for south west and south central pacific swordfish was discussed. One CCM noted that the EC had been asked by the Executive Director to provide formal clarification with respect to these data, and that correspondence has not been received. This CCM also stated that there needs to be formal correspondence from the EC detailing and validating their swordfish catch.

5. It was noted that the quality of data have improved over the past year, although progress towards addressing some significant data gaps remains to be achieved. The timely submission of data was encouraged.

6. The definition of what constitutes a "data gap", and whether the provision of data according to this definition is a guideline or requirement was raised. It was clarified that "Scientific data to be provided to the Commission" was a specification that had been adopted by the Commission in 2007.

7. Some CCMs stated that domestic legal constraints were an obstacle to the provision of operational level catch and effort data. One CCM stated that the non-provision of operational level catch and effort data was not a "gap" if the flag state had domestic legal constraints that prevented it from supplying such data. The Executive Director reminded participants that the Busan Commission meeting had urged CCMs to work to overcome any such domestic legal constraints.

8. Two CCMs questioned the scientific need for operational level catch and effort data as specified in the Commission's data standards, and stated that some other RFMOs do not require the provision of operational level data.

9. Some CCMs stated that all WCPFC data should be held at the Commission's office in Pohnpei.

Agreed text

10. The ST-SWG requested that the WCPFC Executive Director resend his letter to CCMs (and copied to representatives of the Scientific Committee) asking them to authorize the release to the WCPFC of their operational logsheet data held by the SPC.

11. The ST-SWG recommended that the issue related to the attribution of catch under charter arrangements be referred to the TCC.

12. **The ST-SWG recommended that the issue of obtaining aggregate distant-water longline data for the Pacific Ocean (for use in stock assessments) should be covered in the data exchange protocols in the MOU with the IATTC.** The ST-SWG noted that IATTC have agreed to Attachment G

(regarding data exchange protocols), but the amendments made by IATTC to the data exchange protocol are yet to be considered by the WCPFC.

13. The ST-SWG recommended that all CCMs familiarize themselves and comply with the obligations of the Commission's data submission standards (Scientific Data to be Provided to the Commission).

14. The ST-SWG recommended that the TCC consider non-compliance with data reporting obligations as a significant part of the Compliance with Conservation and Management Measures (CCMM) Working Group process.

Agenda item 4.2 – Update on "A study to identify causes of data gaps in the work of the WCPFC"

Presentation(s)

15. SungKwon Soh reported on ST-WP-02, a report of a study endorsed by the Commission in 2007 to identify the causes of data gaps. Due to the initially low level of response from CCMs to the questionnaire, the final report was not available until WCPFC5, December 2008. The study identified several indicative reasons for data gaps, including i) misunderstanding of what data are required and how data are to be provided; ii) translation of English language requirements; iii) lack of resources within CCMs; iv) collecting data but not the specific types required by the Commission; v) domestic legal constraints; vi) other agreements (i.e. all data being collected and stored but authorization not given to release data); and vii) potential lack of recognition among key officials of the importance of data for stock assessment and other management tasks. The report made the following recommendations:

- In order to gain robust outcomes from stock assessment and ecological analysis, provision of operational level catch and effort data is essential.
- The Commission should investigate the employment/contract of a Data Capture Manager who would regularly contact and work with CCM data correspondents.
- The Commission should investigate holding workshops with data correspondents, to clarify issues associated with the capture and provision of data.
- The Commission should continue to liaise with senior representatives of CCM's and other relevant entities to coordinate data provision.

Discussion

15b Several CCMs commented that it is not essential that operational level catch and effort data be provided to the Commission, only that it be made available to the Commission; and that in some other RFMOs no operational level catch and effort data is provided to the RFMO.

16. The following statement was made in response to this review:

"FFA Members would like to thank the consultants for providing their final report for our consideration. It is a shame that despite the discussions we had at SC4, only about 50% of CCMs participated in the consultant's questionnaire.

In terms of the recommendations in the working paper, FFA Members are concerned that they focus too largely on only one of the three main causes of data gaps that were identified. The employment of a data capture manager, introduction of further data workshops and greater extension efforts by the WCPFC Secretariat all seek to increase CCM awareness about the "what, when, how and why" of data submission.

While FFA Members agree that is an important undertaking, there are other causes, such as domestic legal constraints and capacity or resourcing issues that would not be addressed. FFA Members also note that the recommendations of the consultants do not cover any remedial or punitive action against those who do not comply with the requirements that we have all agreed to.

It is an unfortunate fact of human nature that we often don't act until there is a compelling reason for us to do so and as such FFA Members suggest that non-compliance with data provision requirements should be a significant part of the compliance monitoring process that is being developed intersessionally. We believe that this should form the basis of a recommendation from SC to TCC and the Commission."

16b Several CCMs objected to the content of this statement and said that it contained material that was beyond the scope of the ST-SWG.

Agreed text

17. The ST-SWG recommended that the decisions on i) the employment of a data capture manager, and ii) the holding of a workshop for data correspondents; be deferred until after consideration of the "Independent Review of the Commission's Transitional Science Structure and Functions".

Agenda item 4.3 – Update on the species composition of purse-seine catches

Presentation(s)

18. Tim Lawson presented SC5–ST–WP3, "Selectivity bias in grab samples and other factors affecting the analysis of species composition data collected by observers on purse seiners in the Western and Central Pacific Ocean". Species composition data from paired spill-and-grab samples collected during four purse-seine trips in the waters of Papua New Guinea in 2008 were analyzed. The species compositions per trip determined from the spill samples were almost identical, which suggests that they are accurate (unbiased) and reliable (low variance). The paired samples were used to estimate the selectivity bias of the grab samples and it was determined that the grab samples tend to miss the very small and very large fish. The selectivity bias was quantified with a model of the availability of fish of various length intervals to be sampled. The estimates of the bias were used to correct grab samples collected by observers from 1995 to 2008 and the corrected observer data were then used to adjust the purse-seine catch data that are used in the MULTIFAN-CL stock assessments. The adjusted data suggest that the proportions of skipjack and yellowfin in the unadjusted data are over-estimated and under-estimated respectively.

19. SPC-OFP was contracted by the Commission to conduct Project 60, "Collection and evaluation of purse-seine species composition data". Mr Lawson reported that since the project began earlier in the year, i) observers collected paired grab and spill samples onboard a New Zealand purse seiner fishing out of Pago Pago and a Solomon Islands purse seiner out of Noro; ii) a study on selectivity bias in grab samples was completed; iii) port sampling of landing categories in Noro was established; iv) a motion-compensated scale was ordered for a study of length-weight relationships; v) MULTIFAN-CL purse-seine input data were adjusted with observer data corrected for size selectivity bias; and vi) he attended the International Working Group Meeting on Tuna Purse-Seine and Baitboat Catch Species Composition Data Derived From Observer and Port Sampled Data, 15–19 June 2009, Sète, France. It was noted that the estimates of the selectivity bias of grab samples presented in SC5–ST–WP3 are based on paired spill and grab samples from only four trips, during each of which only anchored FADs were fished, and that many more paired samples are required to better estimate the bias, particularly samples from other school associations.

20. Alain Fonteneau reported on an international working group (WG) organized by IRD in Sète, 15–19 June 2009 on "tuna purse-seine and baitboat catch species composition derived from observer and port sampler data". Scientists from the four oceans (SPC, IATTC, IOTC and ICCAT) participated in the WG meeting. The basic goals were to: i) examine the functioning of the various species sampling schemes developed worldwide for surface fisheries; ii) discuss their statistical validity and potential problems; and

iii) make recommendations to the various scientific committees of tuna RFMOs to improve the functioning of these sampling schemes and of the subsequent data processing allowing for improved estimates of tuna catch-at-size. A detailed report will be available soon as an ICCAT Standing Committee Research and Statistics (SCRS) 2009 document. The main outputs of the WG were summarized by Fonteneau as follows:

- The WG provided confirmation that most of the methods used to sample the species and size composition of purse-seine catches, their difficulties and uncertainties have been poorly described and analyzed in the literature of the various RMFOs. As a consequence, many of the changes in the species composition of historical catches by purse seine, for instance the percentage of bigeye tuna caught, may be due to an unknown degree either to real changes in fisheries or to improvements in the species sampling. A good example of this type of uncertainty is shown in the US purse seiner fleet in the WCPFC area, which is a well sampled fishery recorded to have caught 0% of bigeye tuna during 1981–1988; an average 0.3% of bigeye tuna during 1989–1995 and more than 4% during 1996–2006.
- The WG provided an improved overview of the major uncertainties faced worldwide in the estimation of species composition and especially of bigeye tuna catches. Bigeye is of key importance in this sampling; taking note of the frequent misidentification of small bigeye in purse-seine catches and of the heavy and increasing pressure suffered by these stocks in all oceans. These statistical uncertainties are potentially very important in the WCPFC area, as the real quantities of bigeye (and to a less degree of yellowfin) in the purse-seine catch remain widely uncertain. It was accepted that past observer sampling was heavily biased and port sampling results questionable.
- The WG provided an improved overview of the diversity of the sampling methods used, in the past and currently, in order to better estimate species and size composition of purse-seine tuna catches in the various oceans: on port during landing and/or at sea by observers
- The WG resulted in a better understanding of the great interest and difficulties of linking the sampling data and the multiple sources of connected data (log books, well maps, landing sheets, and cannery data) in order to better estimate the catch at size tables by strata.
- The WG resulted in a better understanding of the interest and difficulties of using these various sampling methods, and of their multiple sources of potentially cascading uncertainties and bias. For instance, including potential bias in the bin sampling when sampling large size yellowfin and bigeye tuna over 20–30kg.
- The WG made recommendations to the scientific bodies of RFMOs such that they could improve the multi-species sampling done in the various oceans, their past and present results, and also their future running and data processing.
- The WG provided a firm conclusion that all of these sampling questions should be more actively discussed and their problems better solved by the future collaboration of WGs to combine the concerned experts from the various RFMOs to address the worldwide similarities of these tuna statistical problems.

Discussion

21. The work undertaken by Project 60 was welcomed by the ST-SWG. The inclusion of data from canneries was discussed. It was noted that protocols for the handling of landing data from canneries was being investigated as part of Project 60.

21b. It was noted that some canneries have agreed to provide data under a developing protocol.

Agreed text

22. ST-SWG recommended the continuation of Project 60, including additional surveys of canneries.

Agenda item 4.4 – ISC data

Presentation(s)

23. The Executive Director introduced GN-IP-09, which summarized the recommendations of the Independent Review of Interim Arrangements for Science Structure and Function relating to the harmonization of data held by the Commission and the ISC. WCPFC5 had recommended that the Secretariat work with ISC, SPC-OFP and relevant CCMs to develop a strategy for the incorporation of ISC data into the Commission's data holdings. The Executive Director reported that the Secretariat had prepared a draft strategy, for further consideration of the ISC, which proposed a comparison of the data procedures and security protocols that apply in each organizations, and inventory of the existing data holdings of each, identification of gaps and the development of a procedure for the harmonization of data holdings.

24. Chinese-Taipei and Canada reported that the Statistics Working Group of the ISC, and the 9th plenary (ISC9) session of the ISC which met at Kaoshiung in July, discussed the recommendations of the Independent Review and the Secretariat's proposal. ISC9 agreed that it would be appropriate for ISC and WCPFC to exchange data inventories and identify data gaps as a first step.

Discussion

25. There was discussion of the different operating practices used for WCPFC stock assessments and ISC stock assessments, specifically:

- The WCPFC pools data in a central repository (located with the Commissions data contractor in Noumea) before it is analyzed; but
- ISC Members do not submit operational data to a central repository. Instead each Member uses its own operational data (for CPUE standardization and other relevant studies) and brings the results to the stock assessment meeting for discussion and incorporation into model runs.

26. ISC Members confirmed that, as a consequence of these different operating practices, the ISC does not hold any fine scale (for example, operational catch and effort) data. The ISC does hold aggregated data, but this is the same data that the WCPFC already holds; the only exception to this being that the ISC does hold some aggregated data for Mexico.

27. Most CCMs supported the arrangement of a data sharing agreement between ISC and WCPFC, and it was noted that such an agreement would provide an element of transparency. Concerns were expressed that the exchange of data between ISC and WCPFC may result in data quality issues such as double counting of the North Pacific stocks. The need to reconcile the data holdings of the ISC and WCPFC, and identify data gaps was emphasized. It was noted that the identification of WCPFC/ISC data gaps was initiated at WCPFC5 in Busan, Korea in December 2008 by drafting of a preliminary matrix of ISC and WCPFC data holdings.

28. The ST-SWG were also advised that rules for ISC data reporting and exchange were specified in the ISC operations manual.

Agreed text

29. The ST-SWG recommended:

a. The Secretariat provides an inventory of Commission data holdings for North Pacific stocks to ISC by ISC10.

b. **The Secretariat, ISC, SPC-OFP, and interested CCMs complete a reconciliation of ISC and Commission data holdings, for North Pacific stocks, to identify any data gaps by 1 October 2010.**
c. **The Secretariat and ISC collaborate to exchange data, to address data gaps for north Pacific stocks, subject to the Commission's "Rules and Procedures for the Protection of, Access to, and Dissemination of Data Provided to the Commission" and the rules and procedures governing data exchange that are contained within ISC's "Operations Manual".**
d. **The ISC and the Secretariat establish a mechanism for the periodic exchange of data to address gaps in the data for North Pacific stocks.**
e. **The Secretariat provides a report of progress on these matters to SC6.**

Agenda Item 4.5 – High Seas Vessel Day Data

Presentation(s)

30. Andrew Wright introduced GN-WP-16, which was based on presentations to last year's meetings of the SC, TCC and the Commission relating to a process to consider a vessel day scheme for the high seas to promote compatibility between EEZs, which are managed in PNA Members under their vessel day scheme (VDS), and the high seas. He noted that since SC4 the Commission had adopted CMM 2008-01 which proposes a closure of high seas pockets in the Convention Area from 1 January 2010. The fate of effort in those high seas pockets was not yet decided with some views that that effort should be removed from the fishery while others considered they could be relocated to other areas of high seas in the Convention Area. In addition to a revision of 2001–2004 high seas data based on new information provided by CCMs (Table 2 of the paper) he noted that the Commission's vessel monitoring system (VMS) had been operating effectively since 1 April 2009, and that an operational VMS was critical to the implementation of any high seas vessel day scheme for the high seas.

31. Peter Williams' reported that Table 2 of GN WP-16 shows the latest limit estimates of purse-seine effort for the high seas and zones of non-PNA Member countries that have been established by CMM 2008-01 and also provides notes in regards to the current status on the provision, compilation and evaluation of estimates of high seas purse-seine effort by each CCM. Since this table was presented in the paper WCPFC 2008/13 at the Commission's regular meeting in Busan, South Korea (December 2009), the following updates have been made:

- The Philippines has since provided comprehensive operational level catch and effort data to the WCPFC Secretariat, which was subsequently evaluated to ensure that the procedures are consistent with how high seas effort have been determined for other CCMS, that is, complete operational level catch and effort data with positional information are required to determine high seas effort. Table 1 in this paper summarizes the current status of data provision and evaluation undertaken by the WCPFC Data Services Provider.
- Japan provided operational catch/effort data for the period 2001–2004 in April 2009 in accordance with CMM 2008-01 paras 15 and 16. The high seas effort estimate for their fleet was subsequently modified according to these data (which were not previously available to the WCPFC and represent the best possible estimate available).

32. Peter Williams reported that no other information was received at the time of writing the paper, although just prior to SC5, New Zealand advised of a revision to their high seas effort in 2004, which will be included in this table in due course. The high seas effort for the Philippines will be revised once all operational data have been received, processed and evaluated.

Discussion

33. A request was made for the ST-SWG to discuss an appropriate metric for fishing vessel days. In response to this issue, the need for fishing days to be apportioned based on a metric that constrains effort and/or fishing mortality to defined levels was noted. FFA Members requested that the WCPFC Secretariat provide advice on metric measurements of a fishing day for CCMs to consider. This advice could potentially be based on vessel length, as per the PNA VDS or other metric measurements that effectively capture the fishing capacity of vessels. The difficulties in collecting information about all of the elements of fishing power were noted. It was emphasized that if data about fishing efficiency such as gear could be obtained from CCMs they would be very useful in investigating an appropriate metric for fishing vessel days. Concern was expressed regarding a likely disparity in the existing metrics of fishing vessel days between different areas of the Pacific Ocean.

34. It was noted that, as a result of the expected high seas pockets closure, a high seas VDS will only apply to the high seas Convention Area outside these pockets. Given that a high seas VDS will only apply in the areas outside the pockets closure any allocation of historical fishing effort to CCMs, at either the 2004 or average of 2001–2004, should be for days fished outside the pockets closure area. In order to reflect this position, consistent with the advice sought from the WCPFC Secretariat to confirm the information in Table 2 of the high seas VDS paper, FFA Members considered that Table 2 should only contain days fished in 2004 and the average of 2001–2004 in areas between 20°N and 20°S outside the pockets closure area.

35. It was noted that if Table 2 is not modified to remove effort in the high seas pockets, potential exists for effort in the pockets closure area to be transferred to other high seas areas once the pockets closure is implemented. It was considered that this will undermine the application of the pockets closure as a conservation measure. Support of effort control was noted but cuts in effort should be apportioned appropriately and not simply as a blunt tool used from oversimplification of the data. The ST-SWG recognized the legitimate concern of some CCMs with regard to the shift in effort, but considered that it is simply not appropriate to re-allocate effort on something as arbitrary as who fished in the high seas pockets. When reducing effort, consideration should be given to the proportion of effort that individual CCMs stand to loose if the historic days fished in the high seas pockets are simply to be dissolved, without appropriately taking into account exemptions in the measure and shifts in effort into EEZs and into archipelagic waters.

36. In regard to the application and implementation of a high seas VDS it was also noted that a high seas VDS should not undermine the in-zone VDS that has been applied by the PNA. It should be clear that the high seas VDS is separate from the in-zone VDS and the transfer of days between the two will not be permitted, consistent with the existing CMM 2008-01.

37. FFA Members expressed that consistent with the advice sought from the WCPFC Secretariat in relation to Table 2 in the high seas VDS paper, that purse-seine effort in the waters of non-PNA is largely attributed to vessels operating under the US Treaty. It was emphasized that Table 2 needs to reflect, as per the Treaty arrangements and CMM 2008-01, effort limits that cannot be applied to vessels operating under the Treaty when in national waters. FFA Members requested the WCPFC Secretariat include a reference to paras 6 and 7 of CMM 2008-01 in the notes that accompany this table.

38. It was noted that the existing definition of vessels days originated from purse-seine operations. The need for consideration of how these fisheries have changed or developed, for example, the change in the number of FADs in the water was emphasized. Support for consistency with what has been done to date was expressed by some CCMs.

Agreed text

39. The ST-SWG recommended that:

- **a. CCMs identify what they have defined as their "fishing day" unit in Table 2 of WP GN-16.**
- **b. In the interim, the WCPFC adopt as their definition of "fishing day" a day when i) a set was made, or ii) a day that included any "searching" effort.**
- **c. The Secretariat commission research in 2010 into a meaningful standard metric of "fishing day" that encapsulates effort and/or fishing mortality to defined levels.**
- **d. High seas component of Table 2 be split into columns to show i) effort in the two high seas pockets, and ii) effort in the high seas outside the two pockets.**

Data verification

Agenda Items 5.1 and 5.2 – Landing reports and transhipment reports

Presentation(s)

40. Peter Williams provided an update on data verification issues regarding landing and transhipment reports. The introduction to this agenda Item referred to background working papers ST SWG WP-04, WP-05 and WP-12, and in particular, reference to data to be collected from transhipments for scientific purposes. Distinction between what is termed "unloading" and "transhipment" was provided: "Transhipment" is understood to be a sub-set of "Unloading" options since "transhipment" occurs from vessel to vessel, while "unloading" includes "transhipment" but also covers the transfer of catch to on-shore facilities in port. In the context of the WCPFC tuna fisheries, an "unloading" may occur from a fishing vessel to one, or several, of the following receivers: i) a carrier vessel, ii) another fishing vessel (acting as a carrier vessel), iii) an unloading facility in port.

41. It was noted that, regardless of the "receiving" entity in the "unloading" process (i.e. whether unloading to a vessel or a port facility), the essential information to be collected for scientific purposes is the same and therefore the data fields to be collected should be standardized for all types of "unloadings".

42. A review of the data fields listed in the draft CMM on transhipment (ST SWG WP-05 – Annex 1) was undertaken to ensure they satisfied the requirements for science; the suggested revisions are provided in ST SWG WP-12. The major points from this review were:

a. The data fields required for scientific purposes from unloading and transhipment are the same, so the list of fields should cover all types of unloadings (not just transhipment) to ensure consistency/standardization.
b. Unloaded target and by-product catch by species in number is fundamental for the longline fishery, so should be added.
c. The unit of catch in weight should be specified.
d. We are not aware of all future scientific (and other) requirements for the unloaded catch broken down by geographic area. However, the link to the logsheet for the fishing trip will be the most efficient way to satisfy the wide range of scientific requirements for geographic location of the unloaded/transhipped catch.

Discussion

43. The need for these "unloadings" data and definitions of the various "unloadings" and "transhipment" categories was reiterated to participants. The ability to collect these data (particularly that from vessel to vessel) on a wide scale was questioned. It was considered by some to be an ambitious undertaking however support by some CCMs for the collection of these data was noted. The concerns of CCMs regarding the list of fields required for the "unloading" data was also noted. Trained observer

coverage was considered to be an important factor that would assist data collection. The need to consider alternative ways of collecting like data was suggested. This may include, for example, regional collection by CCMs of weekly catch information.

44. Republic of the Marshall Islands made the following statement:
"Chair, Marshall Islands would like to thank SPC for presenting this analysis of the various forms that are already in use or proposed for use throughout the region. As many participants will be aware, the attempted development of a CMM to manage and monitor transhipment has been largely driven by the Marshall Islands with the support of other FFA Members.
In a discussion paper that we released earlier this year, the Marshall Islands presented a number of objectives for a transhipment CMM. One of those, which is directly relevant to the work of the SC was to provide a means for the verification of catches. Statistics working paper 5 for this specialist working group represents the status of the draft CMM that was discussed at WCPFC5. The attachment to the paper provides a list of data fields that were discussed in brief as being the minimum requirements for transhipment reporting.
The data fields listed in Annex 1 of working paper 5 represent important information that needs to be completed in order for a transhipment CMM to verify catch information in a way that is meaningful for WCPFC Members.
FFA Members suggest that the SC recommend the list of the fields in Annex 1, with some other useful inclusions described by SPC, to the TCC for their consideration."

44b Several CCMs objected to the inclusion of this statement and said that it contained material that was beyond the scope of the ST-SWG.

45. CCMs discussed the scientific issues associated with providing data at the point of transhipment. fPC–OFP explained that transhipment data is a source of providing catch data by region and is particularly important where boats are fishing in areas under the jurisdiction of a number of RFMOs. Furthermore, it was explained that transhipment data was required to enable aggregate data to be broken down by time area strata and could that this data can be used to verify the catch data recorded in logsheets. A number of CCMs corroborated the need to verify catch data and that in other domestic fisheries there were a number of opportunities or points at which verification could be undertaken.

Agreed text

46. The ST-SWG recommended that, with regard to transhipments, the list of fields to be collected for scientific purposes described in Annex 1 of ST-SWG WP-05 be forwarded to the TCC for their consideration.

Regional Observer Programme

Agenda item 6.1 – Implications for science of the use of cadets

Presentation(s)

47. Dr John Hampton presented working paper ST-WP-06: Regional Observer Programme Data Administration and Management Options. ST-WP-06 discussed a number of issues that arose due to the decision of WCPFC5 to implement 100% coverage on purse-seine vessels from 1 January 2010 by the Commission's Regional Observer Programme (ROP). The main issues raised were:

a. Observer training – There is currently a shortage of fully-trained observers, and better resourcing of observer training will be required to meet the increased demands for observers in 2010 and beyond.
b. Catch sampling for estimating species and size composition – A decision is required on the desired level of coverage for catch sampling. If the level of catch sampling by observers is

significantly less than 100% of all observer trips, consideration may need to be given to the sampling design. A sampling design should ensure that representative coverage is achieved across area-time strata, purse-seine set types and vessel nationalities.

c. Previous work has shown that the standard grab-sampling methodology is likely to produce biased estimates of species composition. It is suggested that a transition to spill sampling needs to be made as soon as possible, and the cooperation of industry in effecting this transition is requested.
d. Work has progressed on conducting paired grab-spill sampling experiments, to estimate factors that can be used to remove the species and size composition bias in historical grab-sample data. Further, such experiments are required, and a sampling design for the remainder of 2009 and 2010 is suggested in the paper. Industry cooperation in this work is essential.

Discussion

48. The SC were advised that in response to the huge demand for observers and observer training FFA and SPC have ramped up programs to meet the significant demand for observers by August and September 2009. One CCM commended the Commission for meeting the observer demand within such a short timeframe alerting to the issue that when large numbers of observers are trained it is often difficult to make sure they are suitably trained to accurately obtain scientific data.

49. A number of CCMs also highlighted the capacity for port sampling to obtain some of the scientific information obtained by observers as has been the case in the EPO, the Atlantic and the Indian Oceans. SPC advised that observer catch sampling is required to establish time and set type strata, which cannot be achieved through port sampling (when this basic information is most often available in the Atlantic and Indian oceans using the well maps where the storage location of each set is well identified, Sete WG report)

50. The SC were advised that at SC2 the advice that went forward was that 20% observer coverage was required and that 20% was generally considered the figure required to obtain a sufficient sample size. It was further noted that the figure of 100% observer coverage had mainly the goal of providing compliance services for the management arrangements applied under CMM 2008-01, specifically the FAD closures.

50b. It was proposed that as CMM-2008-01 required 100% observer coverage, and that observers should be sourced from the ROP (defined in CMM-2007-01) the 100% coverage must be by scientific observers.

51. FFA Members provided a number of statements in relation to the implications for science of the use of cadets. The points raised were:

a. The training of cadets is a short-term option to meet the demand for observers required for the 2009 FAD closure period.
b. The purpose of SC5 is to provide a scientific basis to guide data collection efforts not to discuss monitoring tools.
c. CMM 2008-01 places responsibility on vessels to obtain observers, not on CCMs to provide them and that FFA Members have provided sufficient observers for fleets fishing in the area of 20°N to 20°S to meet vessel obligations for 100% observer coverage.
d. FFA Members plan to further build the capacity of the observer programme to meet the ongoing needs of CMM 2008-01 for 2010-2011, for which of the training of cadets will no longer be required. The low level of coverage in the past should have warranted temporal and spatial structure to observer placements. The FFA sees 100% observer coverage as just that and intends to provide capable observers with the skills needed. This will negate the issues of biases in placements among fleets.

e. Information paper SC2-ST-SWG-IP-02 was a useful guide on observer coverage required for non-target species. But coverage levels required for species composition samples for target species has not yet been addressed. The FFA would like to use this discussion to gain an indication of coverage levels needed to further enhance the CPUE estimates for critical bigeye stock assessment. FFA Members assured other CCMS that they would provide the skilled observers needed for that purpose.

51b Several CCMs objected to the inclusion of this statement.

52. SPC advised that the purpose of the presentation was to seek advice on the table contained in the paper breaking down the trips designated to individual CCMs for spill and grab sampling. SPC was seeking advice from CCMs on their commitment to place observers on vessels to undertake spill and grab sampling. CCMs were encouraged to contact SPC and advise of their ability to commit to the trip numbers specified in the table.

53. Two CCMs made the suggestion that where possible (e.g. on USA, Spanish and Japanese purse seiners) the planned spill sampling operational tests should preferably be conducted in association with multi-species port sampling and cannery data analysis carried out on the same trips. This would allow better comparison of the validity of the two types of sampling data (observer data, and port sampling data).

54. To finish the agenda item the Chair called on FFA to provide a breakdown of the status of observer coverage for next year. The SC were advised that from 1 January 2010, 217 purse-seine vessels would need to be covered and this would require 460 observers, at present 400 observers have been trained through national programs.

Agreed text

55. The ST-SWG noted its appreciation of the efforts of observer programmes (and the FFA/SPC) in training observers for the ROP in 2009.

56. The ST-SWG recommended that flag states be encouraged to make their vessels available for grab / spill sampling experiments preferably in conjunction with port sampling and cannery data analysis

Agenda item 6.2 – Data management options

Presentation(s)

57. Mr Karl Staisch presented working paper ST-WP-09: Regional Observer Programme Data Administration and Management Options.

58. At ROP-IWG3 held in Guam in June 2009, ROP data management centre costs and hosting possibilities were discussed (refer to paras 23–29 ROP-IWG3 Summary Report). To direct discussion on this matter ROP–IWG3 directed that this paper be sent to TCC5 for consideration and to SC5 for their information.

59. CMM 2008-01 requires 100% observer coverage of the purse-seine fishery between 20°N and 20°S for the period August/September 2009 and then continuously from January 2010, while CMM 2007-01 sets a target of 5% coverage of the long line fishery within the WCPFC Convention Area by June 2012. SPC-OFP calculated the number of trips associated with the coverage targets to be approximately 3,036 observer trips (2,174 for the purse-seine fishery and 862 for the longline fishery)

60. ROP-IWG3 recommended a comparison of costs associated with the following three data hosting options. The calculations take into account staff costs and equipment required to service the estimated amount of trips.

a. Current arrangements with SPC at Noumea, New Caledonia;
b. Data entry and hosting at SPC's offices at Suva, Fiji;
c. Data entry and hosting at the Commission Secretariat office, at Pohnpei, Federated States of Micronesia.

61. Data Management Centre cost items

- Staff costs were calculated for Noumea, New Caledonia; Suva, Fiji; and Pohnpei, Federated States of Micronesia by using the equivalent Committee of Regional Organizations in the Pacific (CROP) agency salary scales for the positions as paid in SPC Noumea.
- Costs for other items were determined as if these costs would be similar for each option. Where possible the costs were calculated using known current costs for similar items.

62. The comparison of data management centre hosting options demonstrates that personnel costs have the most impact on total costs. Equipment and other costs may vary between options but for this exercise it has been assumed that they will be the same for each option. Equipment costs for 16 data entry persons are included in all options, including for Noumea.

63. ROP-IWG3 directed the Secretariat to cost the three options, however it was noted that there are other potential hybrid options, which have not been incorporated in the paper. These hybrid options include:

- real time electronic data collection by observers;
- the use of private enterprises punching data;
- data punched by providers of the observers; or
- a combination of different options are just a few of the many different possible options.

64. A separate issue raised that could also be undertaken by CCMs is data inputting prior to submitting to the data collector. The capacity to do this would be dependent on the internal structures of individual CCMs.

Discussion

65. The Chair advised the SC that this paper will be considered by TCC5 and has only been provided to the SC for information.

66. The comments made on the paper were primarily in relation to the cost variation between locations. A number of CCMs noted that the cost of housing the Data Management Centre in New Caledonia were higher than for other locations. The ST-SWG was advised that these increased costs were mostly as a result of the increase cost of employing data entry staff.

67. Advice was sought from SPC on this matter, with SPC advising that those entering data were required to meet a minimum standard of expertise, which required understanding of the data to ensure they were inputted correctly in addition to completing the observer course. Furthermore, SPC advised that the costings do not take into consideration experience and capability to deliver services effectively. The point was also made that through data entry by CCMs, the costs of the Data Management Centre location could be considerably decreased.

68. The presenter highlighted that the information made available under the three options only captured the very basic costs of housing the Data Management Centre in the three locations and did not capture detailed costs or the various scenarios that could potentially impact on costs in the future.

68b. Some CCMs noted the value of having the data co-located with the scientists utilizing the data

Agenda item 6.3 – Data fields contained in the FAD form

Presentation(s)

69. Karl Staisch presented working paper ST-WP-11: Fish Aggregation Device (FAD) Information Recorded.

70. ROP-IWG3 developed an Interim FAD Form for use during the FAD Closure period in Aug/Sept 2009. This form (Interim Form PS-4) contained the minimum data standards considered by ROP-IWG3 required for collecting information on FADS for both science and monitoring purposes. Because of the urgency to have a format for observers to use during the closure in 2009 the form was developed for use during this period and was based on the current FAD information form used by SPC and FFA and also contained much of the information contained in IATTC FAD forms. The form developed by ROP-IWG3 is only an Interim Form for the 2009 period.

71. It should be noted that the fields on the form were considered by ROP-IWG3 to be the minimum standards required for collecting FAD information, and individual countries or programmes may collect this information in whatever format they decide to use.

72. The proposed minimum data standard fields on the form include fields relevant for information required by science, and are presented for comment, additions, deletions by SWG before being presented to SC5 for approval and forwarded to TCC for further consideration.

73. In conclusion the presenter noted that FAD field list had been discussed extensively at IWG-ROP and suggestions in relation to additional FAD fields would be put to TCC for further consideration.

Discussion

74. The convenor advised that the list of fields would go through the TCC before potentially being adopted at WCPFC6. It was further explained that the ST-SWG was being asked to provide comments on fields for the purpose of obtaining scientific information.

75. Participants noted that IWG-ROP3 agreed to the set fields offered in the FAD form was an interim solution to be used for the current August and September FAD closure. It was further commented that the list of fields was a starting point that could be built on.

Agreed text

76. The ST-SWG supported the list of fields contained in Appendix 2 as an interim list for use in 2009.

77. The ST-SWG recommended that the following fields be added to the interim list of FAD fields if this is practical:

- **a. FAD depth**
- **b. alterations to FADs**
- **c. times FADs were relocated**
- **d. depth of net hanging off object**
- **e. identification number of the FAD**

78. The ST-SWG recommended that the use of sonar upon approaching a FAD be added to the list of vessel activity codes if this is practical.

Agenda item 6.4 – Definition of a FAD set

Presentation(s)

79. Karl Staisch presented: WCPFC/ROP – IWG3/2009-IP2 Defining a FAD set.

80. ROP-IWG agreed that in relation to CMM 2008-01 that ROP observers on board purse seiners will carry out their usual functions with the additional roles of monitoring FAD closure and catch retention. Since the focus will be on FAD closure, the Secretariat was requested to provide the ROP-IWG with a definition of "FAD set", based on the definitions used by other RFMOs and the Parties to the Nauru Agreement (PNA).

81. The WCPFC Secretariat explained that WCPFC/ROP-IWG3/2009-IP02 (Rev.1) includes a definition of "FAD set" taken from an earlier IATTC definition and the PNA 3rd Implementing Agreement draft regulations. ROP-IWG discussed various options for a definition of "FAD set", taking into account issues such as the distance of a fishing vessel from a FAD and the need for consistency with terminology used in CMM 2008-01.

82. ROP-IWG agreed that a "FAD set" for the period August–September 2009 be defined as "a set on a FAD is a set with a purse-seine net made by a fishing vessel that is a distance of one nautical mile or less from a FAD at the moment in which the skiff is released into the water for the purposes of that set."

83. This definition was adopted for the 2009 closure period only, and is presented for review, change or acceptance and definition by the SC and TCC before being presented at WCPFC6.

84. To add to this discussion from a scientific perspective Dr Shelton Harley presented working paper ST-WP-07 entitled "Analysis of purse-seine set times for different school associations: A further tool to assist in compliance with FAD closures?"

85. One of the key components to CMM2008-01 adopted at WCPFC-5 in Busan in December 2008, was a prohibition on setting on FADs for a period in 2009, 2010 and 2011. The application of FAD restrictions in other RFMO's has suffered from problems of compliance and monitoring. SPC-OFP examined operational level purse-seine catch and effort data for almost 50,000 sets, in particular records of the start of set time, to see if there are any major differences in other characteristics between sets on various floating objects. The study found that 94% of sets on FADs occurred prior to "official" sunrise, while only 3% of unassociated school sets occurred before sunrise, with the remainder occurring at consistent rates during daylight hours.

86. If further work of this type is thought to be useful, then three streams of future work should include: i) expansion of the data set available for analysis by standardizing set time records; ii) conducting similar analyses with observer data; and iii) developing statistical techniques to distinguish set types based on the species composition of the catch.

Discussion

87. CCMs were interested in this research and noted that it may be useful for enforcing, or estimating compliance with, the WCPFC FAD restrictions contained within CMM2008-01 and the Third Implementing Agreement of the Parties to the Nauru Agreement.

Agreed text

88. ST-SWG recommended that ST-WP-O7 (Analysis of purse-seine set times for different school associations: A further tool to assist in compliance with FAD closures?) be forwarded to TCC for their consideration.

89. ST-SWG recommended the continuation of the work described in ST-WP-07.

ADVICE TO Ad Hoc Task Group on Data

Agenda item 7.1 – VMS data for scientific purposes

Presentation(s)

90. The Executive Director introduced ST-WP-10 concerning the use of VMS data for scientific purposes. He noted that SC4 in 2008 had a preliminary discussion on this and had tentatively identified the purposes of VMS data for scientific purposes and associated VMS information required to support that work. He noted that SC4 had proposed applying the same time frame as applies in ICCAT to the availability of VMS for scientific purposes (i.e. data no more recent than three years old). He noted that in 2008, ICCAT had revised the resolution relating to this matter, which relates to the Atlantic and Mediterranean, and that available data could be released on request to Contracting Parties and Cooperating Non-Parties (CPCs) with an active inspection presence in the region or to the SCRS, on request

Discussion

90b Clarification was sought with regard to the purpose of the ICCAT 2008 revised recommendation. The response was that the revised recommendation applied specifically to East Atlantic and Mediterranean bluefin tuna.

91. One CCM noted the potential for real time data reporting through VMS, and that VMS data can be used for determining exactly where catch is taken.

92. Some CCMs stated that they were comfortable with their VMS data being accessed for scientific purposes.

Agreed text

93. The ST-SWG recommended that CCMs provide any additional comments on the purposes, data requirements and timeframe to the Chair of the AHTG on Data, and copied to the Secretariat, by 1 September 2009.

Agenda item 7.2 – Definition of public domain catch and effort data

Presentation(s)

94. Tim Lawson presented SC5–ST–WP8, "Status of public domain catch and effort data held by the Western and Central Pacific Fisheries Commission". The definition of catch and effort data in the public domain that is in the current version of the Rules and Procedures for the Protection, Access to and Dissemination of Data Compiled by the Commission is "catch and effort data aggregated by gear type, flag, year and month and, for longline, 5° latitude and 5° longitude, and, for surface gear types, 1° latitude and 1° longitude – and made up of observations from a minimum of three vessels". Conceptual and practical problems with the three-vessel rule are i) the relevance of number of vessels to raised aggregated

catch and effort data, given that aggregated data are almost always raised from operational data; ii) the lack of data held by the Commission on the number of vessels covered by the operational used to derive the aggregated data; and iii) potential bias in CPUE determined from filtered aggregated catch and effort data.

95. The effect of filtering for the three-vessel rule on catch and effort data aggregated by gear type, flag, year and month and 5° x 5° area was examined by assuming a maximum level of fishing effort of two vessels in a stratum. Filtering of the data resulted in a) the elimination of certain flags from the data; b) a considerable drop in the number of time–area strata covered; and c) serious biases in the estimates of CPUE. For most fleets (flag and gear type), the three-vessel rule was thus considered to be incompatible with a definition of public domain data as catch and effort data aggregated by gear type, flag, year and month and 5° x 5° area.

96. Four approaches to deal with this incompatibility were proposed. The first approach would be to recommend that "the WCPFC Secretariat write to CCMs encouraging them to use para 34 of the Rules and Procedures to voluntarily authorize the Commission to waive the three vessel restrictions for catch and effort data that they have provided". However, this recommendation was made at SC4, adopted by the Commission at WCPFC5, and carried out by the Secretariat on 6 February 2009 in Circular 2009/02, but the Secretariat has not received any responses from CCMs regarding the waiving of the three-vessel rule. For this approach to be successful, if repeated, most CCMs would have to provide positive responses and, even if successful, this may take a considerable amount of time.

97. The second approach would be an alternative formulation of the three-vessel rule in the Rules and Procedures and Provision of Scientific Data to the Commission. The Rules and Procedures would be changed by striking out the text "Catch and effort data in the public domain shall be made up of observations from a minimum of three vessels" in para 9 and "and made up of a minimum of observations from a minimum of three vessels" in Appendix 1, item 4. The following text would be added to Scientific Data to be Provided to the Commission in section 4 (Catch and effort data aggregated by time period and geographic area) after the fourth paragraph in that section: "In addition to the aggregated catch and effort data described above, a separate set of aggregated catch and effort data that has been filtered on the basis of a minimum number of vessels per stratum of time-area may also be provided for release into the public domain." This approach would have the advantages that a) the Commission previously adopted the proposed changes to the Rules and Procedures at WCPFC3; b) a CCM would have the option of filtering aggregated catch and effort data for the public domain on the basis of any number of vessels, and not just on three vessels; and c) a CCM that did not require filtering of its public domain catch and effort data would not have to take any additional action. If this approach is taken, the aggregated catch and effort data would be released into the public domain following the next 30 April deadline for the provision of data subsequent to the adoption of the revised texts by the Commission, which would give CCMs the opportunity to provide filtered data.

98. The third approach would be to revert to the definition of public domain catch and effort data prior to the establishment of the Commission, such that catch and effort data aggregated by gear type, year and month and 5° x 5° area, but not flag, are in the public domain, while the fourth approach would be to define all aggregated catch and effort data as non-public domain.

Discussion

99. One CCM noted that following this rule, all the catches of its small purse-seine fleet (four vessels catching 40,000 t annually) would more or less completely disappear from the public domain database. This CCM stated that it is essential for all tuna RFMOs to be fully transparent in the availability by gear and country of these basic catch/effort and size caught data. Unfortunately, the three-vessel confidentiality restriction means that this is not the case in the WCPFC area. It also noted that the

legitimate and permanent need for scientists, the public and concerned NGOs to have access to these basic fishery data has been now widely reinforced by the increasing scientific need to do comparative scientific analyses of world tuna stocks and pelagic ecosystems. The ambitious CLIOTOP/GLOBEC programme, and its planned worldwide catch and effort database of tuna fisheries requires access to such data. The data are essential to run the very promising SEAPODYM model at a world wide scale. It also stated that losing the information on fishing flags was not satisfactory, as the subsequent mixture of heterogeneous catch and effort does not allow for comprehensive analyses of these fisheries data to be conducted. The CCM concluded that there was an urgent need to ensure the full availability of WCPFC public domain data, and that such data are fully available in most other tuna RFMOs.

100. Some CCMs indicated that the second approach was preferable; however, there is a risk that if too many CCMs provide filtered data for the public domain, then the public domain data may not be useful. It was therefore suggested that if this happens, then the third approach would be preferable.

101. One CCM noted that, as phrased in SC5-ST-WP-08, the second approach would leave no obligation upon the Secretariat or its service providers to only publish the additional datasets that CCMs provide for release into the public domain. In this regard, the presenter suggested that text be added to the proposed text for Scientific Data to be Provided to the Commission (see para 98) to the effect that if filtered catch and effort data are provided to the Commission for release into the public domain, then no other catch and effort data shall be released into the public domain

102. Another CCM noted that:

- The report on data confidentiality (WCPFC / Prepcon / WP10) produced for the WCPFC's Manila Preparatory Conference included the comment "Many organizations apply rules that preclude the supply of aggregated data if that aggregation contains fewer than three vessels. This is because if one knows which vessels have participated in a fishery, and there are only one or two of them, it is fairly easy to determine where a competitor has been fishing."
- The three-vessel restriction does not apply to "Staff of the Secretariat, the WCPFC Science Services Providers, and Officers of the Commission and its Subsidiary Bodies", and likewise it did not apply to CCMs accessing data for the purposes of the Convention. As such the three-vessel restriction does not introduce any bias into analyses being performed for the WCPFC.
- The Commissions priority should be data provision, and that the removal of the three-vessel restriction may serve to discourage some CCMs from the voluntary provision of data.

103. The presenter stated that this last bullet point would be a compliance issue that is separate from the definition of public domain aggregated catch and effort data. He noted that after the proposed deletion in para 9 of the Rules and Procedures, the remaining sentence would still protect "the individual activities of any vessel, company or person".

Agreed text

104. ST-SWG recommended that the AHTG on Data investigate changes to the Rules and Procedures to protect confidentiality requirements of individual CCMs, while allowing those CCMs that wish their aggregate data to be made available without restriction to do so.

Other matters

Agenda item 8.1 – Work programme

105. The ST-SWG reiterated its earlier recommendation for the continuation of Project 60 (Collection and evaluation of purse-seine species composition data).

Agenda item 8.2 – ST-SWG convenor

106. The ST-SWG confirmed Kim Duckworth as the convenor for 2010 and 2011

ADOPTION OF REPORT

107. The ST-SWG adopted this report by consensus.

Attachment K, Appendix 1

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

Scientific Committee
Fifth Regular Session

Port Vila, Vanuatu
10–21 August 2009

AGENDA FOR THE STATISTICS SPECIALIST WORKING GROUP

1. **Opening of the meeting**
2. **Selection of rapporteurs**
3. **Adoption of agenda**
4. **Data gaps**
   - 4.1. Data gaps and progress towards addressing gaps
   - 4.2. Review of "A study to identify causes of data gaps in the work of the WCPFC"
   - 4.3. Species composition of purse-seine catches
   - 4.4. ISC data
   - 4.5. High seas vessel day scheme
5. **Data verification**
   - 5.1. Landing reports
   - 5.2. Transhipment reports
6. **Regional Observer Programme (ROP)**
   - 6.1. Implications for science of the use of cadets
   - 6.2. Data management options
   - 6.3. Data fields contained in the FAD Form
   - 6.4. Definition of a FAD set
7. **Advice to Ad Hoc Task Group [Data]**
   - 7.1. VMS data for scientific purposes
   - 7.2. Definition of public domain catch and effort data
8. **Other matters**
9. **Adoption of report**
10. **Close of meeting**

Attachment K, Appendix 2

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

Scientific Committee
Fifth Regular Session

Port Vila, Vanuatu
10–21 August 2009

FAD data fields suggested by ROP-IWG3

1	**NAME OF OBSERVER**	
2	**VESSEL NAME**	
3	**VESSEL IRCS**	
4	**OBSERVER TRIP NUMBER**	
5	**PAGE NUMBER**	
6	**DATE FAD SIGHTED**	
7	**TIME FAD SIGHTED**	
8	**LATITUDE OF FAD**	Record position of FAD using Latitude
9	**LONGITUDE OF FAD**	Record position of FAD using Longitude
10	**HOW FAD IS DETECTED** **How FAD is detected** 1 Seen from vessel by crew 2 Helicopter report 3 Found using vessel radio buoy 4 Bird radar 5 Sonar / depth sounder 6 Information from other vessel 7 Anchored (GPS) 8 Marked with GPS buoy 9 Navigation radar 10 Lights 11 Flock of birds sighted from vessel 12 Discovered in pursed net 13 Being deployed (so not detected) 14 Other (please specify in comments) 20 Unknown	Record the primary method used to locate the FAD
11	**FAD ANCHORED OR DRIFTING**	Indicate whether the floating object is an object or not.
12	**MATERIALS FAD IS MADE FROM** FAD Main Materials 1 Logs / trees / branches 2 Timber / planks / pallets / spools 3 PVC or plastic tubing 4 Plastic drums 5 Plastic sheeting 6 Metal drums (i.e. 44 gal) 7 Philippines design drum FAD 8 Bamboo / cane 9 Floats / corks 10 Floating animal (dead) 11 Floating animal (alive)	Record main components that make up the floating object.

	(circle "Y" for **Y**es or "N" for **N**o to show if FAD is anchored or not) 20 Unknown (describe in comments)	
13	**ELECTRONICS ASSOCIATED WITH FAD** Electronics associated with FAD 1 Radio buoy (with identification) 2 Radio buoy – unidentified 3 GPS buoy (with identification) 4 GPS buoy – unidentified 5 Sounder buoy (with identification) 6 Sounder buoy – unidentified 7 Light buoy 8 Other (describe) (record all available identification characters) 20 Unknown (describe in comments)	Record whether any electronics were the floating object
14	**ORIGIN OF FAD** Origin of FAD 1 Your Vessel 2 Other vessels - with permission 3 Other vessels - without permission 4 Drifting and found by your vessel 5 Deployed by FAD auxiliary vessel 6 Other (describe in comments) 20 Unknown (describe in comments	Observer is to try to find out the origin of the object - how did it get to be in the water ?
15	**FAD ACTIVITY** FAD Activity 1 Setting on FAD 2 Deploying FAD 3 Servicing FAD 4 Retrieving FAD 5. Vessel drifting beside FAD – attracting fish away from FAD before carrying out a set. 6. Vessel setting close to FAD – specify estimated distance in comments	Observers best describes the activity that the boat is involved in with the FAD
16	**ESTIMATED SIZE OF FAD** Simple diagram to be drawn by observer indicating dimensions.	Record the width, breadth, depth of the main body of the object as found or deployed.
17	**COMMENTS**	Observer to record in writing any FAD information not covered by the fields.

Attachment L

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

Scientific Committee
Fifth Regular Session

Vila, Vanuatu
10–21 August 2009

REPORT OF THE STOCK ASSESSMENT SPECIALIST WORKING GROUP

INTRODUCTION

1. The meeting of the Stock Assessment Specialist Working Group (SA-SWG) took place during on 11 and 12 August 2009. Keith Bigelow (USA) served as convener of the meeting, with Don Bromhead, Shui-Kai Chang, Nick Davies, Pierre Kleiber, Adam Langley, Peter Miyake, Wez Norris, Samasoni Sauni and Kurt Schaefer serving as rapporteurs.

2. A provisional agenda was circulated for review prior to the meeting, and adopted as attached as Appendix I to this report. Eight working papers were presented to the SA-SWG, including stock assessments for WCPO yellowfin and bigeye tuna and South Pacific albacore. The three assessments were conducted with MULTIFAN-CL (MFCL).Seven information papers were provided in support of the assessments. A complete listing of documents presented to the SA-SWG is included in Attachment 1 of the main report.

3. The SA-SWG discussed the prioritization of species assessments (to occur on Monday, 17 August) and identified short- to medium-term research items to advance stock assessments.

4. On the basis of the presentation of the stock assessment working papers and the discussions of the SA-SWG, stock status descriptions were formulated for three species: WCPO yellowfin and bigeye tuna, and South Pacific albacore. Summaries of each working paper, including relevant status descriptions and SA-SWG discussions, and proposed short- to medium-term research items follow.

4. STOCK ASSESSMENTS

4.1 Yellowfin Tuna Stock Assessment

a) Summary of SC5-SA-WP-1

5. Simon Hoyle presented the paper SA-SWG-WP1: “CPUE standardization for bigeye and yellowfin tuna in the western and central Pacific Ocean”. Indices of catch per unit of effort (CPUE) were presented for bigeye and yellowfin tuna in the WCPO from 1952 to 2007, based on analyses of Japanese distant-water longline data. Several improvements were made to the methods for estimating indices of abundance for the bigeye and yellowfin stock assessments. These changes affected CPUE trends, which for yellowfin declined slightly less than based on the 2007 method, and for bigeye declined significantly less than based on the 2008 method.

6. In addition, exploratory analyses suggested that work is needed in several areas to improve the indices. First, targeting is a particularly important area, and one that cannot be dealt with effectively when using aggregated data. Cluster analysis can be used to separate datasets into appropriate subsets, but the minimum requirement is data at the trip level. Second, the indices appeared to be affected by the aggregation process. The significance of this is not yet clear, so further analyses of both the operational and the aggregated data will be necessary. Third, preliminary results suggest that fishing power has increased in region 3, particularly for yellowfin tuna. Since this analysis only considered changes in fishing power due to changes in vessels, and ignored factors such as the equipment used on vessels, it is likely to be a minimum rate of increase. Further analyses of these data will also be necessary, given potential confounding between vessel effects and other factors, such as changing fishing grounds and HBF through time. Finally, work is required on several issues not explored in these analyses, such as causes of the large medium-term changes in the region 3 CPUE of both species; the evidence that (within regions) areas of high CPUE have been depleted more than areas of low CPUE; and reasons why nominal indices decline at the same rate or more steeply than standardized indices in regions 3 and 4.

Discussion

7. It was noted that fishing power did not increase in all cases examined resulting from changes in targeting by some vessels or simply reflect happenstance with small number of data in some instances. It was also noted that changing socioeconomic conditions which can cause changes in the composition of crew and many other fishery characteristics which in turn can affect catchability. There was some concern about the effect of the declining area extent of the Japanese fishery, particularly in region 3. Despite these and other concerns, it was noted that longline catchability in terms of fishing vessels has been trending upwards in the long term. It was also accepted that when including other species as indicative of targeting, it is wise to do so in a way that reflects abundance of the indicator species rather than just its catch.

b) Summary of SC5-SA-WP-2

8. Shui-Kai Chang presented working paper SA-SWG-WP1: "Yellowfin CPUE standardization for Taiwanese distant-water longline fishery in the WCPO – with emphasis on target change". This working paper provides eight cases of CPUE standardization runs on WCPO yellowfin tuna for Taiwanese distant-water longline fishery. The runs covered exploratory examinations on four subjects: effect of different treatments of target factor (separating data by fleet types or designing target indicators into the model), region factor (treating region as a factor in the model or conducting separate model runs by regions) and grid (longitude x latitude) factors (including grid factor in the model or not), and the effect of different model assumptions (lognormal or delta lognormal).

9. The analyses concluded that the most important factor in the model was targeting, especially for a fishery with complex target species like Taiwanese fishery. Four different target indicators were designed and tested, however separating the raw data by different targeting fleets (according to ad hoc criteria from observer data) provided better model performance than using a target indicator approach and is thus recommended. The authors also recommended using the standardization result (Case-8) that has considered 5-degree grid effect into the model, separate GLM runs by regions and fleet types and a delta lognormal assumption, for stock assessment purposes.

Discussion

10. It was suggested that it might be better include the catch in weight of an indicator species rather than in numbers as it is the weight that is important to the fisherman. It was further suggested that the monetary value of the indicator species might be even better. It was suggested that in the future it may be useful to adjust the placement of region boundaries to make the regions more consistent with the areas of operation of the various fleet types.

c. Summary of SC5-SA-WP-3

11. Adam Langley presented working paper SC5-SA-WP-3: "Stock assessment of yellowfin tuna in the WCPO". The Executive Summary is as follows with several figures regarding stock status:

12. 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.

13. Since 2000, the total yellowfin tuna catch in the WCPO has varied between 370,000 mt and 440,000 mt. Purse seiners harvest the majority of the yellowfin tuna catch (53% by weight in 2007), with the longline and pole-and-line fisheries comprising 16% and 4% of the total catch, respectively (source: WCPFC 2007 Yearbook). 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).

14. Longline catches in recent years (70,000–80,000 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 25–30% of total WCPO yellowfin tuna catches.

15. The assessment uses the stock assessment model and computer software known as MULTIFAN-CL. The yellowfin tuna model is age (28 age-classes) and spatially structured (6 regions) and the catch, effort, size composition and tagging data used in the model are classified by 24 fisheries and quarterly time periods from 1952 through 2008.

16. The spatial and fishery structure is equivalent to that used in the 2007 assessment and the data sets have been updated to include the catch, effort, and size composition data from the last two years. However, there have been a number of significant changes to the model inputs, in particular the adoption of an alternative catch history for the purse-seine fleet that includes a substantially higher level of catch for the associated sets in the purse-seine fishery. There have also been refinements to the catch histories from the Philippines fisheries, the longline CPUE indices, and biological parameters (*M*-at-age and spawning fraction). The current assessment also investigated a range of structural assumptions related to the relative weighting of the longline CPUE indices and longline size frequency data, the consideration of an increase in the catchability of the longline fisheries ("effort creep"), and assumptions regarding the parameterization of the spawner-recruit relationship (SRR).

17. For comparative purposes, the current assessment model was also configured to be equivalent to the 2007 assessment (including purse-seine catches calculated using the previous approach). The model yielded results that were very similar to the results of the 2007 base-case assessment model. In general, the results from the range of current model options were considerably more optimistic than the 2007 base-case model with respect to the key *MSY* based indicators of stock status. This was principally due to the assumptions regarding the steepness of the SRR, although some of the other changes in model inputs and assumptions were also influential.

18. The main conclusions of the current assessment are as follows. For all analyses, there are strong temporal trends in the estimated recruitment series (Fig. YFT1). Initial recruitment was relatively high but

declined during the 1950s and 1960s. Recruitment remained relatively constant during the 1970s and 1980s and then declined steadily from the early 1990s. Recent recruitment is estimated to be considerably lower than the long-term average.

19. Trends in biomass are generally consistent with the underlying trends in recruitment. Biomass is estimated to have declined throughout the model period (Fig. YFT2). Model options that incorporate an increase in longline efficiency (catchability) were characterised by a higher initial biomass level and a stronger overall decline.

20. The biomass trends in the model are principally driven by the time-series of catch and GLM standardized effort from the principal longline fisheries. The current assessment incorporated a revised set of longline CPUE indices and, for some model options, the indices were modified to account for an estimated increase in longline catchability. For some of the main longline fisheries (in particularly LL ALL 3), there is an apparent inconsistency between the trends in the size-frequency data and the trends in longline catch and effort (i.e., the two types of data are providing somewhat different information about the relative level of fishing mortality in the region). The current assessment includes a range of model sensitivities to examine the relative influence of these two data sources. Nonetheless, further research is required to explore the relationship between longline CPUE and yellowfin abundance and the methodology applied to standardize the longline CPUE data.

21. Fishing mortality for adult and juvenile yellowfin tuna is estimated to have increased continuously since the beginning of industrial tuna fishing (Fig. YFT3). A significant component of the increase in juvenile fishing mortality is attributable to the Philippines and Indonesian surface fisheries, which have the weakest catch, effort and size data. There has been recent progress made in the acquisition of a large amount of historical length-frequency data from the Philippines and these data were incorporated in the assessment. However, there is an ongoing need to improve estimates of recent and historical catch from these fisheries and maintain the current fishery monitoring programme within the Philippines. While the various analyses have shown that the current stock status is relatively insensitive to the assumed level of catch from the Indonesian fishery, yield estimates from the fishery vary in accordance with the level of assumed Indonesian catch. Therefore, improved estimates of historical and current catch from these fisheries are important in the determination of the underlying productivity of the stock.

22. The ratios $B_t / B_{t,F=0}$ provide a time-series index of population depletion by the fisheries (Fig. YFT4). Depletion has increased steadily over time, reaching a level of about 60% of unexploited biomass (a fishery impact of 40%) in 2004–2007. This represents a moderate level of stock-wide depletion although it is considerably higher than the equivalent equilibrium-based reference point ($\tilde{B}_{MSY} / \tilde{B}_0$ of approximately 0.35–0.40). However, depletion is considerably higher in the equatorial region 3 where recent depletion levels are approximately 0.35 and 0.30 for total and adult biomass, respectively (65% and 70% reductions from the unexploited level). Impacts are moderate in region 4 (30%), low (about 15–20%) in regions 1, 2, and 5 and minimal (5%) in region 6. If stock-wide over-fishing criteria were applied at the level of our model regions, we would conclude that region 3 is fully exploited and the remaining regions are under-exploited.

23. The attribution of depletion to various fisheries or groups of fisheries indicates that the Philippines/Indonesian domestic fisheries and associated purse-seine fishery have the highest impact, particularly in region 3, while the unassociated purse-seine fishery has a moderate impact. These fisheries are also contributing significantly to the fishery impact in all other regions. Historically, the coastal Japanese pole-and-line and purse-seine fisheries have had a significant impact on biomass levels in their home region (1). In all regions, the longline fishery has a relatively small impact, less than 5%.

24. The current assessment includes a number of changes to the model assumptions, particularly related to the biological parameters (natural mortality and reproductive capacity), the relative influence of the longline CPUE and size frequency data, and changes to the input data (most notably the purse-seine catch). However, the most influential change from the previous assessment relates to the assumptions regarding the steepness of the spawner-recruit relationship. Previous assessments have determined low values of steepness in the model estimation procedure, while the current assessment has assumed a range of fixed values for steepness (0.55–0.95). Assuming a moderate value of steepness (0.75) has resulted in a considerably more optimistic assessment of the stock status (compared to 2007 base case) due to the actual value of steepness and, to a lesser degree, the interaction between steepness and the other changes in model assumptions (especially the revised biological parameters, lower penalty on the longline effort deviations, and increasing longline catchability).

25. For a moderate value of steepness (0.75), $F_{current}/\tilde{F}_{MSY}$ is estimated to be 0.54–0.68 indicating that under equilibrium conditions the stock would remain well above the level capable of producing *MSY* ($\tilde{B}_{F_{current}}/\tilde{B}_{MSY}$ 1.39–1.59 and $S\tilde{B}_{F_{current}}/S\tilde{B}_{MSY}$ 1.50–1.79), while $B_{current}/\tilde{B}_{MSY}$ and $SB_{current}/S\tilde{B}_{MSY}$ are estimated to be well above 1.0 (1.41–1.67 and 1.46–1.88, respectively). For lower values of steepness (0.55 and 0.65), $B_{current}/\tilde{B}_{MSY}$ and $SB_{current}/S\tilde{B}_{MSY}$ were estimated to be above 1.0 for all the sensitivities considered. Most of the model options with lower values of steepness also yielded estimates of $F_{current}/\tilde{F}_{MSY}$ below 1.0; however, the F_{MSY} reference point was approached or slightly exceeded for a subset of the model options that included the lowest value of steepness (0.55) in combination with a number of other factors.

26. Sensitivity analyses were conducted to investigate the influence of a range of key model inputs, principally those relating to steepness of the SRR, the levels of catch from the Indonesian/Philippines and purse-seine fisheries, *M*-at-age, and the region 6 CPUE index. The interaction between each of these factors and the other key model assumptions (relative weighting of longline CPUE and size frequency data and increase in longline catchability) was also examined. The uncertainty associated with the point estimates of the key *MSY* based reference points was also determined using a likelihood profile approach. Both analyses revealed that most of the uncertainty in estimates of $F_{current}/\tilde{F}_{MSY}$, $B_{current}/\tilde{B}_{MSY}$ and $SB_{current}/S\tilde{B}_{MSY}$ was attributable to the value of steepness for the SRR. Overall, the full range of model options yielded estimates of current biomass that were well above $S\tilde{B}_{MSY}$ and, with the exception of a subset of the model options that incorporated the lowest value of steepness (0.55), estimates of fishing mortality were well below F_{MSY}. The probability distributions derived from the likelihood profiles were generally consistent with these observations.

27. The estimates of *MSY* for the four principal models are 552,000–637,000 mt and considerably higher than recent catches estimates for yellowfin (430,000 mt, source WCPFC Yearbook 2007). The large difference between the *MSY* and recent catches is partly attributable to the stock assessment model incorporating the higher (preliminary) purse-seine catch estimates (representing an additional catch of approximately 100,000 mt per annum in recent years). The more optimistic models suggest that the stock could potentially support long-term average yields above the recent levels of catch. However, it is important to note that recent (1998–2007) levels of estimated recruitment are considerably lower (80%) than the long-term average level of recruitment used to calculate the estimates of *MSY*. If recruitment remains at recent levels, then the overall yield from the fishery will be lower than the *MSY* estimates.

28. While estimates of current fishing mortality are generally well below F_{MSY}, any increase in fishing mortality would most likely occur within region 3 — the region that accounts for most of the catch. This would exacerbate the already high levels of depletion that are occurring within the region.

Further, the computation of *MSY*-based metrics assumes that the relationship between spawning biomass and recruitment occurs at the global level of the stock and, therefore, does not consider the differential levels of impact on spawning biomass between regions. The spawning biomass in region 3 is estimated to have been reduced to approximately 30% of the unexploited level; however, due to the lower overall depletion of the entire WCPO stock, the model assumes that there has been no significant reduction in the spawning capacity of the stock. A more conservative approach would be to consider the spawning capacity at the regional level and define reference points accordingly.

29. The current assessment has undertaken a more comprehensive analysis of model uncertainty than previous assessments. The analysis indicates that the assumptions regarding the spawner-recruit relationship represent the most significant source of uncertainty. For tuna species, there are no strong empirical data available to inform the model regarding the likely range of values of steepness of the SRR that underpin the *MSY* based stock indicators. On that basis, it may be more appropriate to adopt alternative fishing mortality and biomass based reference points that are not reliant on the *MSY* concept, although inevitably some assumption regarding the SRR is necessary, implicitly or explicitly, in the formulation of other alternative stock indicators.

30. The structural uncertainty analysis investigated the impact of a range of sources of uncertainty in the current model and the interaction between these assumptions. Nonetheless, there remains a range of other assumptions in the model that should be investigated either internally or through directed research. Further studies are required: to refine our estimates of growth, natural mortality and reproductive potential, incorporating consideration of spatio-temporal variation and sexual dimorphism; to examine in detail the time-series of size frequency data from the fisheries, which may lead to refinement in the structure of the fisheries included in the model; to consider size-based selectivity processes in the assessment model; to collect age frequency data from the commercial catch in order to improve current estimates of the population age structure; to improve the accuracy of the catch estimates from a number of key fisheries, particularly those catching large quantities of small yellowfin; to refine the methodology and data sets used to derive CPUE abundance indices from the longline fishery; and to refine approaches to integrate the recent tag release/recapture data into the assessment model.

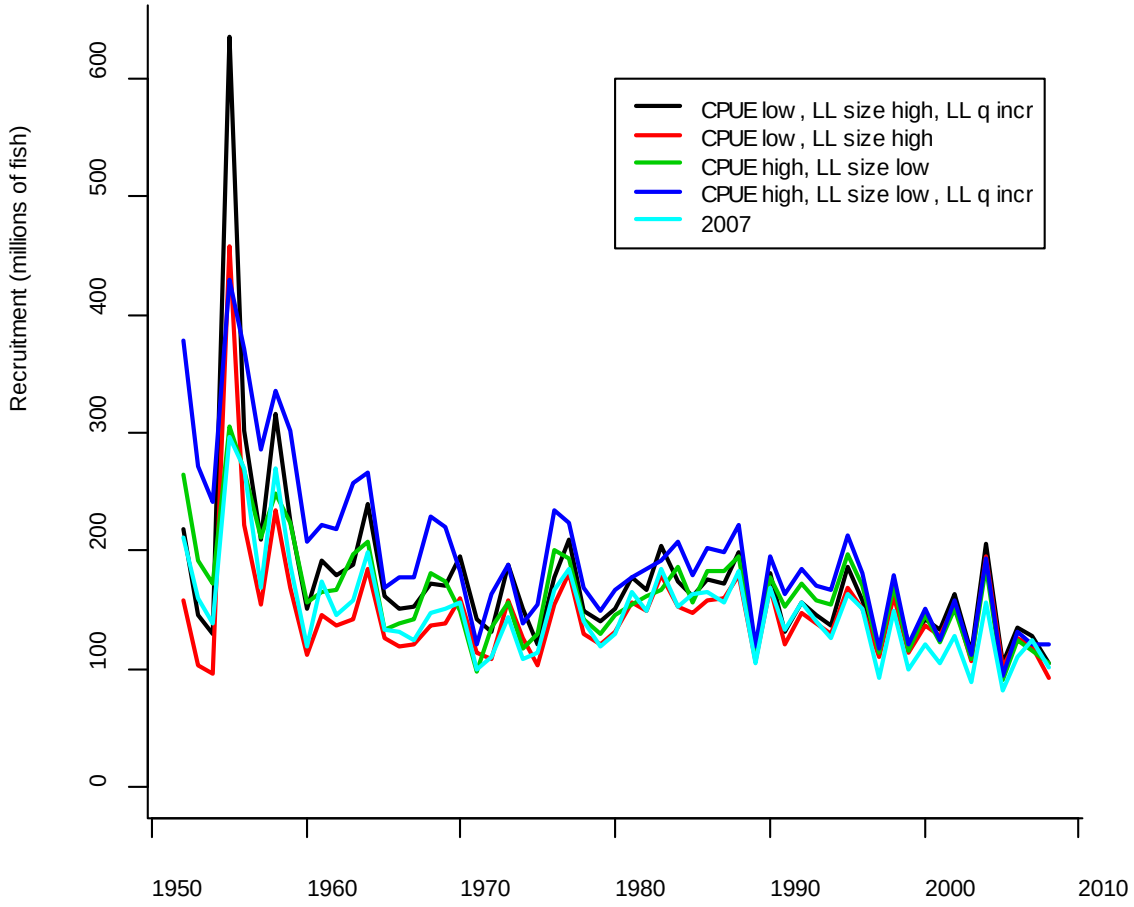


Figure YFT1: Estimated annual recruitment (millions of fish) for the WCPO obtained from the different model options.

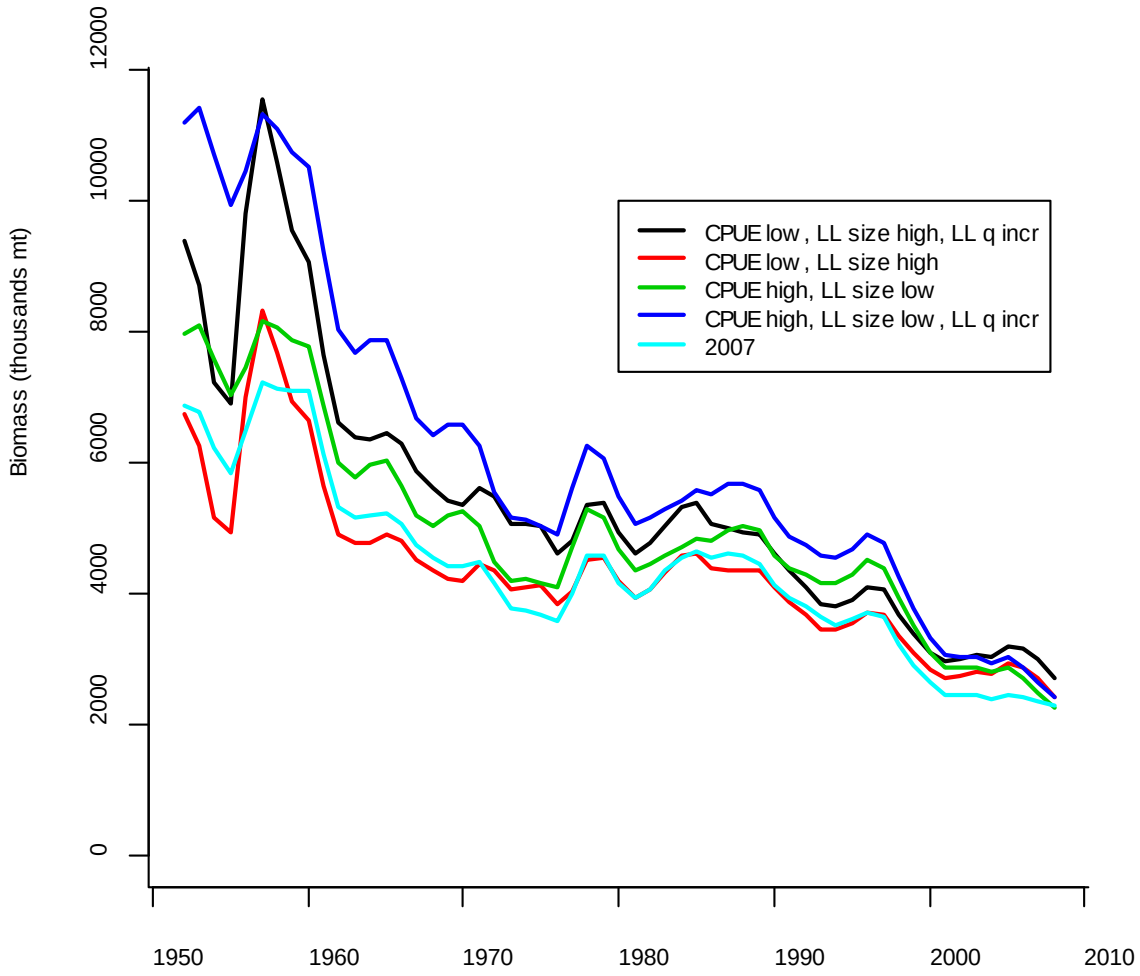


Figure YFT2: Estimated annual average total biomass (thousands mt) for the WCPO obtained from a range of different model options.

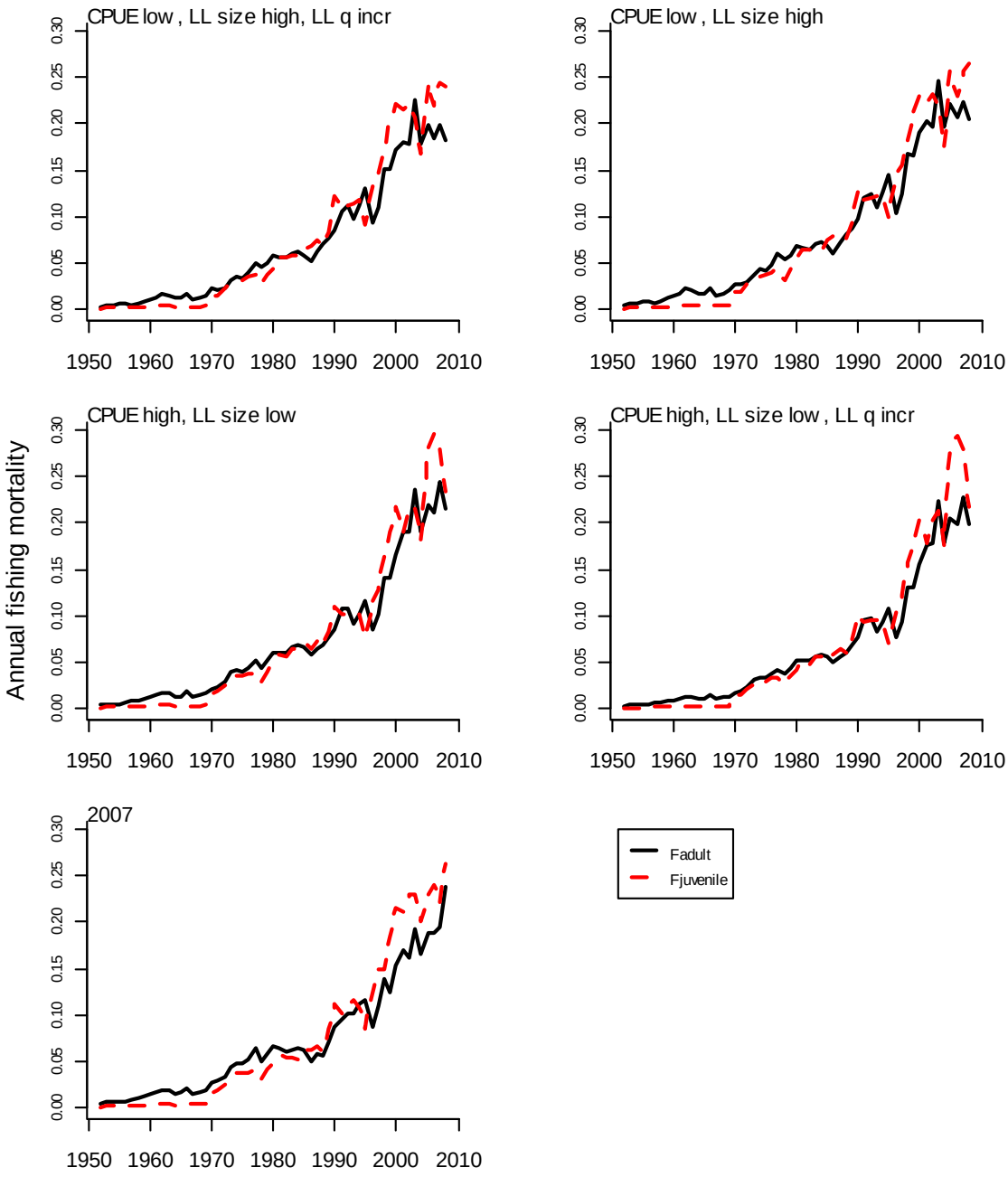


Figure YFT3: Estimated annual average juvenile and adult fishing mortality for the WCPO obtained from the four principal model options and the "Base 2007" model.

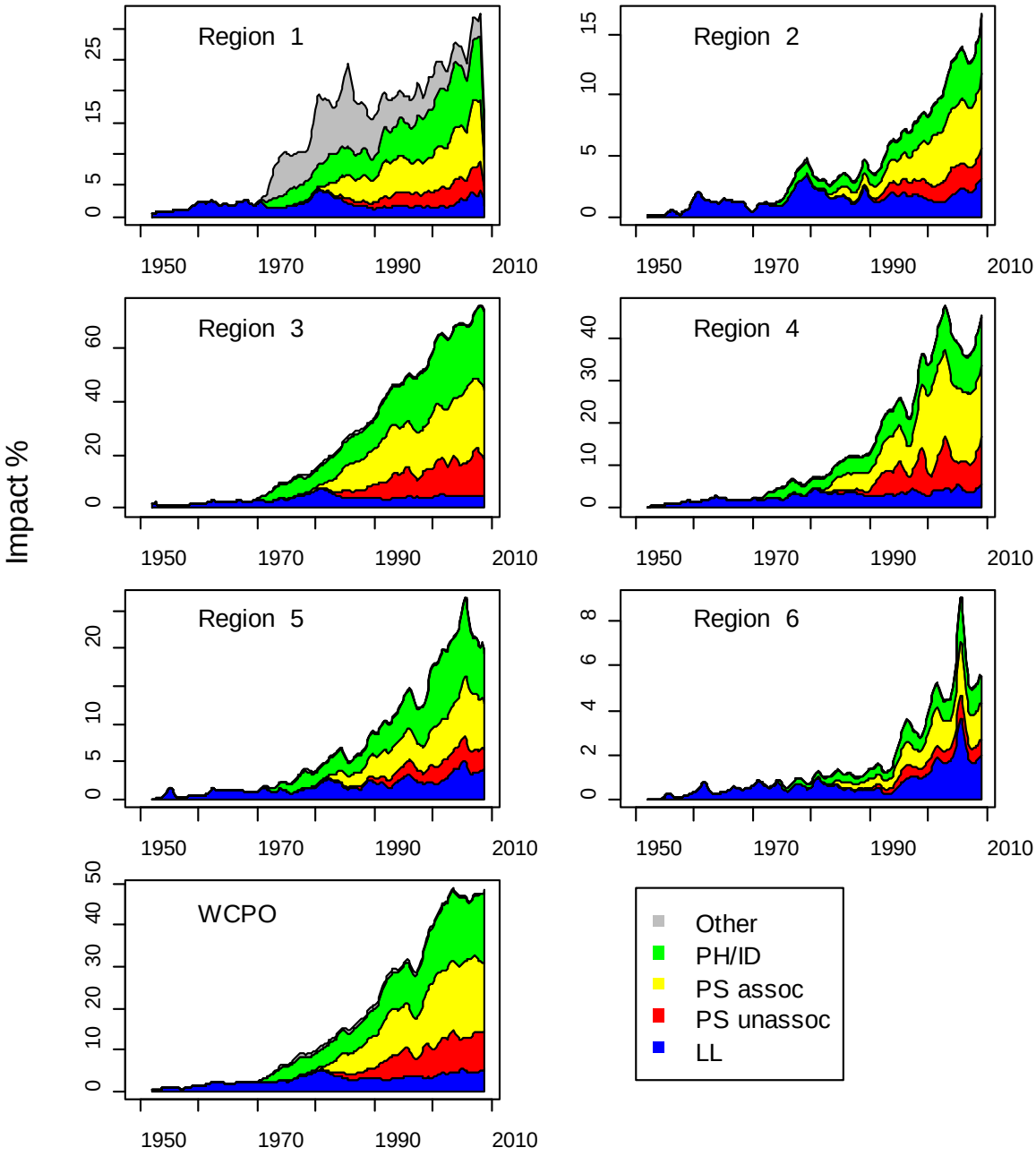


Figure YFT4: Estimates of reduction in spawning biomass due to fishing (fishery impact = $1\text{-}SB_t/SB_{0,t}$) by region and for the WCPO attributed to various fishery groups. LL = all longline fisheries; PH/ID = Philippines and Indonesian domestic fisheries; PS assoc = purse-seine FAD and log sets; PS unassoc = purse-seine school sets; Other = JP coastal PL & PL and equatorial PL.

Discussion

31. There was general agreement that the 2009 yellowfin assessment differed in a number of ways from those of the 2007 assessment. These differences largely result from the incorporation of changes recommended by the previous assessment and discussed in the informal pre-assessment workshop and the inclusion of a greater range in the value of the steepness parameter. If a value of steepness similar to the 2007 base case is assumed, results are very similar for MSY based stock status indicators and changes in MSY are also explainable. Many Members felt that these changes, in conjunction with the array of

sensitivity analyses conducted to explore uncertainty, provide better understanding of stock status for this species for the Commission.

32. After the presentation of the assessment results, significant discussions were held, largely focused on changes made to data inputs and structural assumptions, particularly in the run presented as the base case. The key discussion topics are summarized as follows.

Catchability trends

33. It was noted that the consideration of annually increasing longline catchability (at a constant rate – as proposed by Hoyle 2009 – SA-WP-01) are incorporated within many of the assessment runs (via inclusion of an adjusted standardized effort series). There was a general consensus that the catchability of longline has increased in the long term. However, concerns were noted regarding temporal variation in catchability, which is very difficult to quantify and might not be adequately captured in the correction applied to the standardized effort series. Further collaborative research between scientists from Japan, Chinese Taipei and SPC, into changes in catchability over time, was strongly encouraged.

34. It was noted that the inclusion of an allowance for increasing longline catchability does not substantially change the estimates of the key stock status indicators, compared to other parameters such as steepness. However, to fully capture uncertainty around temporal changes in Japanese longline catchability, it was agreed that the models selected to provide advice to the Commission should include a both runs in where catchability is assumed to be constant or increasing.

Recruitment trends

35. Significant spikes in recruitment were noted in the early time series. It was agreed that this is likely to be driven by high initial longline CPUEs and do not reflect actual relative recruitment levels at that time. It was suggested that future assessments look to estimate yields and associated reference points based on both recent average recruitment levels and, separately, long-term average levels of recruitment, to test the sensitivity of the biological reference points to early recruitment estimates. Further work is required to explore alternate hypotheses which might explain the early declines in CPUE, and allow for consideration of those hypotheses in structural uncertainty analyses.

Reproductive potential

36. The incorporation of the dome shaped reproductive potential was discussed. The authors noted that the inclusion of that specific ogive was supported by empirical research (Hoyle et al. 2009 BI-WP-03) and is also consistent with the 2008 assessments for bigeye tuna and albacore tuna. The purpose of these revised reproductive data was to better describe reproductive potential, in particular the reduced proportion of females observed at larger sizes. Noting differences in sex specific size at age that has been observed in other oceans, further research on this topic was encouraged.

Steepness of the stock recruitment relationship

37. The group noted that the structural uncertainty analyses indicated that steepness (of the stock recruitment relationship) is the factor with the greatest influence upon estimates of biomass, MSY and associated reference points, and is the main factor to have contributed to differences between the results of the 2007 and 2009 assessments. However, it was also noted that there was no empirical evidence to indicate which of the steepness levels investigated (0.55–0.95) might be the most plausible. It was also noted that many of the assessment results indicating improved stock condition were based on models using steepness set at higher levels than estimated in the previous (2007) assessment (0.62). Subsequently, two recommendations were discussed. Firstly, advice to the Commission should be based on consideration of the full range of steepness values explored (0.55–0.95). Secondly, that consideration

be given to including within that advice, reference points which are less sensitive to assumptions regarding steepness and the stock recruitment relationship, such as estimates of depletion of the spawning stock biomass and current spawning biomass relative to equilibrium, unexploited biomass. The group recommended that research into the robustness of alternate reference points which are less reliant on assumptions regarding the stock recruitment relationship (and possibly other parameters) should be undertaken in future.

Purse-seine catch estimates

38. One key change to the assessment discussed was the inclusion of purse-seine catch estimates that were adjusted with estimates of species composition derived from observer data corrected for selectivity bias. The selectivity bias in grab samples collected by observers was estimated from paired grab and spill samples collected during four purse-seine trips in Papua New Guinea in 2008 (Lawson 2009 SA-WP-03). Some concerns were discussed regarding the use of these adjusted catch estimates, given that the estimates of selectivity bias are based on paired samples from only four trips, all of which were from a small area and on anchored FADs. The general levels of catches for bigeye and yellowfin based on these corrections were similar to those determined from port sampling of landing categories of fish unloaded from United States purse seiners in American Samoa. Therefore, while the experimental data are limited, it appears that these adjusted estimates are more plausible than previous catch estimates. However, the continued collection of paired samples over broad spatial and temporal strata, and from other school associations, particularly unassociated schools, throughout the fishery was strongly supported. To this end, it was noted that samples were being obtained during 2009 from New Zealand and Solomon Islands vessels. It was also noted that revised estimates of historical purse-seine catch data (prior to spill sample and observer data adjusted estimates) is essential and further development of methodologies to better estimate historic catch levels was encouraged.

Region 3 impacts

39. The group noted that while the highest depletion levels are estimated to occur in region 3, where the majority of the historical and recent catches of yellowfin tuna are taken, it was not possible to undertake an assessment of region 3 by itself (as undertaken in 2007). This was due to key size data being excluded from the assessment, on the basis of evidence that these data were not representative of catches taken in that region. As a result, the model was unable to estimate growth parameters consistent with those obtained in the 2007 analysis.

40. Nonetheless, the region-specific results from the WCPO model indicate that region 3 is fully exploited and this observation should be reflected in advice to the Commission, to temper the generally more positive assessment of overall stock condition.

Fishery contraction

41. It was noted that the spatial distribution of Japanese longline fishing effort appears to have contracted considerably in the last two decades, particularly within region 3. Given this, it may be that the region 3 CPUE series, in particular, has become less representative of the trends in biomass, particularly if fishing effort has contracted, as expected, to the areas in which catch rates are highest. The authors noted that these concerns led to the testing of different relative weightings for the size and CPUE data. The weighting procedure assigned relative weights to the CPUE indices that were generally comparable to the statistical uncertainty associated with the region-specific CPUE indices, while still maintaining a moderate weight to the CPUE indices for the core regions of the WCPO model. On this basis, it was generally agreed that the models selected for management advice would include the weight schedule that assigned the lower relative weight to the CPUE indices. It was suggested that a series of CPUE-based indices could be constructed using different hypotheses about catch rates in unfished areas.

Tagging data

42. The group noted that tagging data from the current regional tropical tuna tagging project would start to be incorporated within the stock assessments in 2010. In response to how the tagging data might be used to estimate fishing mortality, the authors indicated that, for the most part, it would be estimated within the assessment model. Different weighting factors for the tag likelihood could be used to identify any differences in key parameters based on the tagging data compared to the integrated assessment data. Some stand-alone analyses of the tagging data are also envisaged.

Stock status

43. With respect to the provision of advice regarding stock status of yellowfin tuna by the SA-SWG to the Scientific Committee, there was general agreement on the following:

44. Given uncertainties discussed regarding constant annual potential catchability increases, plausible levels of steepness of the stock recruitment relationship, the impact of longline fishery contraction upon region 3 catch rates, a range of models were selected upon which the Committees advice to the Commission would be based. The models represent the range of most plausible models and encompass uncertainties in the above factors. The model runs selected had the following features:

a. Steepness levels of 0.55, 0.75 or 0.95;
b. Increasing catchability or constant catchability;
c. Low weighting on CPUE data, high weighting on size data in all the runs; Reweighting of the CPUE indices to reflect the statistical variation of the region-specific indices; and
d. Revised estimates of purse-seine catches.

45. The stock status advice should highlight that the current assessment indicates that MSY-based reference points are not being exceed and acknowledge the higher estimated impacts on the entire stock from fisheries in region 3. However, concentration of fishing effort and catches in region 3 represent 95% of the WCPO catch and there is no potential for increased catches of yellowfin tuna from that region.

46. The Scientific Committee should undertake further research to formulate reference points which are less sensitive to assumptions regarding steepness, for example depletion based reference points.

Stock status for yellowfin tuna

47. SA-SWG selected four assessment runs to represent the stock status of yellowfin tuna (Table 1). The results of MSY based reference points (e.g. $F_{current}/\tilde{F}_{MSY}$, $B_{current}/\tilde{B}_{MSY}$) are sensitive to values of steepness (h) assumed in the stock-recruitment relationship (SRR). For a moderate value of steepness (0.75), $F_{current}/\tilde{F}_{MSY}$ is estimated to be 0.58 and 0.62, with an additional assumption on inclusion or non-inclusion of longline catchability, respectively. For a higher value of steepness (0.95) $F_{current}/\tilde{F}_{MSY}$ was lower (0.41), while $F_{current}/\tilde{F}_{MSY}$ was higher (0.95) for a low (0.55) value of steepness. The MSY based reference points were relatively insensitive to the assumptions regarding longline catchability.

48. The key conclusions of the four models selected are that all estimates of $F_{current}/\tilde{F}_{MSY}$ were below 1.0 indicating that the stock is not experiencing overfishing and under equilibrium conditions the stock would remain above the level capable of producing *MSY* (Table 1, Fig. 6). Current biomass exceeds the estimated biomass at *MSY* (>1.0) for the four assessment runs chosen ($SB_{current}/\tilde{SB}_{MSY}$ range: 1.44–2.43) indicating that the yellowfin stock in the WCPO is not in an overfished state (Table 1, Fig. YFT5).

49. However, levels of fishing mortality and depletion vary considerably between the sub-regions of the WCPO. The western equatorial region accounts for approximately 95% of the total yellowfin tuna catch and the spawning biomass in this region is estimated to have declined to about 30% of the unexploited level (approximately the level of SBMSY) and the region is considered to be fully exploited (Fig. YFT5). The fishery impacts are considerably lower outside of the equatorial region resulting in the more optimistic stock status for the overall WCPO.

50. Probability distributions derived from the likelihood profiles confirmed the yellowfin stock status in relation to the management quantities ($F_{current}/\tilde{F}_{MSY}$, $SB_{current}/S\tilde{B}_{MSY}$).

51. The present (2009) yellowfin assessment is not directly comparable to the 2007 basecase assessment due to differences in the size frequency data for some fisheries, and inclusion of two additional years of catch, effort, and size frequency data. The period for computing the MSY-based reference points was also advanced two years (from 2002–2005 to 2004–2007). Nevertheless, the "base 2007" model yielded comparable MSY-based fishing mortality ($F_{current}/\tilde{F}_{MSY}$ =0.85 in 2009; 0.95 in 2007) and biomass estimates ($SB_{current}/S\tilde{B}_{MSY}$ =1.44 in 2009; 1.25 in 2007) when a similar value of steepness (0.55) was assumed in the 2009 assessment as estimated (0.62) in the 2007 assessment (Table 2).

52. The estimates of *MSY* for the four principal models are 485,200–584,000 mt and range over the recent yellowfin catch of 539,481 mt (2008). The difference in MSY estimates between the two assessments is attributable to the revision of the time-series of catch estimates from the purse-seine fishery as well as the adoption of higher values of steepness than estimated from the 2007 base-case model.

Table YFT1. Estimates of reference points from the 2009 yellowfin stock assessment considering four sensitivity analyses.

Management quantity	Units	CPUE low, LL sample high, LL catchability increase Steepness=0.55	CPUE low, LL sample high, LL catchability increase Steepness=0.75	CPUE low, LL sample high, LL catchability increase Steepness=0.95	CPUE low, LL sample high, no LL catchability increase Steepness=0.75
$\tilde{Y}_{F_{current}}$	mt per year	485,200	555,600	584,000	496,400
$\tilde{Y}_{F_{MSY}}$ (or *MSY*)	mt per year	493,600	636,800	767,200	552,000
$\tilde{B}_0$	mt	5,431,000	5,283,000	5,191,000	4,499,000
$\tilde{B}_{F_{current}}$	mt	2,618,000	2,991,000	3,145,000	2,452,000
$\tilde{B}_{MSY}$	mt	2,263,000	1,979,000	1,649,000	1,695,000
$S\tilde{B}_0$	mt	2,929,000	2,850,000	2,801,000	2,441,000
$S\tilde{B}_{F_{current}}$	mt	1,259,000	1,437,000	1,511,000	1,174,000
$S\tilde{B}_{MSY}$	mt	1,062,000	855,300	626,300	736,900
$B_{current}$	mt	3,107,639	3,099,135	3,097,439	2,826,518
$SB_{current}$	mt	1,527,743	1,522,039	1,520,557	1,386,464
SB_{2007}		1,529,487	1,526,249	1,526,350	1,378,534
$B_{current,F=0}$	mt	5,905,599	5,246,194	4,935,454	4,955,395
$B_{current}/\tilde{B}_0$		0.572	0.587	0.597	0.628
$B_{current}/\tilde{B}_{F_{current}}$		1.187	1.036	0.985	1.153
$B_{current}/\tilde{B}_{MSY}$		1.375	1.568	1.880	1.669
$B_{current}/B_{current,F=0}$		0.526	0.591	0.628	0.570
$SB_{current}/S\tilde{B}_0$		0.522	0.534	0.543	0.568
$SB_{2007}/S\tilde{B}_0$		0.522	0.536	0.545	0.565
$SB_{current}/S\tilde{B}_{F_{current}}$		1.213	1.059	1.006	1.181
$SB_{current}/S\tilde{B}_{MSY}$		1.442	1.784	2.434	1.885
$\tilde{B}_{F_{current}}/\tilde{B}_0$		0.482	0.566	0.606	0.545
$S\tilde{B}_{F_{current}}/S\tilde{B}_0$		0.430	0.504	0.539	0.481
$\tilde{B}_{MSY}/\tilde{B}_0$		0.417	0.375	0.318	0.377
$S\tilde{B}_{MSY}/S\tilde{B}_0$		0.363	0.300	0.224	0.302
$F_{current}/\tilde{F}_{MSY}$		0.853	0.584	0.407	0.625
$\tilde{B}_{F_{current}}/\tilde{B}_{MSY}$		1.157	1.511	1.907	1.447
$S\tilde{B}_{F_{current}}/S\tilde{B}_{MSY}$		1.185	1.680	2.413	1.593
$\tilde{Y}_{F_{current}}/MSY$		0.983	0.872	0.761	0.899
$B_{current}/B_{1998}$		0.835	0.838	0.840	0.840
SB_{2007}/SB_{1998}		0.748	0.752	0.754	0.754

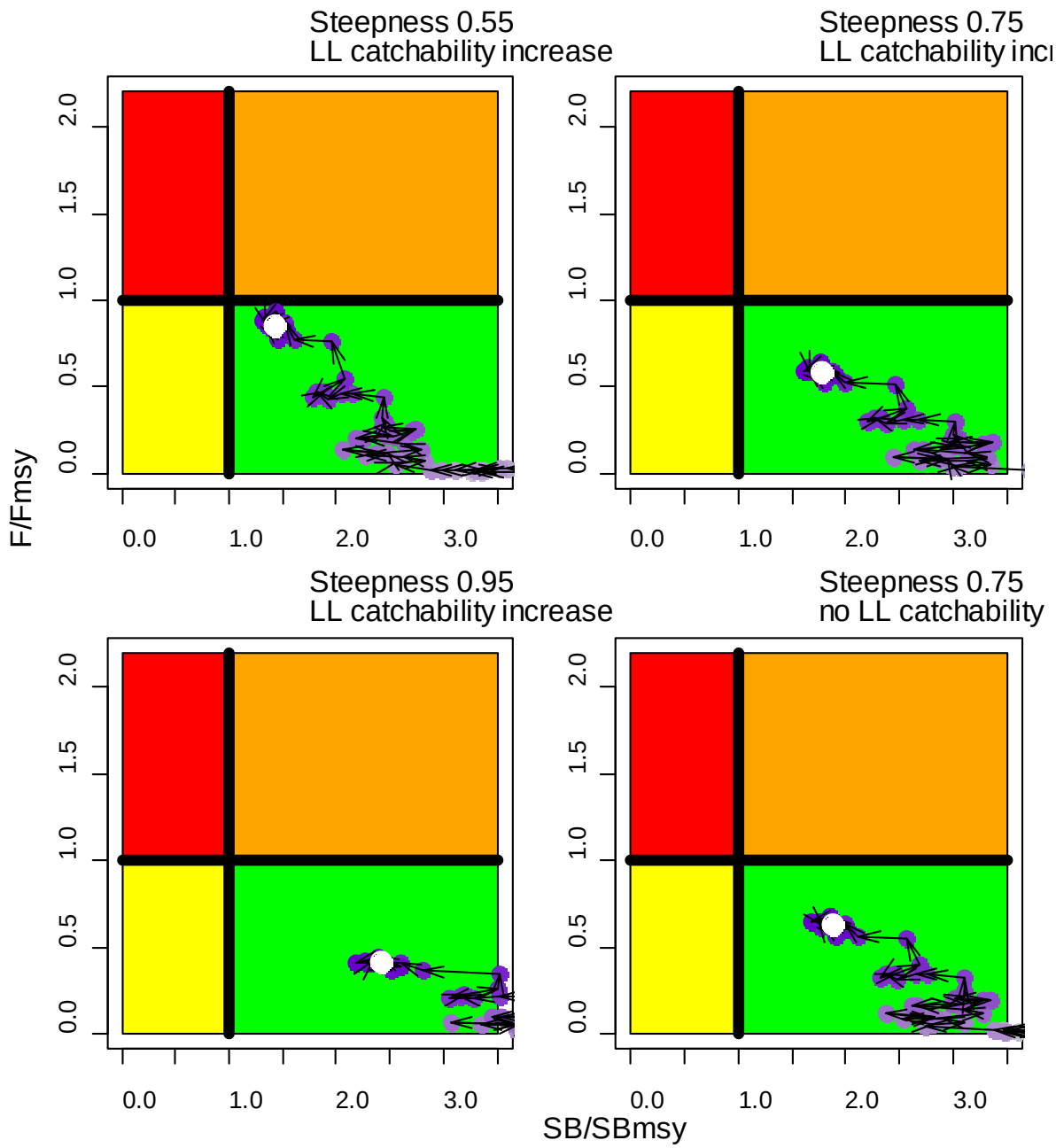


Figure YFT5: Temporal trend in annual stock status, relative to spawning biomass (SB_{MSY} x-axis) and F_{MSY} (y-axis) reference points, for the model period (1952–2008) from four principal model options chosen by SC5. The color of the points is graduated from mauve (1952) to dark purple (2008) and the points are labelled at five-year intervals.

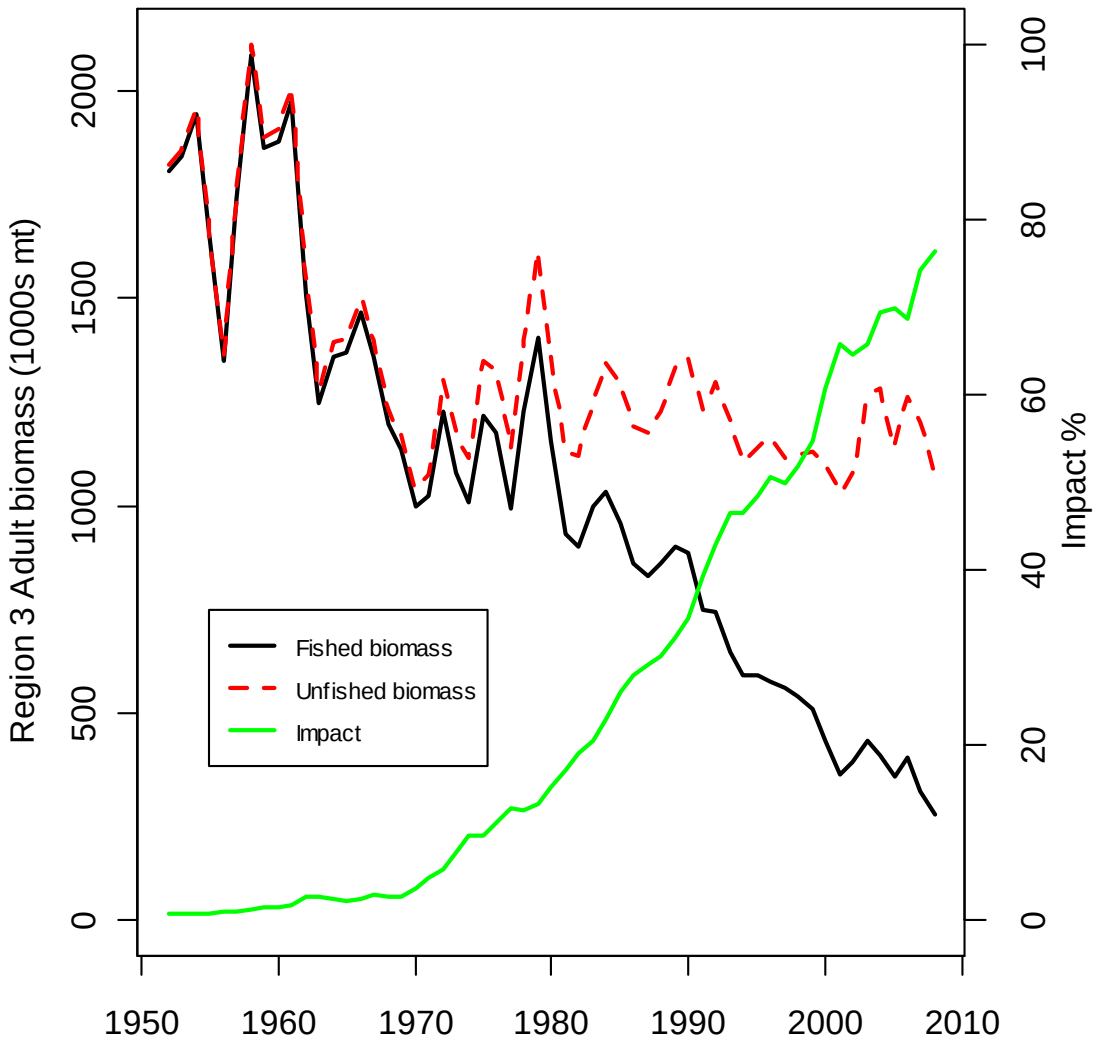


Figure YFT6: The trends in adult yellowfin tuna biomass for the western equatorial region and the estimated biomass trajectory in the absence of fishing (unfished biomass). The impact (%) represents the percentage reduction in adult biomass level in the western equatorial region from the unfished level.

Table YFT2. Comparison of reference points from the 2009 yellowfin stock assessment considering four sensitivity analyses and the basecase from the 2007 assessment.

Management Quantity	2009 Assessment	2007 Assessment
Most Recent Catch	539,481 mt (2008)	426,726 mt (2006)
MSY	Range: 493,600 ~ 767,200 mt	Base case: 400,000 mt Range: 344,520 ~ 549,200 mt
$\mathbf{F_{current}/F_{MSY}}$	Range: 0.41 ~ 0.85	Base case: 0.95 Range: 0.56 ~ 1.0
$\mathbf{B_{current}/B_{MSY}}$	Range: 1.38 ~ 1.88	Base case: 1.17 Range: 1.13 ~ 1.42
$\mathbf{SB_{current}/SB_{MSY}}$	Range: 1.44 ~ 2.43	Base case: 1.25 Range: 1.12 ~ 1.74
$\mathbf{Y_{Fcurrent}/MSY}$	Range: 0.76 ~ 0.98	Base case: 1.0 Range: 0.88 ~ 1.0
$\mathbf{B_{current}/B_{current,\ F=0}}$	Range: 0.53 ~ 0.63	Base case: 0.51 Range: 0.51 ~ 0.58

Management recommendations

53. The SA-SWG deferred management recommendations on yellowfin tuna to the SC5 plenary as recommendations should be formulated after appraisal of working paper on the Assessment of the Potential Implications of Application of CMM-2008-01 for Bigeye and Yellowfin Tuna (WCPFC-SC5-2009/GN-WP-17).

4.2 Bigeye Tuna Stock Assessment

a) Summary of SC4-SA-WP-4

54. Shelton Harley presented working paper SC5-SA-WP-34: "Stock assessment of bigeye tuna in the WCPO". The Executive Summary is as follows with several figures regarding stock status.

55. This paper presents the streamlined 2009 assessment of bigeye tuna in the western and central Pacific Ocean. The primary purpose of this assessment is to allow for an evaluation of the potential benefits of CMM2008-01 using the most recent information. Consequently, this paper contains less background material and supporting material (e.g. diagnostics) than the 2008 assessment report and interested readers should consult that report if further information is required.

56. Further, we attempted to produce an assessment consistent with the 2008 assessment, with only minor modifications. We do not view this model run ("run 10"), which is most comparable to the 2008 assessment "run 4", as containing the most plausible set of data and model structure assumptions. Other model runs, which we believe contain more plausible assumptions, are also presented.

57. Changes to the data from the 2008 assessment included: updated catch, effort, and size data for 2007 and some limited data for 2008; revisions to recent historical data for some fisheries (e.g. since 2000); an extended purse-seine catch history that partially corrects for logsheet reporting bias; new standardized CPUE series for the main longline fisheries based on an improved methodology; exclusion of some historical size data from the Philippines, which was "contaminated" with samples from two different fisheries. Other changes included: an updated version of the MULTIFAN-CL software which

had some new features and minor bug fixes; and decreased penalties for effort deviates for all fisheries (i.e. increased c.v.'s) to make them both more realistic and consistent with approaches used in other Pacific tuna assessments.

58. Over 130 different model runs were undertaken in developing this assessment, examining the impacts of changes in data, weighting of different data sources, key parameter values, and other structural model assumptions. The key assumptions in the main model runs presented in this paper are described below and we again emphasise that the many of the "alternative" assumptions considered in the assessment are as least as plausible, if not more plausible, than some of the assumptions in the model which is more comparable to the 2008 base-case assessment: The main conclusions of the current assessment are as follows.

59. Recruitment in all analyses is estimated to have been high during 1995–2005 (Fig. BET1). This result was similar to that of previous assessments, and there are some indications that the high recruitment may be, due to data conflicts, inaccurate data, or incorrect structural assumptions of the model. Recruitment in the most recent years is estimated to have declined to a level approximating the long-term average, although these estimates have high uncertainty.

Component	**Model comparable to 2008**	**Alternatives**
Longline data weighting	CPUE cv=0.2, size data = n/20	CPUE cv=0.2, size data = n/50
Steepness	Estimated	0.55, 0.65, 0.75, 0.85, 0.95
Purse-seine catches	Grab sample (s_best)	Spill sample corrected
Effort creep	No effort creep	0.47% per year (non-compounding)
ID/PH small-fish fishery catches	As submitted	Reduced by 33%

60. Total and spawning biomass for the WCPO are estimated to have declined to about half of its initial level by about 1970 (Fig. BET2), with total biomass remaining relatively constant since then ($B_{current}/B_0$ = 47.4%) (where current is the average for 2004-07), while spawning biomass has continued to decline ($SB_{current}/SB_0$ = 29.2%). Declines are larger for the model with increasing longline catchability and increased purse-seine catches.

61. When the non-equilibrium nature of recent recruitment is taken into account, we can estimate the level of depletion that has occurred. It is estimated that spawning biomass is at 15% of the level predicted to exist in the absence of fishing considering the average over the period 2004-07, and that value is reduced to 10% when we consider 2008 spawning biomass levels.

62. The attribution of depletion to various fisheries or groups of fisheries indicates that the longline fishery has the greatest impact throughout the model domain (Fig. BET3). The purse-seine and Philippines and Indonesian domestic fisheries also have substantial impact in region 3 and to a lesser extent in region 4. The Japanese coastal pole-and-line and purse-seine fisheries are also having a significant impact in their home region (region 1). For the sensitivity analysis with higher purse-seine catch, the longline and purse-seine fisheries are estimated to have approximately equal impact on spawning biomass.

63. Recent catches are well above the *MSY* level of 56,880 mt, but this is mostly due to a combination of above average recruitment and high fishing mortality. When *MSY* is re-calculated assuming recent recruitment levels persist, catches are still around 20% higher than the re-calculated *MSY*. Based on these results, we conclude that current levels of catch are not sustainable even at the recent [high] levels of recruitment estimated for the last decade.

64. Fishing mortality for adult and juvenile bigeye tuna is estimated to have increased continuously since the beginning of industrial tuna fishing (Fig. BET4). For the models with higher purse-seine catch and increasing longline catchability, estimates of recent juvenile fishing mortality are considerably higher than for run 10, while the opposite is the case for the PH/ID low catch option.

65. For all of the model runs $F_{current}/F_{MSY}$ is considerably greater than 1. For run 10 the ratio is estimated at 1.785, indicating that a 44% reduction in fishing mortality is required from the 2004–2007 level to reduce fishing mortality to sustainable levels. The results are far worse with lower values of steepness. Based on these results, we conclude that overfishing is occurring in the bigeye tuna stock.

66. The reference points that predict the status of the stock under equilibrium conditions are $B_{F\,current}/B_{MSY}$ and $SB_{F\,current}/SB_{MSY}$. The model predicts that total biomass and spawning biomass would be reduced to 48.1% and 33.6%, respectively, of the level that supports *MSY*. In terms of the reduction against virgin biomass the declines reach as low as 8% for spawning biomass. Current stock status compared to these reference points indicates that the current total and spawning biomass are higher than the associated MSY levels ($B_{current}/B_{MSY}$ = 1.44 and $SB_{current}/SB_{MSY}$ = 1.22). However, in the case of spawning biomass, the estimate for 2008 (still considered relatively reliable) is below SB_{MSY} (0.947). The likelihood profile analysis indicates a 3% probability that $SB_{current} < SB_{MSY}$ which increases to 70% for SB_{latest} (based on 2008 levels). Some of the more plausible alternative models are more pessimistic as are the conclusions of the structural uncertainty analysis. Based on these results, we conclude that it is likely that bigeye tuna is in, at least, a slightly overfished state, or will be in the near future.

67. Consideration of current levels of fishing mortality and historical patterns in the mix of fishing gears indicates that considerable levels of potential yields from the bigeye tuna stock are being lost through harvest of juveniles and overfishing. Based on these results, we conclude that greater overall yields could be obtained by reducing the mortality of small fish.

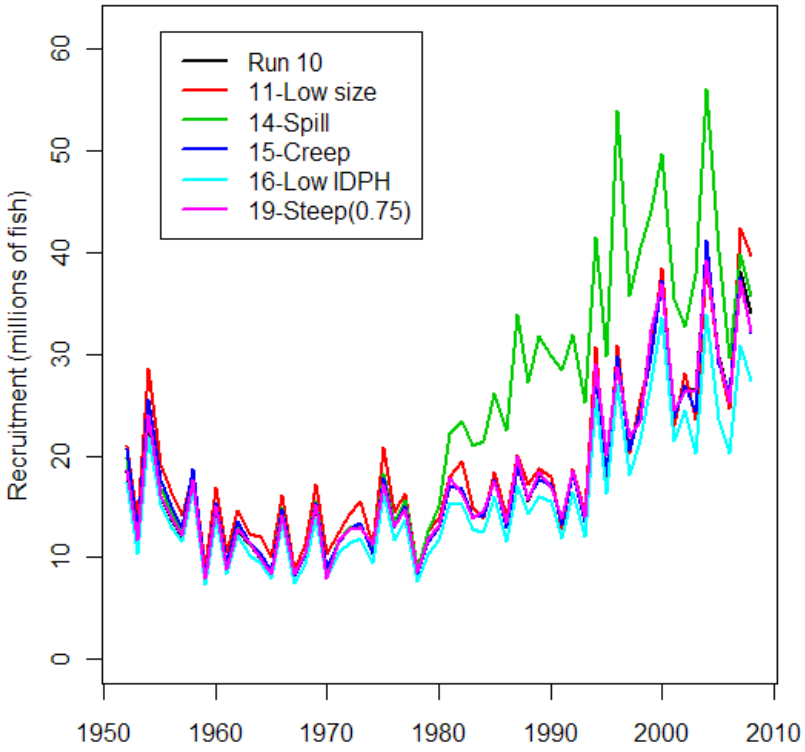


Figure BET1: Estimated annual recruitment (millions of fish) for the WCPO obtained from five different model options.

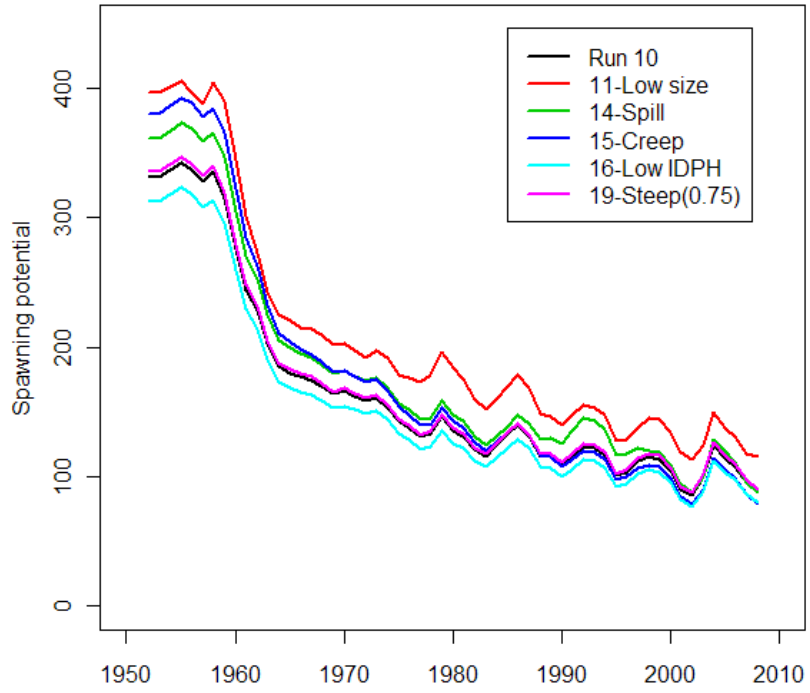


Figure BET2: Estimated annual average spawning biomass for the WCPO obtained from run 10 and the alternative runs.

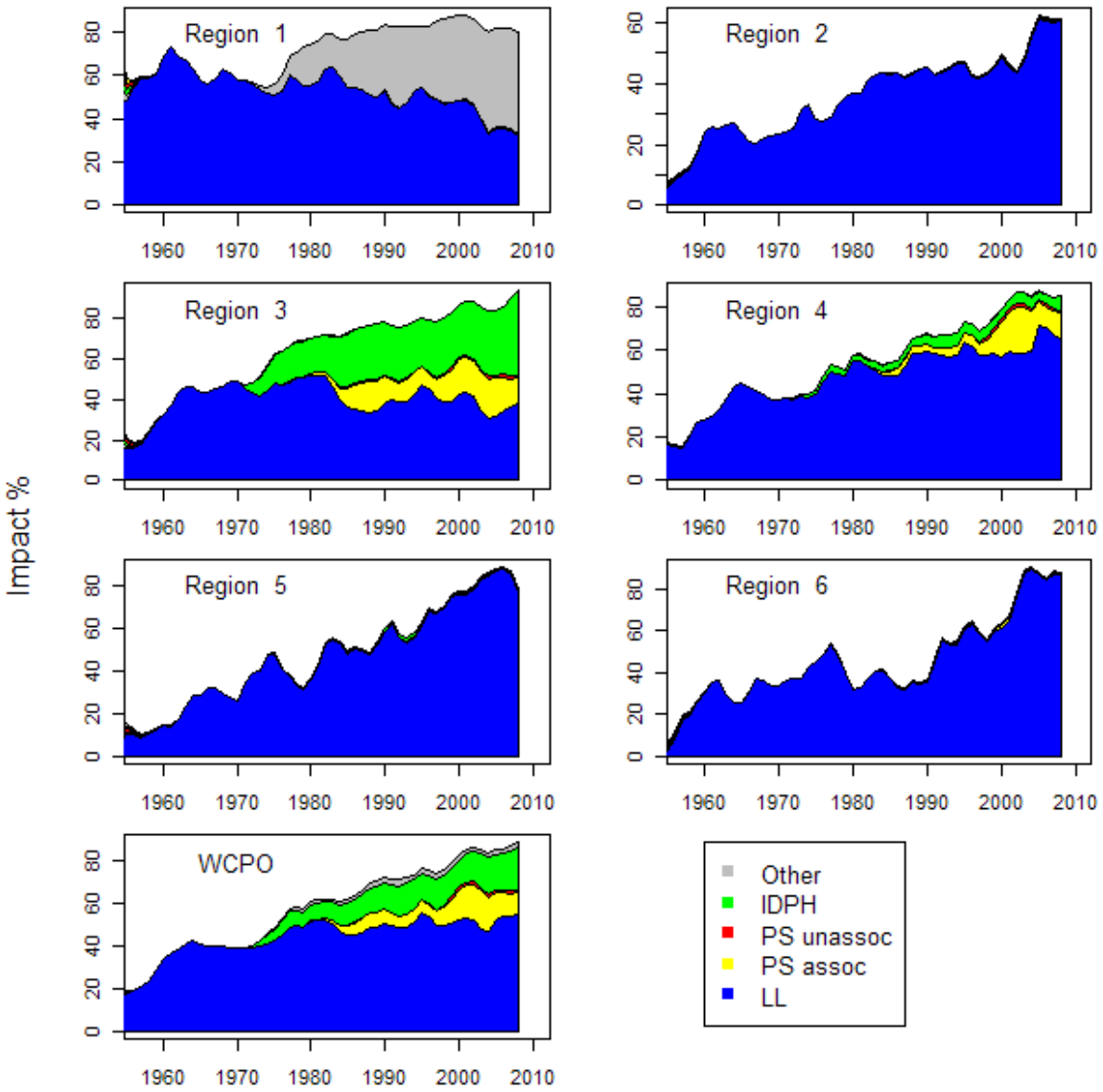
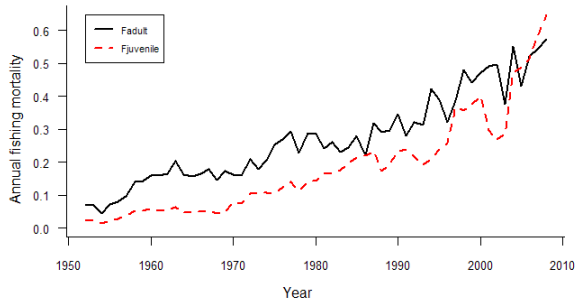
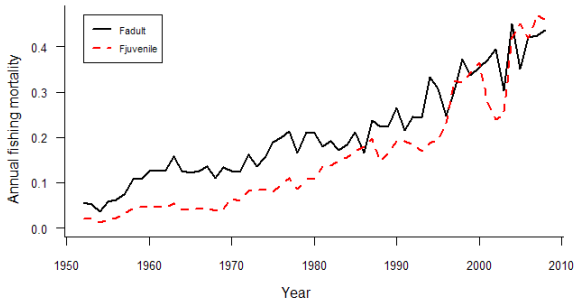


Figure BET3: Estimates of reduction in WCPO spawning biomass due to fishing (fishery impact = $(1-SB_t)/SB_{t_{F=0}}$) attributed to various fishery groups for the four main alternative models. LL = all longline fisheries; PH/ID = Philippines and Indonesian domestic fisheries; PS assoc = purse-seine log and FAD sets; PS unassoc = purse-seine school sets; Other = pole-and-line fisheries and coastal Japan purse-seine.

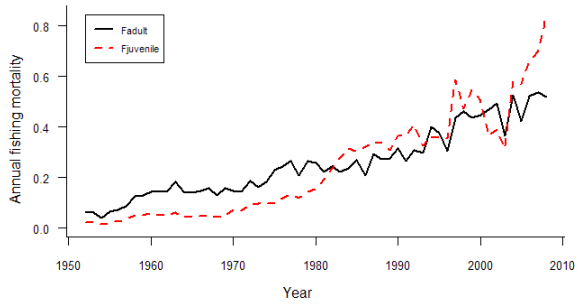
Run 10



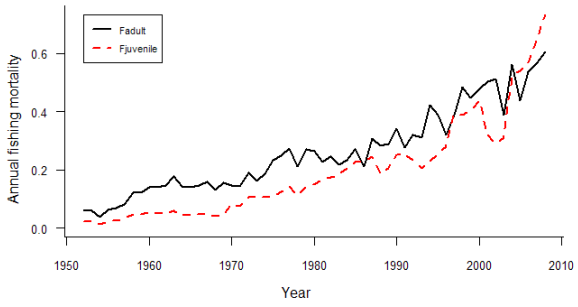
Run 11 - low size



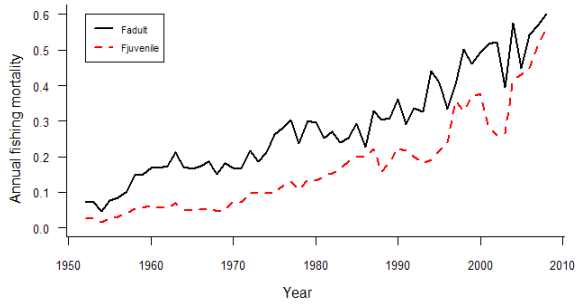
Run 14 - spill



Run 15 - creep



Run 16 – low IDPH



Run 19 – steep (0.75)

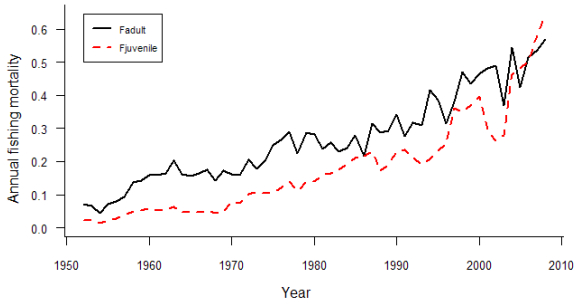


Figure BET4: Estimated annual average juvenile and adult fishing mortality for the WCPO obtained from selected analyses.

Discussion

Introduction

68. There was general agreement that the 2009 streamlined bigeye assessment included a number of changes in the model and data used such as: a revised standardized longline CPUE, the consideration of alternative purse-seine catches, and the inclusion of newly submitted data for 2007 and previous years and revision of historical data of Indonesia and Philippine fisheries. These developments respond to some of the issues that were raised in relation to the 2008 assessment. A large array of sensitivity analyses were conducted to explore parameter and structural uncertainty, as well as recommendations being provided for future research. It was noted that a run using the same structural assumptions should be conducted as in

the previous assessment to assess continuity. There followed discussion on five main topics: 1) input data, 2) model structure and parameterization, 3) model output and diagnostics, 4) management advice, and 5) recommendations for future research, that are outlined below.

Input data

68 bis. Stock assessment of the WCPO bigeye stock is hampered by the uncertainties in the total catches of small bigeye taken by purse seiners, a serious uncertainty faced by both the purse-seine domestic fisheries of Philippines and Indonesia, and by the international fleet of purse seiners active in the equatorial WCPO and catching about half of its tuna catches on FADs, where small bigeye are commonly caught. Progress has been made in these estimations, for instance estimating better the potential use of grab or spill sampling by observers and of port sampling, but in the absence of a fully consistent and permanent sampling programme of bigeye catches, the present uncertainty in the total bigeye catch levels appears to be important.

69. The impacts of both, new input data, and changes to historical time series, on the updated model results were discussed in respect of comparisons with the previous assessment results in 2008. In attempting to identify the most influential of these data changes on the model results, focus was directed at:

- the update of the most recent data;
- the shift of the MSY-window from 2003–2006 to 2004–2007; and
- the combined effects of changes made to the historical time series of individual country data.

70. Given the effects on model estimates produced by the updated input data for the 2009 model, the degree to which this may be attributed to revisions of the historical time series for fishing fleets and countries was questioned. Specifically, for which years and data types had the data changed.

71. It was noted that there were three main changes to the historical data that had the potential to affect the assessment: 1) the revision by Members of recent data (e.g. the last two to three years; and 2) the addition of another years catch data for the distant-water fishing nation longline fisheries (in the absence of catch estimates for the most recent year, the assessment assumed constant effort and predicted catch; these predicted catches were sometimes different to the actual catches which were submitted a year later). The changes to recent data from 1 and 2 above were relatively minor for most CCMs, although a major revision occurred to Philippines catch data.

72. With respect to the Philippines, it was noted that the quality of reporting of catch and size data by gear type from the Philippines has changed significantly. The catch history of the handline fishery was revised for this assessment - with the catch of small and large fish being reallocated over the history of the catch time series. Historical catches from the small-scale municipal fisheries are much higher than can reasonably be expected. The effects of the high Indonesian catches around 2004 on model estimates was also recognised given the high selectivity of this fishery for small fish.

73. It was noted that certain components of the Philippines catch (handline fisheries) and of the high historical Indonesian catch impacted on model estimates, and given the high uncertainty in these data, they warrant closer examination. The change in the estimated MSY was mostly attributed to these changes in catch from the Philippines and the model estimating a selectivity curve with higher selectivity for the youngest ages for this fishery. These changes appeared to have a smaller impact on fishing mortality and most of the change in $F_{current}/F_{MSY}$ can be attributed to the change in the MSY time window from 2003–2006 (2008 assessment) to 2004–2007 (current assessment) and the much lower estimate of fishing mortality for 2003 (the year dropped) relative to that for 2007 (the year added). Many of the other key management quantities were broadly similar.

74. It was recommended that that future stock assessment reports clearly document any major revisions to historical data that were included. In order for the assessment scientists to include such details, CCMs will also need to provide supporting information for major changes to historical data.

Model Structure and Parameterization

Recruitment and MSY

75. There was lengthy discussion regarding the consistent increasing trend in recruitment estimated in the model, which produces very high annual recruitments in recent years, and the effects of this on MSY estimates. This has been a key issue discussed in the past by the Working Group in regards to the status of bigeye and the role it has played in maintaining estimates of current biomass above the estimated B_{MSY}, and in current catches exceeding the estimated MSY. It was noted that this trend may actually be an effect caused by the model fit to conflicting observations, rather than being a real situation. The working group discussed as a possible cause, the relatively slow decline in longline CPUE for the western equatorial fishery despite steadily increasing catches overall through the same period, particularly of small bigeye. Reference was made to SA-IP-2 that described the concentration of fishing effort with respect to particular areas within a model region. This study indicated that effort has been directed to areas exhibiting high CPUE, which may result in the index not directly reflecting the underlying population abundance within a region.

76. A direct effect of the recruitment trend is that the estimated MSY is substantially lower than recent catches, since it is derived using the long-term average recruitment that is lower than current levels. An alternative and substantially higher value for MSY was presented based upon the recent recruitments (MSY^{rec}).

77. It was also pointed out that, for the updated model, MSY had decreased relative to that estimated in the 2008 assessment, and this was due to the large change in the estimated selectivity for the Indonesian and Philippines domestic small fish fisheries towards smaller fish.

78. Various suggestions were made for examining the sensitivity of MSY to the model parameterization, including a comparison of recent catches with a "dynamic", or annual, MSY calculated for any one year. It was also suggested that alternative modelling approaches, such as simpler stock-production models, be explored to demonstrate the differences in MSY estimates obtained. However, it was considered by some that a stock-production model is unlikely to be a suitable alternative bigeye model, since it ignores the effects of age-specific fishing mortality. It was recognised that the alternative calculation methods of MSY as suggested in the discussion, had implications for the reference points to be reported to managers, and were noted for discussion in a later session on this topic.

79. It was pointed out that the updated estimate of $F_{current}/F_{MSY}$ was substantially higher than the 2008 assessment value, and this could be attributed to the recent period for which the average fishing mortality applied in the F_{MSY} calculation (i.e. the shift of the MSY-window from 2003–2006 to 2004–2007 for the updated 2009 model). The updated estimate excludes the low fishing mortality value in 2003 and includes the higher fishing mortality estimated for 2007.

Natural mortality

79 bis. It was noted by some participants that the natural mortality used in the present assessment model remains quite uncertain, especially natural mortality of juvenile bigeye caught by purse seiners. It has been noted that this uncertainty may influence the negative impact of purse-seine fisheries on the longline fishery, but these uncertainties have not be analyzed. It is expected that the incoming recoveries of tagged bigeye will soon reduce this serious biological uncertainty.

Movement

80. The estimates of movement between model regions were low, and likely to be confounded with region-specific recruitments outside of the equatorial regions because there are few observations of small fish in these areas. The estimates were strongly influenced by the model fit to longline catch size composition data that exhibits clear modal structures in some regions. This indicates that size distributions were largely determined by region-specific processes (such as recruitment and growth), and lacks the effects of fish mixing from other regions. It was noted that, as tagging data becomes available, it is proposed to examine the model assumptions affecting movement out of model region 3.

80 bis. It was noted by some participant that the stock structure used in the present stock assessment remains questionable, as this legal frontier at 150°W is positioned in the middle of major fishing zones of adult bigeye tuna (probably a spawning zone) and in an equatorial area where juvenile bigeye are also frequent under FADs. Some scientists consider that there is significant potential of east west movement of bigeye tuna across this artificial frontier during the life of bigeye (more than 10 years) and that a Pacific-wide modelling would be more realistic than the present model assuming a strict frontier at 150°W. It is expected than the results of the present tagging programs in the WCPO and in the EPO and the ecological tuna models (such as SEAPODYM) may provide estimates on these potential age specific movements.

Discussion − Model Output and Diagnostics

81. It was recommended that the plot of spawning stock biomass and estimated absolute recruitment be revised to show annual, rather than quarterly, recruitments. This was noted for the next assessment.

Stock status

82. Rather than presenting a "base-case" model, as the most plausible estimate of stock status on which to provide management advice, the working group elected to base the advice on stock status using the Kobe plot showing a range of model runs, to better provide an understanding of the uncertainty.

83. This plot would include the six sensitivities presented in the summary Table 6 of SA-WP.4, with the adjustment that instead of presenting the average status over the period 2004 to 2008, the status predicted for 2008 only would be displayed.

83 bis. - Concern was expressed on significant uncertainties associated with assessments and input data; decreased spawning biomass, recent increasing recruitment estimated and stock recruitment relationship. Some Members noted these uncertainties and run 10 which used the closest setting as in the 2008 assessments, should be given special attention.

83 ter - It was noted that there was an inconsistency in the fishery indicators in the overfished region 3. During the last 20 years the bigeye fishery has been showing a permanent increase of its yearly catches while at the same time a remarkable stability of the CPUE of Japanese longliners. The recommendation from the stock assessment report, that this inconsistency should be fully explored in the next assessment, was strongly endorsed by the SA-SWG.

Stock status for bigeye tuna

84. SA-SWG selected six assessment runs to represent the stock status of bigeye tuna (Table BET1). For all of the six model runs, $F_{current}/F_{MSY}$ is considerably greater than 1, ranging from 1.51–2.01 for a variety of assumptions with similar steepness (~0.98). The range of $F_{current}/F_{MSY}$ ratios indicate that a 34–50% reduction in fishing mortality is required from the 2004–2007 level to reduce fishing mortality to sustainable levels at a steepness of ~0.98. The results indicate a 61% reduction in fishing mortality if a lower value (0.75) of steepness is assumed. All of the results conclude that overfishing is occurring for the WCPO bigeye tuna stock.

85. Current spawning biomass exceeds the estimated spawning biomass at *MSY* (>1.0) for the five of the six assessment runs chosen ($SB_{current} / \tilde{SB}_{MSY}$, Table 1) indicating that the bigeye stock in the WCPO is not in an overfished state (Table 1, Fig. BET5 top) if the spawning biomass reference period is 2004–2007. However, if the spawning biomass period is considered as 2008 (SB_{latest} / SB_{MSY}), then only 1 of the 6 runs indicates that the bigeye stock is not in an overfished state (Table 1, Fig. BET5 bottom). The bigeye stock status is concluded to be in a slightly overfished state, or will be in the near future. MSY calculated based on recent recruitment (average of the last 10 years), was almost double the long-term MSY estimates, but still 20% below recent catches.

86. The bigeye assessment in 2009 is comparable with the 2008 assessment (Table BET2) though there are differences in catch and effort data, size frequency and a few different structural assumptions. The 2009 range of $F_{current} / F_{MSY}$ estimates are substantially higher than the 2008 assessment value and largely relates to the shift of the MSY-window from 2003–2006 to 2004–2007 for the updated 2009 model (Table BET3).

87. All of the models run using the 2009 data were rerun assuming the previous MSY time window (2003–2006) to see how the view of the past has changed. Not only have conditions deteriorated since the previous assessment, our view of past conditions is now more pessimistic. For example, the $F_{current}/F_{MSY}$ for run 10 when calculated using the period 2003–2006 is 1.57 compared with 1.44 from run 4 in the 2008 assessment. The main reason for this appears to be the shift in the selectivity for the increasingly influential domestic fisheries in Indonesia and the Philippines

Table BET1. Estimates of reference points from the 2009 bigeye stock assessment considering six sensitivity analyses.

Quantity	Run10 (h=0.977)	Run11 (low size)	Run14 (spill)	Run15 (creep)	Run16 (low IDPH)	Run19 (h=0.75)
$C_{current}$	141,206	141,304	174,154	140,631	130,689	141,377
C_{latest}	126,051	129,479	129,874	124,853	115,759	126,252
$Y_{F_{current}}$	48,680	57,520	54,280	48,840	49,720	6,224
$Y_{F_{MSY}}$ or MSY	56,880	62,240	67,800	58,480	56,160	52,120
$\frac{Y_{F_{current}}}{MSY}$	0.856	0.924	0.801	0.835	0.885	0.119
$\frac{C_{current}}{MSY}$	2.483	2.27	2.569	2.405	2.327	2.713
$\frac{C_{latest}}{MSY}$	2.216	2.08	1.916	2.135	2.061	2.422
F_{MSY}	0.06	0.06	0.059	0.059	0.063	0.042
F_{mult}	0.560	0.664	0.498	0.538	0.593	0.392
$\frac{F_{current}}{F_{MSY}}$	1.785	1.506	2.009	1.859	1.685	2.549
B_0	726,400	788,900	927,800	757,000	675,200	819,200
B_{MSY}	238,800	260,900	286,200	246,200	223,300	313,600
$\frac{B_{MSY}}{B_0}$	0.329	0.331	0.308	0.325	0.331	0.383
$B_{current}$	344,234	403,642	370,609	328,583	321,304	348,719
B_{latest}	263,790	354,604	255,255	251,709	248,733	271,097
$B_{F_{current}}$	117,900	162,100	109,900	113,000	122,400	15,230
$B_{current_{F=0}}$	1,413,917	1,393,349	2,047,232	1,432,520	1,263,412	1,796,876
$B_{latest_{F=0}}$	1,506,655	1,472,473	2,043,165	1,517,196	1,282,781	1,880,117
SB_0	378,500	398,600	479,600	391,700	349,700	426,700
SB_{MSY}	90,510	94,270	109,200	92,290	81,080	133,300
$\frac{SB_{MSY}}{SB_0}$	0.239	0.237	0.228	0.236	0.232	0.312
$SB_{current}$	110,520	134,038	113,667	101,394	100,125	112,935
SB_{latest}	80,799	115,043	88,066	79,150	80,063	90,329
$SB_{F_{current}}$	31,930	47,040	26,810	29,050	32,310	4,165
$SB_{current_{F=0}}$	737,560	705,793	1,060,121	738,206	664,557	936,685
$SB_{latest_{F=0}}$	789,322	740,714	1,107,838	790,920	680,641	998,205
$\frac{B_{current}}{B_0}$	0.474	0.512	0.399	0.434	0.476	0.426
$\frac{B_{latest}}{B_0}$	0.363	0.449	0.275	0.333	0.368	0.331
$\frac{B_{F_{current}}}{B_0}$	0.162	0.205	0.118	0.149	0.181	0.019
$\frac{B_{current}}{B_{MSY}}$	1.442	1.547	1.295	1.335	1.439	1.112
$\frac{B_{latest}}{B_{MSY}}$	1.105	1.359	0.892	1.022	1.114	0.864
$\frac{B_{F_{current}}}{B_{MSY}}$	0.494	0.621	0.384	0.459	0.548	0.049
$\frac{B_{current}}{B_{current_{F=0}}}$	0.243	0.29	0.181	0.229	0.254	0.194
$\frac{B_{latest}}{B_{latest_{F=0}}}$	0.175	0.241	0.125	0.166	0.194	0.144

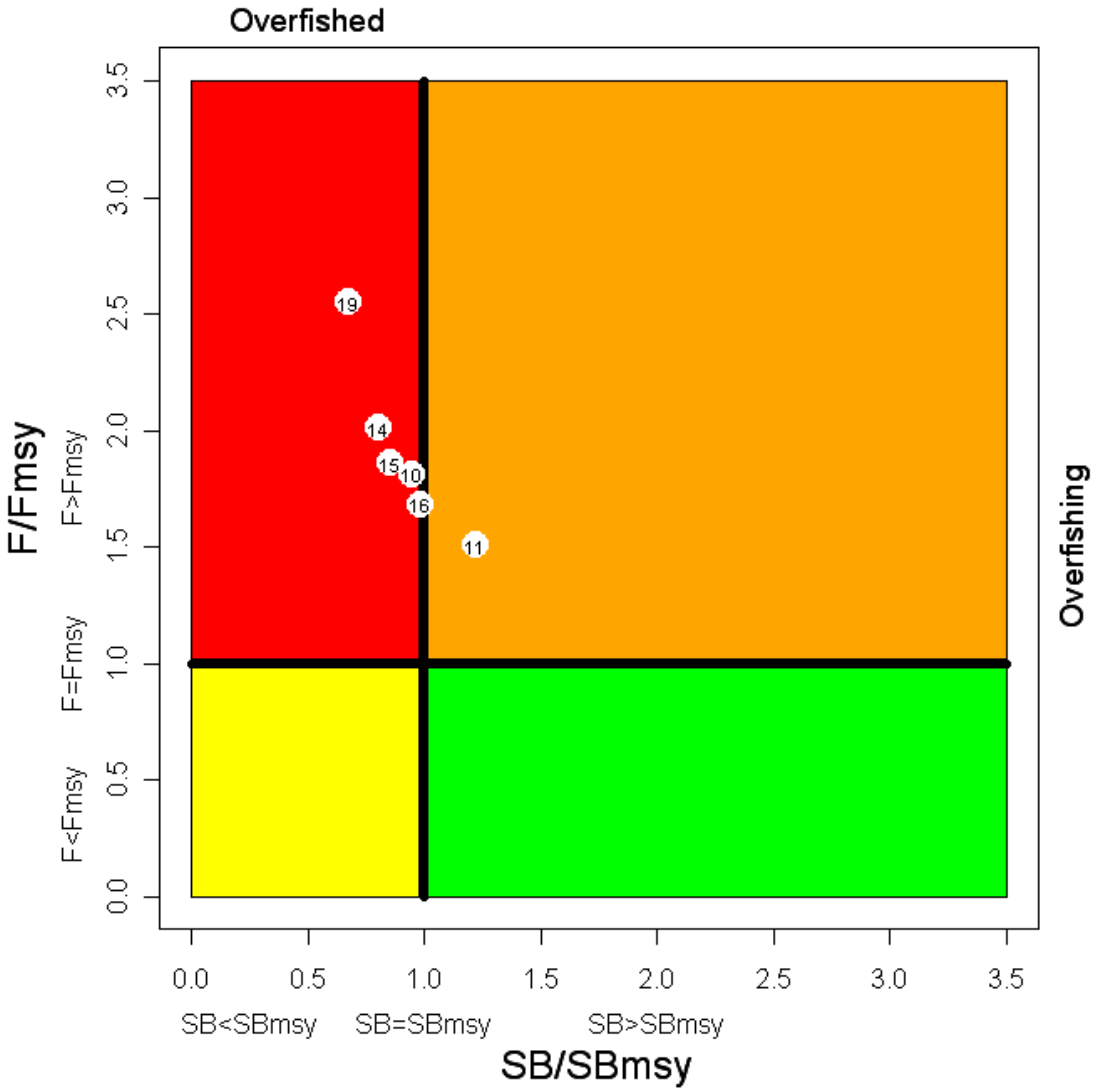
$\frac{SB_{current}}{SB_0}$	0.292	0.336	0.237	0.259	0.286	0.265
$\frac{SB_{latest}}{SB_0}$	0.213	0.289	0.184	0.202	0.229	0.212
$\frac{SB_{F_{current}}}{SB_0}$	0.084	0.118	0.056	0.074	0.092	0.01
$\frac{SB_{current}}{SB_{MSY}}$	1.221	1.422	1.041	1.099	1.235	0.847
$\frac{SB_{latest}}{SB_{MSY}}$	0.893	1.22	0.806	0.858	0.987	0.678
$\frac{SB_{F_{current}}}{SB_{MSY}}$	0.353	0.499	0.246	0.315	0.398	0.031
$\frac{SB_{current}}{SB_{current_{F=0}}}$	0.15	0.19	0.107	0.137	0.151	0.121
$\frac{SB_{latest}}{SB_{latest_{F=0}}}$	0.102	0.155	0.079	0.1	0.118	0.09
Steepness (h)	0.977	0.967	0.987	0.981	0.976	0.75

Table BET2. Comparison of reference points from the 2009 bigeye stock assessment considering six sensitivity analyses and the 2008 assessment.

Management Quantity	**2009 Assessment**	**2008 Assessment**
Most Recent Catch	134,315 mt (2008)	143,059 mt (2007)
MSY and MSY(recent R)	Range: 52,120 ~ 67,800 mt Range:110,000–146,114 mt	Base case: 64,600 mt Range: 56,800 ~ 65,520 mt
$F_{current}/F_{MSY}$	Range: 1.51 ~ 2.55	Base case: 1.44 Range: 1.33 ~ 2.09
$B_{current}/B_{MSY}$	Range: 1.11 ~ 1.55	Base case: 1.37 Range: 1.02 ~ 1.37
$SB_{current}/SB_{MSY}$	Range: 0.85 ~ 1.42	Base case: 1.19 Range: 0.76 ~ 1.20
$Y_{Fcurrent}/MSY$	Range: 0.12 ~ 0.92	Base case: 0.94 Range: 0.50 ~ 0.97
$B_{current}/B_{current, F=0}$	Range: 0.18 ~ 0.29	Base case: 0.26 Range: 0.20 ~ 0.28

Table BET3. Comparison of the F-related quantities for the six model runs for the 2009 bigeye stock assessment based on MSY-calculation time periods of 2003–2006 and 2004–2007.

	F_{mult}		$F_{current}/F_{MSY}$	
Run	**2003–2006**	**2004–2007**	**2003–2006**	**2004–2007**
run10	0.64	0.56	1.57	1.79
run11	0.75	0.66	1.34	1.51
run14	0.57	0.50	1.75	2.01
run15	0.61	0.54	1.64	1.86
run16	0.67	0.59	1.48	1.69
run19	0.44	0.39	2.25	2.55



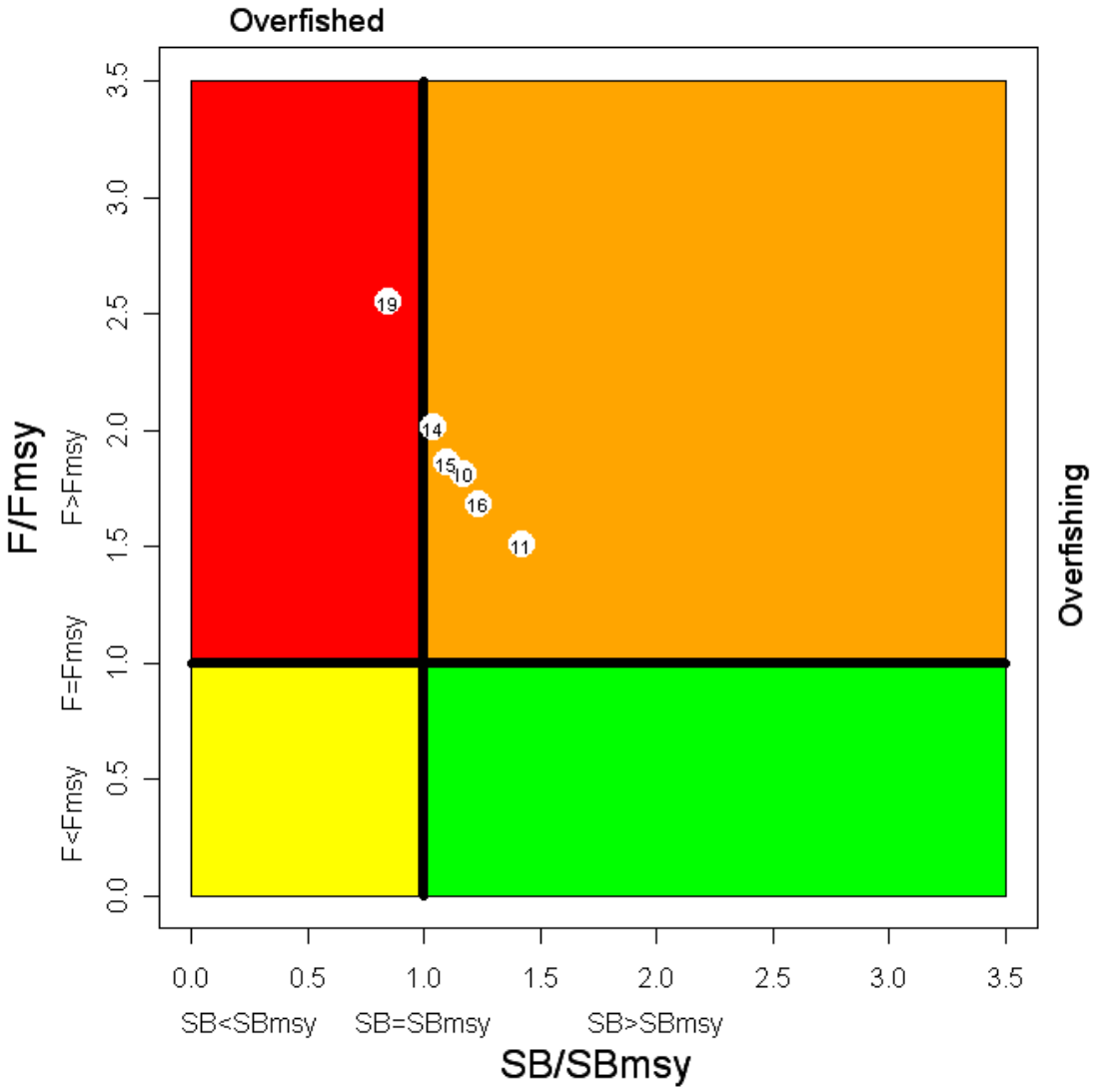


Figure BET5. A comparison of $\frac{SB_{current}}{SB_{MSY}}$ versus $\frac{F_{current}}{F_{MSY}}$ for selected model runs (denoted in the plot) based on MSY being calculated for the period 2004–2007 for $\frac{SB_{current}}{SB_{MSY}}$ with a spawning biomass reference period as year 2008 (top) and 2004–2007 (bottom).

Management recommendations

88. The SA-SWG deferred management recommendations on bigeye tuna to the SC5 plenary as recommendations should be formulated after appraisal of working paper on the Assessment of the Potential Implications of Application of CMM-2008-01 for Bigeye and Yellowfin Tuna (WCPFC-SC5-2009/GN-WP-17).

4.3 South Pacific Albacore Assessment

a. Summary of SC5-SA-WP-5

89. Keith Bigelow presented working paper SC5-SA-WP-5: "Standardized CPUE for distant–water fleets targeting South Pacific albacore".

90. South Pacific albacore is the only WCPFC species that is assessed with standardized CPUE indices constructed with operational data. The 2008 CPUE standardization using operational level data represented an improvement in constructing relative abundance indices for South Pacific albacore, though there was concern that some Taiwanese vessels had changed targeting from albacore to bigeye tuna since the late 1990s.

90 bis The objective of this study was to: i) incorporate operational data into the CPUE analysis in addition to data provided by vessels landing at the canneries (Pago Pago and Levuka); ii) statistically disaggregate albacore and bigeye tuna targeting operations using cluster analysis; and iii) apply traditional GLMs to the albacore targeted fishery to estimate relative abundance indices for assessment. A cluster analysis indicated two and three clusters for the Taiwanese fleet for periods 1990–1998 and 1999–2007. The albacore clusters based on longline set or trip had higher CPUE from 2004 to 2006 in comparison to using all Taiwanese data, although there was little difference in CPUE by clustering on set or trip. Differences between GLM nominal and standardized indices are more apparent in the low latitude regions (1 and 2) than at higher latitudes (3 and 4).

90 ter There was a rapid decline from the early 1960s until 1975 followed by a slower decline thereafter. In the 1990s, there was an increase in standardized CPUE in the west (regions 1 and 3), which was not evident in the east (regions 2 and 4). There was a decline in standardized CPUE for the Taiwanese distant-water fleet since 2000 that also occurred in most domestic Pacific Island fisheries. Depressed CPUE since 2002 results from a decline in population abundance and/or a yet unexplained change in South Pacific availability that affected the Taiwanese fleet and domestic Pacific Island fleets. The mean of year-quarter indices and their standard deviations were incorporated into the 2009 albacore assessment.

Discussion

91. There was discussion about relative merits of aggregated data versus set by set data. It was noted that set by set data allows use of operational data, which can correctly assign sets to target type even if the target changes during a trip. However, it was noted that operational data are not automatically released for some Members. Japanese scientists suggested a difficulty of the analysis of set-bt-set data without a good knowledge of the skipper effect and fleet communication. Concern was expressed that the effort associated with "failed sets" may be lost when clustering on individual longline set data. It was suggested that operational data should be made available for WCPFC.

b. Summary of SC5-SA-WP-6

92. Simon Hoyle presented working paper SC5-SA-WP6: "Stock assessment of albacore tuna in the South Pacific Ocean". The Executive Summary is as follows with several figures regarding stock status.

93. Since the last assessment, many of the model's underlying structural assumptions have been reviewed, with a focus on providing reliable estimates of population dynamics. This is a pre-requisite for providing useful management advice. Major changes to model data inputs and structure in the base case include:

94. An update of catch, effort, and size data to mid-2008; revised CPUE from a GLM for distant-water fishing nation (DWFN) longline fisheries; time-dependent variance in CPUE; changes to growth modelling; monthly data aggregation for troll fisheries; model timing changed to mid-year; time splits in longline selectivity and first age bias in troll selectivity; use of 0.75 rather than 0.9 for steepness; and catchability decline estimated for the initial stages of the fishery.

95. These changes have resulted in a more realistic and credible model that fits the data better. The problem with bias in the CPUE series that result from switches in targeting and which were identified in 2008 appears to have been largely resolved. The conflict between information in the CPUE and the longline length-frequency data remains, but its effects have been reduced. The new growth estimates fit the troll fishery length-frequency data well and are close to estimates derived from otoliths.

96. The main conclusions of the assessment are:

- Levels of stock size and *MSY* appear more realistic than in the 2008 assessment, because many sources of potential bias have been removed.
- However, moderate uncertainty remains about biomass and fishing mortality levels.
- Models that down-weight the length-frequency data (in order to rely on the index of abundance from the CPUE data), tend to give lower biomass relative to B_{MSY}, and higher fishing mortality relative to F_{MSY}, throughout the time series.
- There is considerable uncertainty about the early biomass trend, but this has negligible effect on the management parameters, or advice to managers regarding the status of the stock.
- Estimates of $F_{2005\text{-}2007}/F_{MSY}$ (from 0.1 to 0.5) and $SB_{2005\text{-}2007}$ / SB_{MSY} (from 1.7 to 4.9) are quite variable between model configurations, but all estimates indicate that overfishing is not occurring (i.e. $F_{2005\text{-}2007} < F_{MSY}$) and that the fishery is not in an overfished state (i.e. $SB_{2005\text{-}2007}$ is greater than SB_{MSY}.)
- Most of the variation in management parameters is attributable to the steepness of the stock recruitment relationship – something we have no information about. Alternative metrics such as the expected CPUE, relative to a target CPUE, may be both more relevant and more precise.
- There is no indication that current levels of catch are not sustainable in terms of recruitment overfishing, particularly given the age selectivity of the fisheries. However, current levels of fishing pressure appear to be affecting longline catch rates.

Discussion

97. FFA Members expressed thanks to SPC for the assessment and for the significant improvements that have been achieved both in terms of the model structure and the input data. FFA Members also thanked Member countries such as Chinese Taipei and the USA for the enhanced operational data available for the assessment, while also noting that there remain some issues that could be filled to the benefit of future assessments. FFA Members drew the conclusion that the assessment results reflect a more optimistic, yet realistic, state than the 2008 assessment.

98. There was some concern about allowing q to vary with time in the assessment model because control of q would allow arbitrary choice of outcome from assessment. It was clarified that q varies in MFCL by way of a constrained time series and therefore is not arbitrary. Time variation in q was mainly used to deal with the steep decline in CPUE early in the time frame, and in fact the current status is insensitive to whether time variation of q is used or not. The "stupid fish" hypothesis (such that individual fish in a virgin population would have higher catchability than fish in an exploited population whereby

fish may have learned through interaction with longlines) as an explanation of declining q was not universally accepted by the delegates. It was noted that a study of fish behavior and the early fishery characteristics to inform this assumption would be beneficial but very difficult to achieve.

99. In reference to the observed early decline in CPUE, it was noted that while the q assumption did not change F or B reference points, it did alter the estimate of B0, and therefore negated the use of depletion (Bcurrent/Bt=0) as reference point. However, it was also noted fishery impact (Bcurrent/BF=0) is an indicator of depletion from what biomass would currently be in absence of fishing and is not sensitive to variation in q.

100. Several CCMs noted the importance of oceanographic data to be included in the stock assessment and for it to be matched at a similar spatial scale to the fishery data that is being used. The chair noted that there was an attempt to use fine scale oceanographic information as part of the CPUE standardization process, but these attempts were unfortunately unsuccessful. This was identified as a potential future inclusion, either directly or through additional work on platforms such as SEPODYM.

Stock status for south Pacific albacore

101. The 2009 assessment results differ moderately from results from the 2008 assessment (Tables ALB1−2), due to the aforementioned changes in relative abundance indices, splits in selectivity, assumed values of steepness and changes in growth modeling. These changes have resulted in a more realistic and credible model which fits the data better.

102. Time trends in estimated recruitment, biomass, fishing mortality and depletion are shown in Figures ALB1−4, and Table ALB2 compares reference points between the 2009 and 2008 assessments. The key conclusions of the models presented indicate that overfishing is not occurring and the stock is not in an overfished state (Fig. ALB5). Reference point levels estimated in the 2009 assessment were more optimistic than the 2008 assessment and depletion was moderate at ~26%.

Table ALB1: Estimates and 90% distributions of management quantities from the uncertainty analysis. For comparison, results are given from the base case, and the sensitivity analysis with minimal weight given to the length-frequency data. The highlighted rows are ratios of comparable quantities at the same point in time (black shading) and ratios of comparable equilibrium quantities (grey shading).

Management quantity	Units	Median	5%	95%
$C_{2005\text{-}2007}$	mt	65,801	64,605	66,694
$YF_{2005\text{-}2007}$	mt / year	235,820	212,480	260,640
MSY	mt / year	81,580	58,683	121,855
$YF_{2005\text{-}2007} / MSY$		0.72	0.52	0.92
$C_{2005\text{-}2007} / MSY$		0.80	0.54	1.13
F_{MSY}		0.16	0.12	0.20
$F_{2005\text{-}2007} / F_{MSY}$		0.29	0.11	0.60
B_0	mt	1,098,500	868,050	1,408,900
B_{MSY}	mt	553,200	393,660	734,600
B_{MSY} / B_0		0.49	0.45	0.54
$B_{2005\text{-}2007}$	mt	863,665	619,316	1,106,590
$BF_{2005\text{-}2007}$	mt	836,300	553,100	1,171,900
$B_{2005\text{-}2007}F_0$	mt	1,084,933	875,645	1,300,042
SB_0		406,600	356,140	510,450
SB_{MSY}		101,700	56,841	143,645
SB_{MSY} / SB_0		0.24	0.14	0.32
SB_{2007}		236,793	191,966	317,931
SBF_{2007}		235,250	177,010	335,705
$SB_{2007}F_0$		390,193	355,893	463,218
$B_{2005\text{-}2007} / B_0$		0.76	0.69	0.83
$BF_{2005\text{-}2007} / B_0$		0.74	0.62	0.83
$B_{2005\text{-}2007} / B_{MSY}$		1.53	1.41	1.69
$BF_{2005\text{-}2007} / B_{MSY}$		1.49	1.27	1.68
$B_{2005\text{-}2007} / B_{2005\text{-}2007}F_0$		0.80	0.71	0.85
SB_{2007} / SB_0		0.60	0.52	0.66
SBF_{2007} / SB_0		0.59	0.48	0.68
SB_{2007} / SB_{MSY}		2.44	1.69	4.46
SBF_{2007} / SB_{MSY}		2.36	1.49	4.56
$SB_{2007} / SB_{2007}F_0$		0.64	0.53	0.71

Table ALB2: Estimates of reference points from the 2009 and 2008 South Pacific albacore tuna stock assessments (WCPFC and IATTC RFMO regions). The ranges shown for 2008 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 nor be considered as confidence intervals.

Management Quantity	2009 Assessment	2008 Assessment
Most Recent Catch	51,9672 mt (2008[1])	59,495 mt (2007[1])60,440 mt (2005[1])
MSY	Median = 65,801 mt Base case: 64,000 mt Range: 64,000 ~ 75,000 mt	Base case: 64,000 mt Range: 64,000 ~ 75,000 mt Base case: 180,800 mt Range: 90,080 ~ 201,800 mt
$\mathbf{F_{current}/F_{MSY}}$	Median = 0.29 Base case: 0.44 Range: 0.25 ~ 0.44	Base case: 0.44 Range: 0.25 ~ 0.44 Base case: 0.04 Range: 0.03 ~ 0.11
$\mathbf{B_{current}/B_{MSY}}$	Median = 1.53 Base case: 1.26 Range: 1.26 ~ 1.50	Base case: 1.26 Range: 1.26 ~ 1.50 Base case: 1.34 Range: 1.13 ~ 1.48
$\mathbf{SB_{current}/SB_{MSY}}$	Median = 2.44 Base case: 2.21 Range: 2.21 ~ 2.90	Base case: 2.21 Range: 2.21 ~ 2.90Base case: 4.10 Range: 2.86 ~ 6.11
$\mathbf{Y_{Fcurrent}/MSY}$	Median = 0.72 Base case: 0.86 Range: 0.72 ~ 0.86	Base case: 0.86 Range: 0.72 ~ 0.86 Base case: 0.33 Range: 0.28 ~ 0.59
$\mathbf{B_{current}/B_{current,\ F=0}}$	Median = 0.74 Base case: 0.70 Range: 0.70 ~ 0.77	Base case: 0.70 Range: 0.70 ~ 0.77 Base case: 0.91 Range: 0.79 ~ 0.93

[1] entire South Pacific Ocean

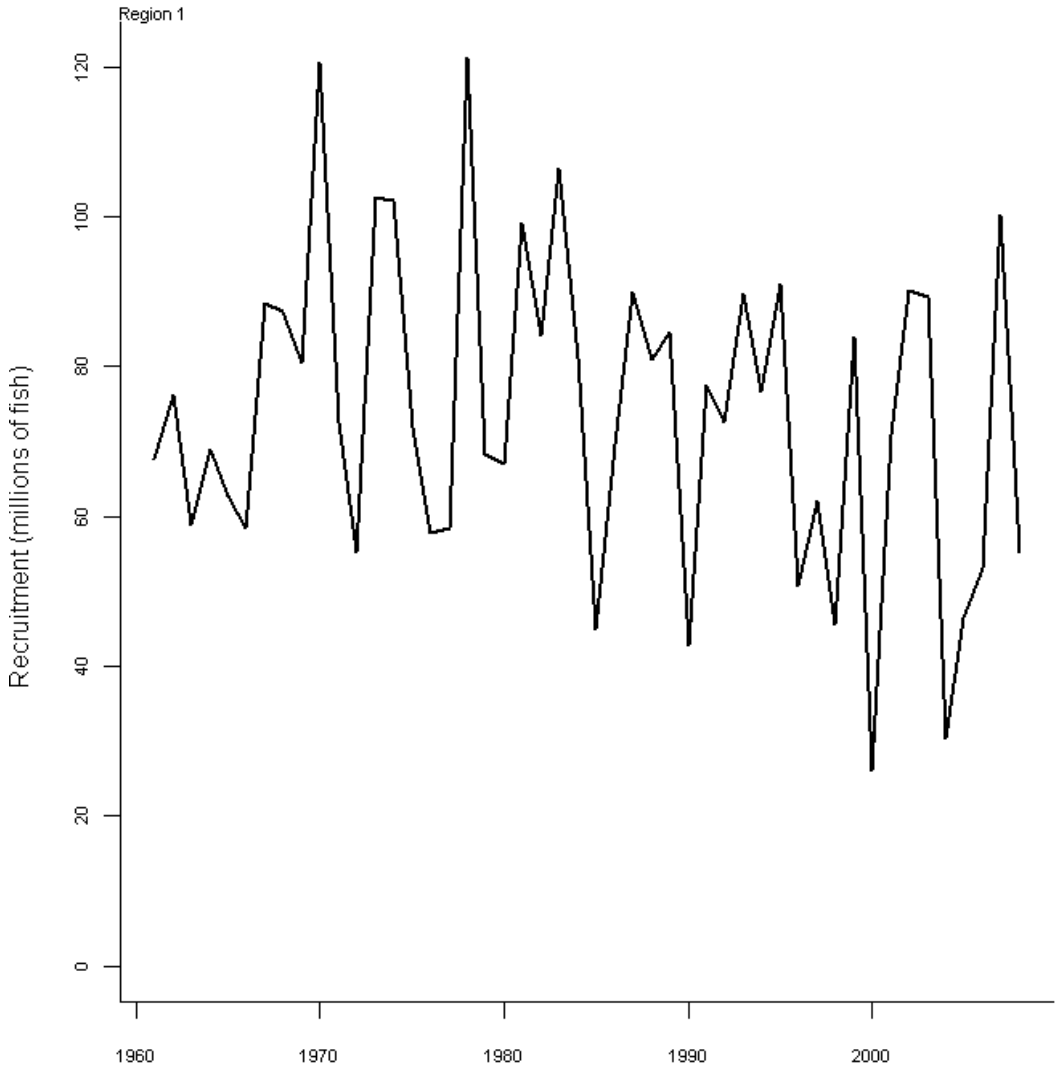


Figure ALB1: Annual recruitment (number of fish) estimates from the one region model. The shaded area indicates the approximate 95% confidence intervals.

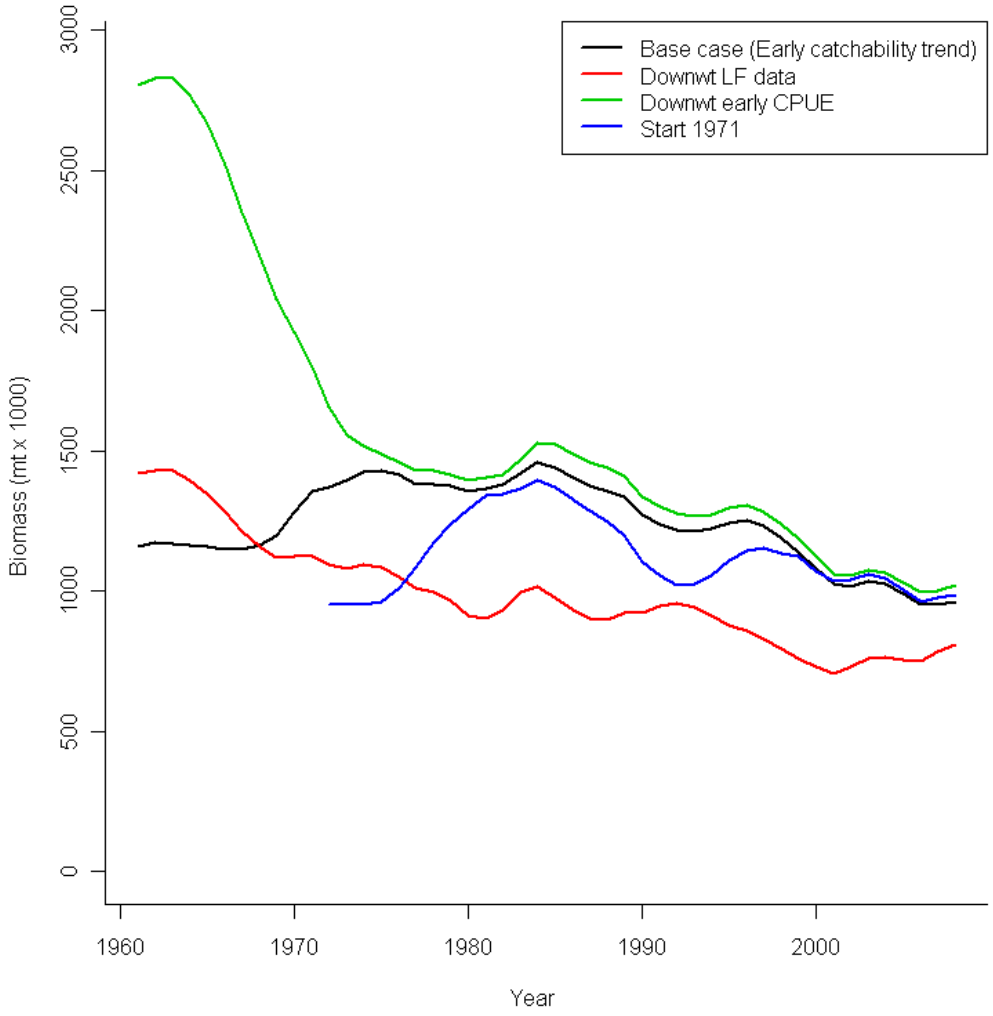


Figure ALB2: Annual estimates of total biomass (thousands of metric tonnes). Several scenarios are shown to illustrate that a) early biomass is particularly uncertain, and b) the recent biomass trend is better established than the absolute level.

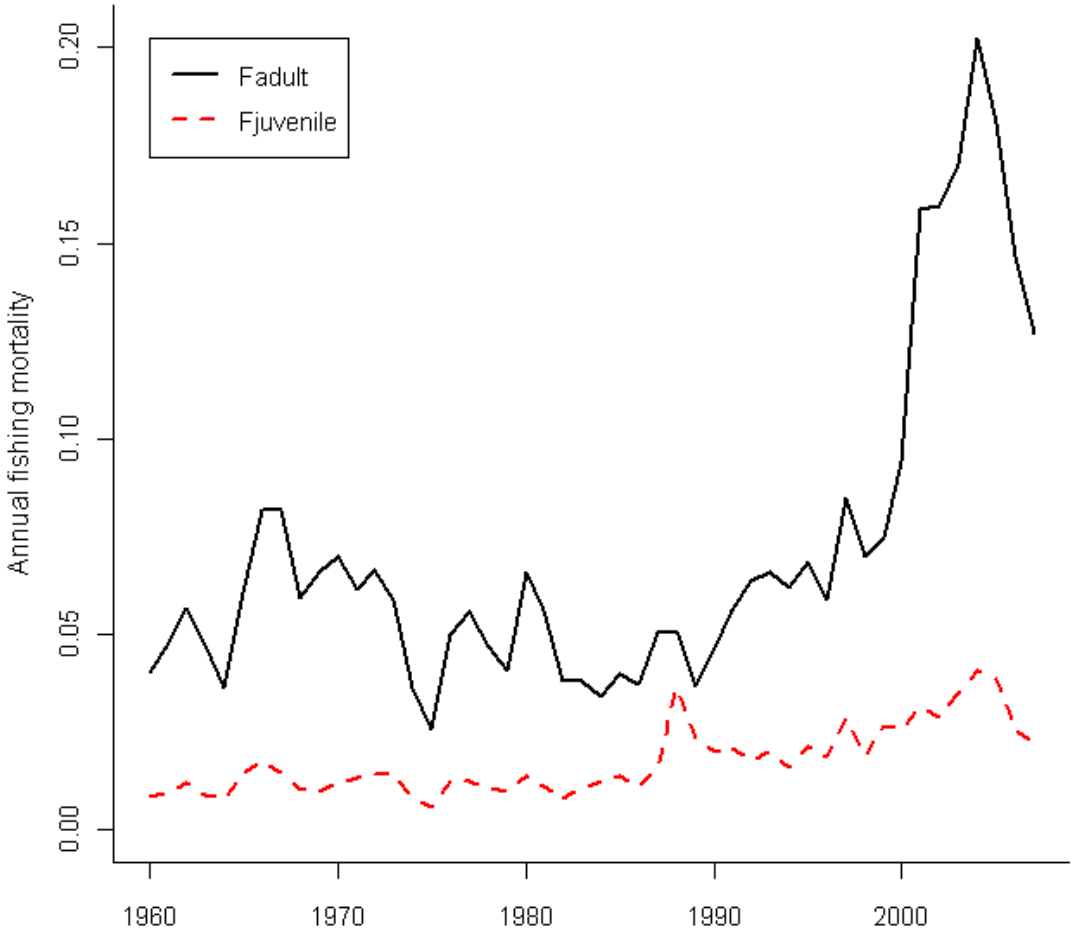


Figure ALB3: Annual estimates of fishing mortality for juvenile and adult South Pacific albacore.

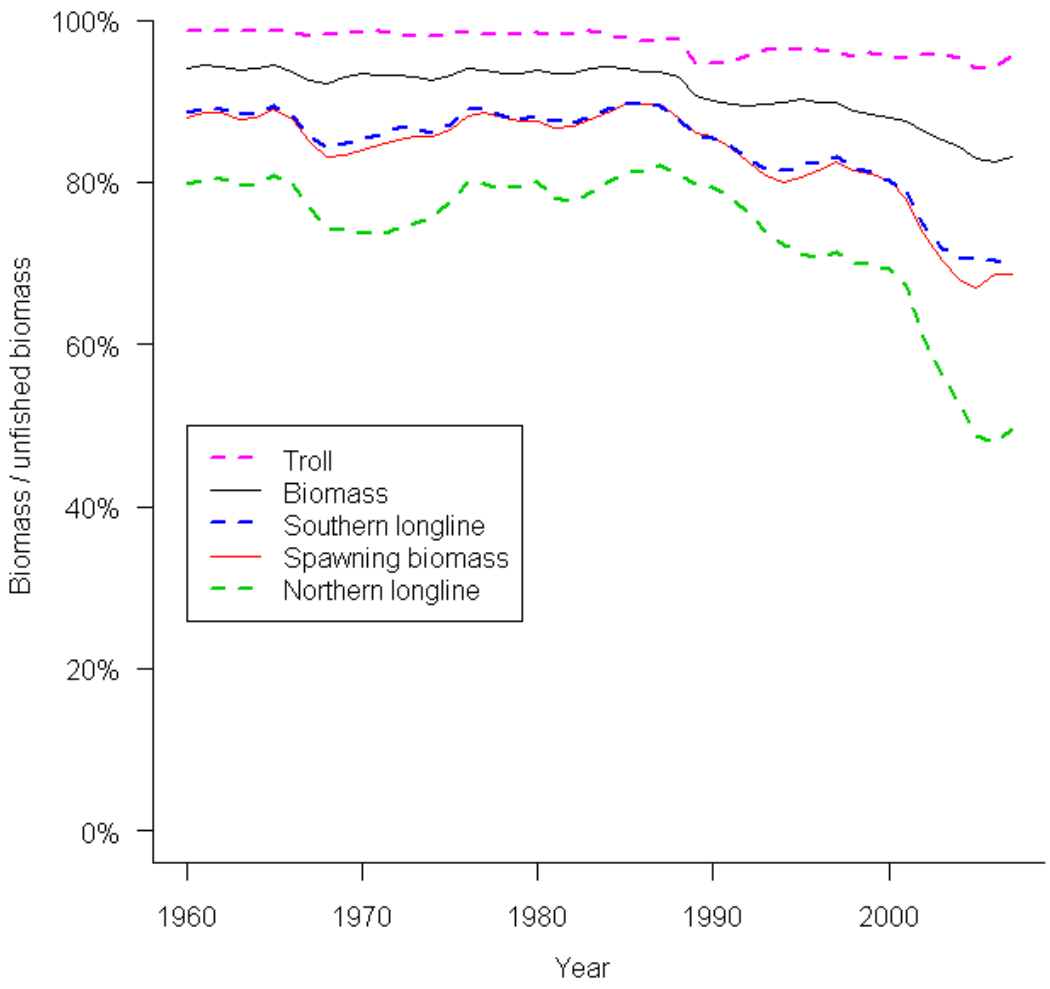


Figure ALB4: Decline in biomass due to the impact of fishing mortality, for exploitable biomass in the troll, southern longline, and northern longline fisheries, for total biomass and for spawning biomass.

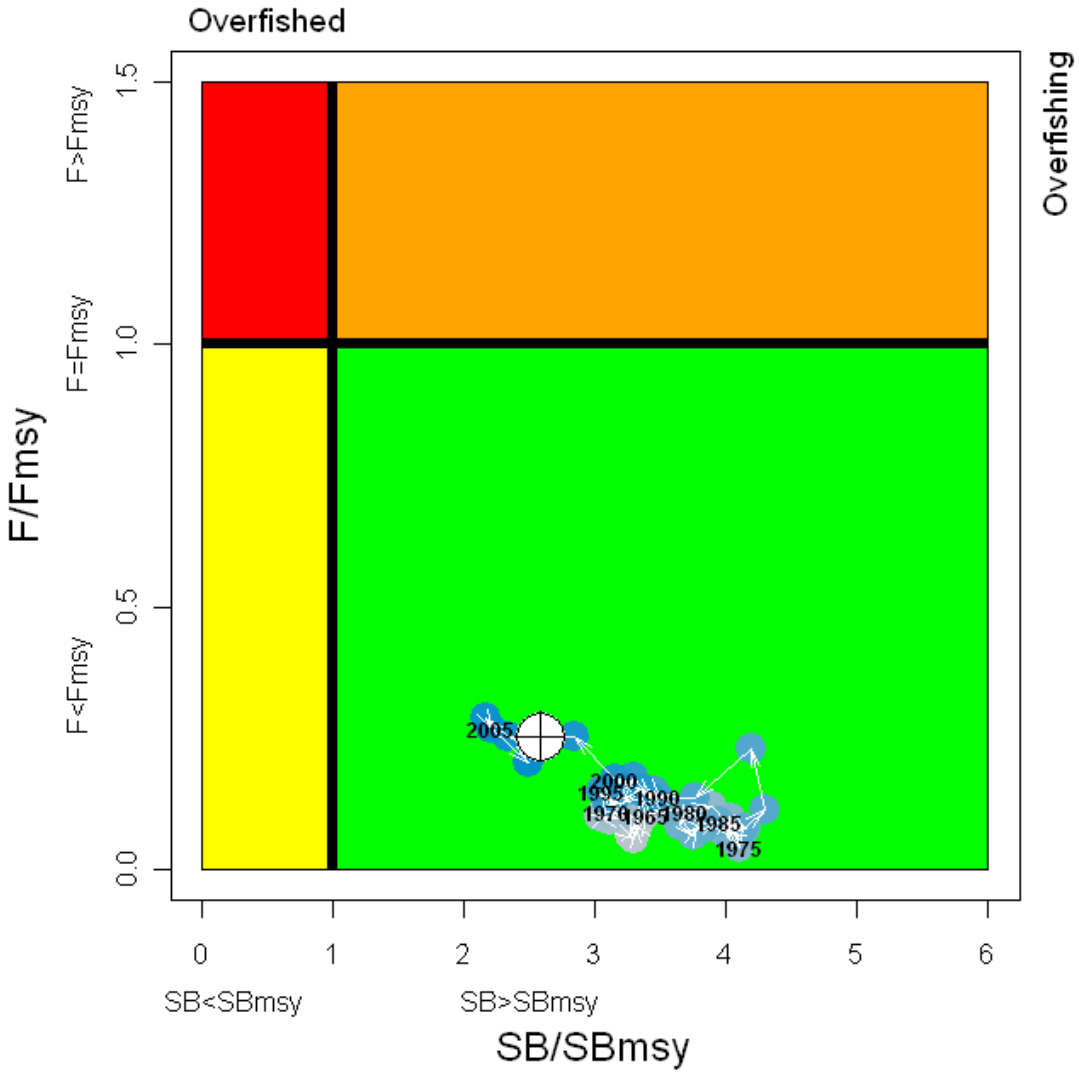


Figure ALB5: Temporal trend in annual stock status, relative to SB_{MSY} (x-axis) and F_{MSY} (y-axis) reference points, for the model period (starting in 1960). The color of the points is graduated from pale blue (1960) to blue (2007), and points are labelled at five-year intervals. The last year of the model (2008) is excluded because it is highly uncertain.

Management recommendations

103. The current assessment resulted in more realistic levels of stock size and *MSY* with a credible model with many sources of potential bias being removed. There is considerable uncertainty about the early trend in biomass, though the trend has a negligible effect on management advice. Estimates indicate that overfishing is not occurring and that the fishery is not in an overfished state. There is no indication that current levels of catch are not sustainable with regard to recruitment overfishing; however, current levels of fishing mortality may be affecting longline catch rates on adult albacore.

4.4 Model Development

a) Summary of SC5-SA-WP-7

104. Zane Zhang presented working paper SC5-SA-WP7: "Generalized Linear Bayesian Models for Standardization of CPUE with Incorporation of Spatial-Temporal Variations". This paper explores the use of three generalized linear Bayesian models (lognormal, Delta lognormal, and zero-inflated lognormal) for standardizing CPUE. The lognormal model has both hierarchical and non-hierarchical forms, whereas the Delta and zero-inflated models were constructed in a hierarchical format only. The hierarchical models enable abundance indices to be estimated with the incorporation of predicted catch rates for un-fished areas, mitigating problems in abundance index estimation due to spatial contraction in fishing patterns.

105. The models were tested on the Japanese longline catch and effort data for the South Pacific albacore stock using year, season, area, depth, and interaction of year and area as explanatory variables for CPUE standardization. The lognormal model fits the data better than either the Delta or Zero-inflated model, and the hierarchical lognormal model is better than the non-hierarchical lognormal model based on the coefficient of determination (R^2 = 0.48) and deviance information criterion (DIC). The estimated abundance indices were similar to the nominal catch rates in the early years, but were significantly lower in the later years, indicating that the impact of area, season, depth, and the interaction term on catch rates was removed through the standardization process. The abundance indices estimated with the incorporation of predicted catch rates for un-fished areas are consistently lower than those without such incorporation for the later years, whereas both abundance indices appear to be similar in the early years, suggesting that possible spatial contraction in albacore fishing patterns by the Japanese longline fleet has been somewhat removed.

106. All of the explanatory variables were significant in explaining variation in catch rates based on DIC. The season variable is of more importance for the model fitting than the depth variable, which is only approximated by hooks-per-basket, and the interaction between year and area on catch rates is more important than either season or depth in explaining variations in catch rates.

Discussion

107. The meeting requested clarification of the difference between combined and uncombined data. It was explained that "combined" data were constructed by aggregating the individual observations within a cell (time, area, season) and this was used as a way of removing zero catches from the data set.

108. The hierarchical models were investigated as a potential method to account for potential biases that may be introduced in CPUE indices derived for a fishery that has a spatial contraction. The hierarchical model uses estimate from overall distribution of the interaction between year and area to predict the CPUE in unfished cells. The resulting CPUE indices were generally lower when the prediction of the non fished cells was included. It was considered that the approach may mitigate some of the problems related to spatial contraction of the distribution of the fish.

109. It was noted that a large number of spatial cells were included in model. Some useful diagnostics of the analysis would be to report the number of cells that were fished in a given year and therefore the number of cells for which the model is making a prediction.

110. There was some discussion about the possible alternative trends in fish abundance in unfished cells depending on such factors as local depletion and the movement dynamics of the species concerned. The CPUE indices will be sensitive to these assumptions and it was unclear whether the predictions of CPUE for the unfished cells were consistent with these hypotheses.

b. Summary of SC5-SA-WP-8

111. Ann Preece presented working paper SC5-SA-WP8: "Management strategy evaluation for Australia's east coast tuna and billfish fishery: Progress update". Australia's Harvest Strategy Policy requires fisheries under the control of the Australian Commonwealth Government be managed by harvest strategies (HS) that lead to sustainable stocks and maximize economic productivity. Harvest strategies generally include the decision rule and the data and methods used to calculate recommended future management actions (e.g. changes to catch or effort). The Australian HS policy states that management strategy evaluation (MSE) should be used to test the performance of alternative HS with respect to risk, biomass targets and limit reference points.

112. The Eastern Tuna and Billfish Fishery (ETBF) operates on the East Coast of Australia. The catch consists of five main species (yellowfin, bigeye, albacore, swordfish and striped marlin). Using the agreed framework for the harvest strategy for the ETBF, we have evaluated a range of alternative HS specifications that adjust future Australian catches, using simulation operating models. These operating models were initialised using population parameter estimates from Western and Central Pacific Fishery Commission (WCPFC) stock assessments, and encompass a wide range of uncertainties.

113. For each species, the performances of the various individual HS are shown as tradeoffs between biological risk and average catches and catch rates. On the basis of these comparisons, industry and management representatives have selected a harvest strategy specification for each species and these will be implemented in the ETBF in Nov 2009. This paper reports on operating model development and HS evaluations to date. The results so far indicate that the performance of the HS will be determined by a number of species-specific fishery characteristics (e.g. stock structure, life history parameters, and the actions of international fleets), such that Australian domestic actions may have considerable capacity to effectively manage some species (swordfish and striped marlin), while unilateral domestic management actions might be largely ineffective for other species (e.g. bigeye and yellowfin).

Discussion

114. The presenter clarified a number of items in the paper and responded to several requests on the utility of MSE in general.

5. RESPONSES TO COMMISSION'S REQUESTS

115. No Commission requests were provided from WCPFC5 to the SA-SWG, noting that SA-SWG SA outputs will be directly relevant to the impending review of CMM 2008-01.

6. RESEARCH PLANNING

a. Short- and medium-term research plan

116. 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 into assessments.

117. General medium- and long-term research priorities:

- Research into alternative fishing mortality and biomass based reference points that are less reliant on the *MSY* concept;

- Further studies are required to refine estimates of growth, natural mortality and reproductive potential, incorporating consideration of spatio-temporal variation and sexual dimorphism;
- Consideration of size-based selectivity processes in the assessment model;
- Further development of the methodology and data sets to be used in deriving CPUE abundance indices for the longline fishery;
- Collaborative research between scientists from Japan, Chinese Taipei and SPC, to further study and possibly quantify temporal changes in longline catchability;
- Exploration of alternate hypotheses which might explain the early declines in longline CPUE, and allow for consideration of those hypotheses in structural uncertainty analyses.

- Non-stock assessment related activities

  Improved estimates of growth, including variability in length at age;

  Increased confidence in the levels and species composition of catches from the domestic fisheries of Indonesia and the Philippines; and

  Improved estimates of the catches from purse-seine fisheries, based on sampling programmes that address known biases (e.g. Lawson 2009).

b. Yellowfin and bigeye tuna research priorities

118. Yellowfin and bigeye tuna research priorities include:
- Collection of age frequency data by scientists from the commercial catch in order to improve current estimates of the population age structure;
- Further refinement of catch estimates from a number of key fisheries, particularly those catching large quantities of small yellowfin and bigeye;
- Development of approaches to integrate the recent tag release/recapture data into the assessment model.
- Research into sex specific size at age for tropical tunas to assist in the refinement of current estimates of growth and spawning potential
- Continued collection of paired samples (grab and spill) over broad spatial and temporal strata from the purse-seine fishery, and from other school associations, particularly unassociated schools, throughout the fishery was strongly supported.
- Investigate methodologies to better estimate historic catches of tropical tuna species pertaining to the period prior to the collection of observer data (or at least since FAD fishing started).

119. Items specific to the next full bigeye tuna assessment include:
- Further examination of all size frequency data should be undertaken, and the splitting of fisheries should be considered (e.g. LL-ALL 2 and potentially splitting the TWN distant-water longline fleet out from the LL-ALL fisheries);
- A thorough examination of all time series included for region 3 and then conducting a structural sensitivity analyses to determine the key data sources or structural assumptions leading to the various trends in estimated quantities (e.g. recruitment and effort deviates); and
- Incorporation of new tagging data, if available. Further, if data for the central Pacific tagging is available for inclusion, then the Pacific-wide assessment should be updated in collaboration with IATTC.

120. Items for bigeye assessments in the medium term include:

a) Noting the strong trends in recruitment estimated for many regions in both the bigeye and yellowfin stock assessments, an operating model should be used to create simulated data sets that can be used within to examine the potential trends in model estimates that can come about through incorrect model assumptions, such as movement and age-specific natural mortality;

b) The effects on longline catch rates, of the fine scale population spatial distribution that determines the availability of fish to the fishery. This may be examined using the spatial

ecosystem and population dynamics model (SEAPODYM) currently being developed. This would include an examination of CPUE indices in model regions 2 and 3; and

c) Consideration be given as to the best approach to estimate uncertainty in key model outputs (e.g. biomass trajectories and stock status).

c. Skipjack tuna research priorities

121. Items specific to the skipjack stock assessment include:

a) Consider both WCPO assessment and tropical regions; and
b) Collaboration between Japan and SPC on skipjack tagging information. and CPUE standardization of pole-and-line data.

d. Model development

122. Model developments specific to the next full albacore assessment include:

a) Thoroughly investigate the length-frequency data in order to resolve the data conflicts which continue to affect the model, and may be biasing abundance estimates.
b) An integrated assessment of North and South Pacific albacore would be beneficial. While separate northern and southern stocks should be maintained as the fundamental stock structure hypothesis, such an integrated assessment may improve the assessment of both stocks because of enhanced overall information on stock dynamics and sharing of common biological characteristics.
c) Adjust the spatial definitions of fisheries to take spatial size variation within regions into account.
d) Models with separate regional sub-populations should be explored.

7. ADMINISRATIVE MATTERS

123. There was a request for a co-convener for the SA-SWG. No nomination was put forth at this time.

8. OTHER MATTERS

124. No other matters were raised by the SA-SWG.

9. ADOPTION OF REPORT

125. The SA report was adopted on August 17, 2009.

10. CLOSE OF MEETING

126. In closing the meeting, the convener thanked SWG participants, presenters and rapporteurs for their contributions.

Attachment L, Appendix 1

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

Scientific Committee
Fifth Regular Session

Vila, Vanuatu
10–21 August 2009

AGENDA FOR THE STOCK ASSESSMENT SPECIALIST WORKING GROUP

1. Opening of Meeting

2. Confirmation of SA-SWG co-convener and selection of rapporteurs

3. Adoption of agenda

4. Stock Assessments

4.1. Yellowfin Tuna Stock Assessment

SA WP−1: S. Hoyle. CPUE standardization for bigeye and yellowfin in the western and central Pacific Ocean. SPC, Noumea, New Caledonia.

SA WP−2: Chang, S-K. [1], S. Hoyle [2] and H-I Liu. [1]. Yellowfin CPUE standardization for Taiwanese distant-water longline fishery in the WCPO - with emphasis on target change. [1] Institute of Marine Affairs, Kaohsiung, Taiwan, [2] SPC, Noumea, New Caledonia.

SA WP−3: Langley, A. [1], S. Harley [2], S. Hoyle [2], N. Davies [2], J. Hampton [2] and P. Kleiber [3]. Stock assessment of yellowfin tuna in the western and central Pacific Ocean. [1] SPC consultant, [2] SPC, Noumea, New Caledonia. [3] NOAA Fisheries, PIFSC, Hawaii, USA.

4.2. Bigeye Assessment

SA WP−4: Harley, S. [1], S. Hoyle [1], A. Langley, A. [2], J. Hampton [1] and P. Kleiber [3]. Stock assessment of bigeye tuna in the western and central Pacific Ocean. [1] SPC, Noumea, New Caledonia, [2] SPC consultant, [3] NOAA Fisheries, PIFSC, Hawaii, USA.

4.3. South Pacific Albacore Assessment

SA WP−5: Bigelow, K. [1] and S. Hoyle [2], Standardized CPUE for distant–water fleets targeting south Pacific albacore. [1] NOAA Fisheries, PIFSC, Hawaii, USA [2] SPC, Noumea, New Caledonia.

SA WP−6: Hoyle, S. and N. Davies. Stock assessment of albacore tuna in the south Pacific Ocean. SPC, Noumea, New Caledonia.

4.4. Model Development

SA WP−7: Zhang, Z. and J. Holmes. Generalized Linear Bayesian Models for Standardization of CPUE with Incorporation of Spatial-Temporal Variations. Pacific Biological Station, British Columbia, Canada.

SA WP−8: Preece, A., D. Kolody, C. Davies and J. Hartog. Management strategy evaluation for Australia's east coast tuna and billfish fishery: progress update. CSIRO, Tasmania, Australia.

Information Papers

SA IP–1: Harley, S., N. Davies, and S. Hoyle. *Report from the SPC pre–assessment workshop*, Noumea, April 2009. SPC, Noumea, New Caledonia.

SA IP–2: Harley, S. *Spatial distribution measures for the analysis of longline catch and effort data*. SPC, Noumea, New Caledonia.

SA IP–3: Harley, S., S. Hoyle and F. Bouyé. *General structural sensitivity analysis for the yellowfin tuna stock assessment*. SPC, Noumea, New Caledonia.

SA IP–4: Davies, N. and S. Hoyle. *General structural sensitivity analysis for the albacore tuna stock assessment in the south Pacific Ocean*. SPC, Noumea, New Caledonia.

SA IP–5: Bromhead, D. [1], S. Hoyle [1], A. Williams [1], S-B Wang [2], and S-K Chang [2]. *Factors influencing the size of albacore tuna sampled from the South Pacific albacore longline fisheries*. [1] SPC, Noumea, New Caledonia, [2] Institute of Marine Affairs, Kaohsiung, Taiwan, [3] College of Marine Science, Kaohsiung, Taiwan

SA IP–6: Campbell, R. *Distribution of albacore tuna size by depth within the Australian eastern tuna and billfish fishery*. , Tasmania, Australia.

SA IP–7: Hoyle, S. [1], D. Fournier [2], P. Kleiber [3], J. Hampton, F. Bouyé, [1], N. Davies [1], and S. Harley [1]. Update of recent developments in Multifcan-CL and related software for stock assessment. [1] SPC, Noumea, New Caledonia, [2] Otter Research Ltd, [3] NOAA Fisheries, PIFSC, Hawaii, USA

5. Responses to the Commission's requests

6. Research Planning

7. Administrative Matters

8. Other Matters

9. Adoption of Report

10. Close of Meeting

Attachment M

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

Scientific Committee
Fifth Regular Session

Port Vila, Vanuatu
10–21 August 2009

BIGEYE PROJECTIONS FOR WCPFC6 TO BE CONDUCTED BY THE SCIENCE SERVICES PROVIDER

Background

Previous analysis of potential management option (e.g. TCC paper) was based on evaluating fishery-specific fishing mortality changes though a yield-based framework. Due to the complex nature of CMM-2008-01 (e.g. a mixture of catch and effort limits, time/area closures, and stepped reductions), this approach was no longer considered sufficient to provide the detailed investigation of management measures requested by the Commission.

In response, SPC developed the capacity within MULTIFAN-CL in order to undertake mixed catch and effort projections. While these analyses are more demanding in terms of the time required to prepare the projection data sets, in particular the stepped reductions, we feel that the additional work is warranted to more accurately reflect the provisions in CMM-2008-01. The first consideration of this approach is described in GN-WP-17.

Requests from SC

Following the presentation of GN-WP-17 at SC-5, the general requests for additional information were requested:

1. Further presentation of the outputs of the projections, in particular spawning biomass trajectories and predicted catches;
2. Examination of the impacts of various exemptions and "special" provisions in CMM2008-01; and
3. Examination of the predicted impacts of additions/ changes to CMM-2008-01 provisions
4. Inclusion of skipjack.

In order to meet these information needs, the following analyses were requested.

Further outputs

The following outputs could be made available:

- Predicted annual catches by broad fisheries groups (see fishery definitions in Table 2 of the bigeye assessment report)
- Total spawning biomass

In addition some plots of regional biomass trends and projected fishery impact plots could be included in future reports.

Exemptions and special provisions

Repeat of some of the scenarios presented in CMM2008-01 (maybe just 5 and 6), with the following exemptions and provisions excluded to illustrate their impacts (one at a time and then combined)[4]:

- Longline
  - No 2,000 mt limit for the longline catch reductions (e.g. reductions for all longline from 2001-04 or 2004)
  - Remove exemptions for the Hawaiian and Chinese longline fleets
- Purse seine
  - Effort at 2004 levels for all fleets (including archipelagic waters)
  - Remove archipelagic waters exemption
  - Removal of the "existing arrangements" provision
  - FAD closure includes archipelagic waters in Indonesia
  - Appropriate domestic Philippines purse-seine fleet
- Other fisheries
  - Set catches and or effort for all other fisheries to 2001–2004 or 2004 levels

CMM-2008-01 alternatives

In order to examine potential impact of strengthening CMM2008-01, the following be included from 2010 in the projections:

- Longline (with and without all longline exemptions)
  - 40–100% reductions in longline catches over 2009–2011
- Purse seine (with and without all PS exemptions)
  - 4–12 month FAD closures
  - Percentage reductions in effort from 2004 levels
- Other fisheries
  - Percentage reductions in catch and effort from 2004 levels

[4] Some of the scenarios below might be redundant (i.e. covered by another scenario)

Attachment N

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

Scientific Committee
Fifth Regular Session

Port Vila, Vanuatu
10–21 August 2009

HANDLING OF TURTLES ENTANGLED BY LONGLINE GEAR

The point of this guidance is to encourage removal of as much line as possible before the turtle is free to swim away.

Visually assess whether the turtle is **hooked or entangled**. If it is entangled then the following steps should be followed, depending on whether the turtle is **dead or alive**. Note that it may be difficult to tell if the turtle is dead or alive when it is still in the water.

(1) Turtle looks dead and is too big to bring onboard:
If the turtle is too **big** to bring onboard, cut loose as much of the tangled lines as possible using a line cutter.

(2) Turtle is alive but too big to bring onboard:
Visually assess if the turtle is:

A) Entangled only: use the line cutter to cut off the tangled lines in the water.

B) Entangled and hooked externally: remove the hook if possible and then use the line cutter to cut off the tangled lines in the water.

C) Entangled and hooked internally: follow the established procedure for handling a hooked turtle.

D) Entangled turtle (heavily entangled): a gaff may be used to restrain the turtle by the tangled lines. Use the line cutter to cut off the tangled lines in the water, taking care not to cut the lines that are used to control the turtle before other lines have been cut and removed. More than one person may be required to assist, in order to prevent the turtle swimming away while still tangled.

(3) Turtle is small enough to be brought onboard:
If the turtle is **alive** then established guidelines should be applied (comatose handling, revival, and release). If it is **dead**, it should be brought on board to be measured and identified.

No other comments were received. The SC recommended that the WCPFC Guidelines for the Handling of Sea Turtles, including the above text on entanglement, be forwarded to the Commission for approval.

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

Scientific Committee
Fifth Regular Session

Port Vila, Vanuatu
10–21 August 2009

REVISED MEMORANDUM OF UNDERSTANDING BETWEEN THE COMMISSION FOR THE CONSERVATION AND MANAGEMENT OF HIGHLY MIGRATORY FISH STOCKS IN THE WESTERN AND CENTRAL PACIFIC OCEAN AND THE SECRETARIAT OF THE PACIFIC COMMUNITY

The Commission for the Conservation and Management of Highly Migratory Fish Stocks in the Western and Central Pacific Ocean (hereinafter referred to as "the Western and Central Pacific Fisheries Commission" or "the Commission") and the Secretariat of the Pacific Community (hereinafter referred to as "the SPC"):

Recognizing that the Commission is required to, *inter alia*:

- adopt measures to ensure long-term sustainability of highly migratory fish stocks in its Convention Area and promote the objective of their optimum utilization;
- ensure that such measures are based on the best scientific evidence available and are designed to maintain or restore stocks at levels capable of producing maximum sustainable yield, as qualified by relevant environmental and economic factors, including the special requirements of developing States in the Convention Area, particularly small island developing States, and taking into account fishing patterns, the interdependence of stocks and any generally recommended international minimum standards, whether subregional, regional, or global;
- assess the impacts of fishing, other human activities and environmental factors on target stocks, non-target species, and species belonging to the same ecosystem or dependent upon or associated with the target stocks;
- adopt measures to minimize waste, discards, catch by lost or abandoned gear, pollution originating from fishing vessels, catch of non-target species, both fish and non-fish species (hereinafter referred to as non-target species) and impacts on associated or dependent species, in particular endangered species and promote the development and use of selective, environmentally safe and cost-effective fishing gear and techniques;
- protect biodiversity in the marine environment;
- take measures to prevent or eliminate over-fishing and excess fishing capacity and to ensure that levels of fishing effort do not exceed those commensurate with the sustainable use of fishery resources;
- collect and share, in a timely manner, complete and accurate data concerning fishing activities on, *inter alia*, vessel position, catch of target and non-target species and fishing effort, as well as information from national and international research programs;
- establish a committee (the Scientific Committee) to ensure that the Commission obtains for its consideration the best scientific information available through review of research results,

encouraging and promoting cooperation in scientific research and assessing status of target or non-target stocks of interest;

- establish a committee (the Technical and Compliance Committee), that is required to collaborate with the Scientific Committee in providing advice and making recommendations to the Commission on conservation and management measures; and
- establish a committee (the Northern Committee) to make recommendations on the implementation of such conservation and management measures as may be adopted by the Commission for the area north of the 20° parallel of north latitude and on the formulation of such measures in respect of stocks which occur mostly in this area;

Noting also that the Commission:

- may engage the services of scientific experts to provide information and advice on the fishery resources covered by its Convention and related matters that may be relevant to the conservation and management of those resources;
- may enter into administrative and financial arrangements to utilise scientific services for this purpose; and
- in order to carry out its functions in a cost-effective manner, shall, to the greatest extent possible, utilise the services of existing regional organizations and shall consult, as appropriate, with any other fisheries management, technical or scientific organization with expertise in matters related to the work of the Commission;

Recognizing that the SPC, through the work of its Oceanic Fisheries Programme (hereinafter referred to as "the OFP"), seeks to:

- ensure that regional and national fisheries management authorities in its region of competence have access to high-quality scientific information and advice on the status of, and fishery impacts on, stocks targeted or otherwise impacted by regional oceanic fisheries;
- ensure that regional and national fisheries management authorities within its region of competence have access to accurate and comprehensive scientific data on fisheries targeting the region's resources of tuna, billfish and other oceanic species including non-target species; and
- improve the understanding of pelagic ecosystems in the western and central Pacific Ocean, with a focus on the western tropical Pacific;

Noting also that the OFP, in pursuing these objectives, has, over a long period of time:

- developed and maintained a comprehensive database of catch, effort, size composition and other biological data from the oceanic fisheries of the western and central Pacific Ocean;
- conducted biological and ecological research on the target and non-target species impacted by the fisheries and their ecosystem;
- conducted regular stock assessments and associated analyses for highly migratory stocks of interest;
- provided a forum for the exchange of knowledge of oceanic fisheries in the western and central Pacific Ocean through the precursor to the Scientific Committee, the Standing Committee on Tuna and Billfish, and thus has an established international and regional network of scientific collaborators; and
- assisted SPC Member countries that are also Members of the Commission in the management of oceanic fisheries through the implementation of fishery monitoring and data management systems, the provision of scientific advice and the provision of national capacity building;

Have agreed as follows:

General cooperation

The Commission and the SPC agree to establish and maintain cooperation in respect of matters of common interest to the two organizations. In particular, the Commission and the SPC will:

i. encourage reciprocal participation in relevant meetings of each organization;
ii. encourage the collaboration of national scientists in the scientific work undertaken by, or on behalf of, the Commission;
iii. actively and regularly exchange relevant meeting reports, information, project plans, documents, and publications regarding matters of mutual interest, up to the limits allowed by the information-sharing policies agreed by each organization's members; and
iv. consult on a regular basis to enhance cooperation and minimize duplication.

Provision of Scientific Services to the Commission by the SPC OFP

The SPC OFP will provide scientific services, in cooperation with other scientists, as appropriate, including those from Members of the Commission, as agreed in triennial Service Agreements, specific services of which shall be reviewed on an annual basis. Services may include, *inter alia*, the following:

i. data management services, including, as appropriate, the collection, compilation and dissemination of fisheries data according to agreed principles and procedures established by the Commission, data processing, and database development and maintenance, taking full account of the procedures and policies of both organizations relating to the confidentiality, disclosure and publication of data;
ii. data summaries and analyses that the Commission may routinely require to carry out its functions;
iii. other data summaries and analyses that the Commission may require from time to time;
iv. regional stock assessments of key target and non-target species;
v. ecosystem analyses, including developing ecosystem modelling and application to management, ecological risk assessment and related work;
vi. scientific evaluation of potential management options, agreed conservation and management measures and related work;
vii. scientific advice in relation to the implementation of the Commission's vessel monitoring system, regional observer programme or other initiatives relating to fishing gear and technology, as appropriate; and
viii. design and implementation of biological, ecological or stock assessment research programmes requested by the Commission, including collaborative research programmes with other regional fishery management organizations.

Provision of Assistance to Commission Members

In support of Article 30 of the Convention on the Conservation and Management of Highly Migratory Fish Stocks in the Western and Central Pacific Ocean, the SPC will provide assistance to its Pacific Island Members to enhance their participation in the work of the Commission. Assistance may include, *inter alia*:

i. assistance in monitoring the fishing activities of national fleets and foreign fleets fishing within Pacific Island exclusive economic zones;
ii. assistance in data management, and in particular in satisfying the data reporting obligations to the Commission;
iii. auditing of national fishery monitoring and data management systems;
iv. assistance in the interpretation of scientific information being provided to the Commission;

v. scientific advice for the management of national fisheries consistent with the objectives of the Commission; and
vi. assistance in the implementation of management measures adopted by the Commission.

Financial Support

The Commission will provide financial support for the provision of scientific services and for the provision of assistance to Commission Members as agreed in this Service Agreement.
In respect of assistance to Pacific Island Commission Members, such assistance will normally be provided by SPC funding sources, or from the Commission's Special Requirements Fund, subject to procedures agreed by the Commission governing the use of that Fund and to the Commission's strategy for capacity building and operationalizing Article 30 of the Convention. Where assistance is to be funded from the Commission's Special Requirements Fund, this shall be included in the Service Agreement. In special circumstances, assistance may also be requested for non-Pacific Island Commission Members. Such assistance will be funded by the Commission (in which case it will be detailed in the Service Agreement) or directly by the countries concerned.

General Administrative Arrangements

i. This MOU becomes effective upon the date of signature of the responsible representatives of both Parties.
ii. This MOU may be modified by written consent of the responsible representatives of both Parties. The modified MOU becomes effective upon the date of signature of such consent.
iii. If any dispute should arise between the Parties on the operation of this MOU, the Parties will make every effort to resolve the dispute themselves, or if necessary, by utilizing a mutually-acceptable arbiter.
iv. Either Party may terminate this MOU by providing written notice to the other of its intention to withdraw from the MOU. Termination shall be effective on 31 December of the year in which such notice is given, or 90 days following such notice, whichever is later. Upon termination of the MOU, any uncommitted funds provided for scientific services and assistance shall be refunded to the Commission.
v. A full review of the terms and operation of this MOU and its Annexes will be conducted in concert with any review of the scientific structure and functions of the Commission.

Signature

Signed on behalf of the Western and Central Pacific Fisheries Commission and the Secretariat of the Pacific Community:

Andrew Wright	Dr Jimmie Rodgers
Executive Director, WCPFC	Director-General, SPC
Date:	Date:

ANNEX I

Agreement for the Provision of Scientific Services to the

Commission and Assistance to Members by the Secretariat of the Pacific Community

I. Period Covered by this Agreement

The initial three-year period covered by this Agreement is 1 January 2010 to 31 December 2012. However, Sections IV and below in this Agreement will be reviewed annually to be extended by one calendar year.

II. Areas for Triennial Scientific Services to be Provided

The scientific services to be provided to the Commission by the SPC OFP during 1 January 2010 to 31 December 2012 are as follows:

1. Data management, statistical analyses and related services
   a) Data management
   b) Compilation of catch and effort estimates
   c) Statistical analyses for catch estimates
   d) Rules and procedures of the Commission's data
   e) Data gaps
   f) Assistance to WPEA OFM Project
   g) Dissemination of data

2. Stock assessment and related analytical services
   a) Stock assessment
   b) CPUE standardization
   c) Sensitivity analysis
   d) Model refinement

3. Management analyses and CMM performance monitoring
   a) Assistance to management related matters
   b) Management options
   c) Appraisal and monitoring of the conservation benefit of proposed and implemented CMMs

4. Ecosystem analyses
   a) Ecosystem, fishery interactions and non-target species assessments
   b) Development of ecosystem modeling and application to management

5. Capacity building of small island developing States

6. Research services

7. Other advisory and technical services

III. Assistance to Commission Members

The SPC OFP will provide services to its membership to assist them to fulfill their responsibilities as Commission Members. These services include assistance in the implementation of fishery monitoring programmes, data management systems and the provision of scientific advice for EEZ-based management. The majority of these services will be provided from existing SPC OFP funding sources.

IV. Specific Services and Terms of Reference for the Provision of Scientific Services by one Calendar Year

This section will be reviewed and revised as needed according to the requests from the Commission and its subsidiary bodies. The specific services and terms of reference for the provision of scientific services to be provided to the Commission by the SPC OFP in 2010 are listed below.

(The table below will be completed after WCPFC6.)

Description of Service	Specific Outputs	Timing
Data management, statistical analyses and related services		
Stock assessment and related analytical services		
Management analyses and CMM performance monitoring		
Ecological Risk Assessment		
Research services		
Other advisory and technical services		

V. Annual Schedule for Payments

The annual schedule of payments shall be as follows:

31 March 2010 (or before)	USD _____
30 June 2010 (or before)	USD _____
30 September 2010 (or before)	USD _____
31 December 2010 (or before)	USD _____

VI. Bank Details for Payments

Name of Bank: Banque de Nouvelle-Caledonie
Address: 25 av Henri Lafleur Victoire, Noumea, New Caledonia
Account name: Secretariat General de la Communaute du Pacifique
Account Number : 14889 00081 01461716025 31

Andrew Wright	Dr Jimmie Rodgers
Executive Director, WCPFC	Director-General, SPC
Date:	Date:

Attachment P

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

Scientific Committee
Fifth Regular Session

Port Vila, Vanuatu
10–21 August 2009

GUIDELINES OUTLINING THE PROCESS FOR FORMULATING THE WORK PROGRAMME AND BUDGET OF THE SCIENTIFIC COMMITTEE

SC4 adopted the process for formulating the work programme and budget of the Scientific Committee as identified in Table 1 below. SC5 further considered Table 2 (Research proposal assessment criteria) and a template for project proposals in Table 3 and adopted the process as a revision. This process may be reviewed as needed.

Table 1. Schedule outlining the process for updating the SC work programme and science budget and identifying projects to be supported by the WCPFC science budget

Month	Task/Activity	Responsibility
SC Meeting in August	1. Update list of SC work programme 2. Review and re-prioritize project themes (i.e. High, Medium, Low) 3. Scoping of New High priority project themes (objectives, scope and tasks, and expected outputs) 4. Science budget	Informal Small Group, including Research Sub-Committee, makes recommendations on Task/Activity to SC Plenary for consideration and adoption
December	Commission reviews and endorses SC recommendations	Commission
December	Call for expressions of interest for priority project themes posted on WCPFC website[1]	Secretariat
February	Deadline for receipt of proposals by Secretariat	Proposer
March	Review and appraisal (and modification, if required) of proposals and identification of projects for funding support using agreed proposal assessment criteria in Table 2	Research Sub-committee: Secretariat (coordinator), SWG convenors, and Expert Advisors
	Signing project contracts	Secretariat
August	1. Update list of SC work programme 2. Review and re-prioritize project themes (High, Medium, Low) 3. Scoping of New High priority project themes	Informal Small Group, in consultation with SWG conveners, makes recommendations on Task/Activity to SC Plenary for consideration and adoption

	(objectives, scope and tasks, and expected outputs) 4. Science budget	
December	Commission reviews and endorses SC recommendations	Commission

[1] There is the option of posting the recommended prioritised SC Work Programme on the website after completion of the SC in order to provide more time for consideration by scientists/organizations who may submit a proposal. The approved budget for supporting proposals would not be known until after the Commission meets in December.

Table 2. Research proposal assessment criteria

Assessment Criteria	Score (1-5)	Justification for score
Attractiveness		
Is the proposal aligned with a priority project listed in the Commission's Scientific Work Programme and the budget allocated to it?		
Is the need and are the planned outputs/benefits well-defined and relevant?		
Adoption and uptake. What is the level of impact and likelihood that the project outputs will be adopted? Is the pathway for uptake described?		
Cost effectiveness: Is the project cost effective? Is it using other sources to lever additional funds?		
Is there an appropriate level of collaboration between the applicant and other relevant researchers, fisheries managers and the fishing industry?		
Feasibility		
Are the objectives clearly specified and are they consistent with the planned project outputs/benefits?		
Sound methodology: Is the project design/method well described and is it consistent with the projects objectives?		
Likelihood of success: Are the project objectives likely to be achieved?		
Is there a strategy for managing data arising from the project so that it will be easily accessible by others in the future?		
Applicant's expertise/experience. Does the research team have the ability, capacity and track record to deliver the outputs?		
Total score		

Scores for assessing proposals: 1 = very low; 2 = low; 3 = medium; 4 = high; 5 = very high

Table 3. Proposals should address, as a minimum, the following issues:

Part A: Administrative Summary	Part B: Project Proposal Description
1) Project Title 2) Organization 3) Administrative Contact 4) Principal Investigator and CV 5) Commencement and Completion Date 6) Project Budget Summary – Salaries, Travel, Operating and Other	1) Background and Need (also identify which project on the Scientific Work Programme the proposal addressed) 2) Objectives 3) Project Outcomes 4) Form of Results 5) Methods 6) Risks of project not achieving Project Objectives 7) Schedule of Milestones 8) Other Related Projects 9) Project Staff and CV's 10) Detailed costs against milestones

Attachment Q

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SCIENTIFIC COMMITTEE'S RESPONSE ON THE RECOMMENDATIONS FROM THE INDEPENDENT REVIEW OF THE COMMISSION'S TRANSITIONAL SCIENCE STRUCTURE AND FUNCTIONS

Recommended Item	Response from SC5
I. DATA CUSTODIANSHIP	
1) Data gaps	1) SC5 supported.
2) Data management and confidentiality	2) SC5 supported.
3) Data custodianship service	3) SC5 supported.
4) Three-year service agreement with SPC to secure resources	4) SC5 supported.
5) Incorporation of ISC data into the WCPFC holdings	5) Will be addressed.
II. SCIENCE STRUCTURE AND FUNCTIONS	
4) Process of project contract a) Update guidelines for SC work programme b) Improve the level of advertising, funding and scope of candidate projects	4) Addressed and adopted.
5) Quality of scientific advice available to the Commission a) Implement periodic external peer review process b) Develop a standard procedure for CCMs to undertake duplicate assessments c) Maintain transparency by posting research inputs and outputs on website d) Develop a strategy to maximize the use of science knowledge of the SPC-OFP and other existing or potential contractors e)SPC to continue training of talented individuals from developing CCMs to	5) a) Partially addressed and adopted. b) Recommendation not accepted by SC. c) SC5 supported. d) By posting on the Commission's website. e) SC5 supported.

enhance their full participation in the scientific activities of the Commission	
6) International Scientific Committee (ISC) a) Amend MOU to allow for ISC work to be requested by the SC b) To support robust science within the ISC i) Additional review by the SC and external peer review ii) For transparency, promote wider participation in ISC's assessment activities, and sufficient funding iii) SC and NC, with funding support, request ISC of validation work on key ISC assessments c) Improve support to ISC i) Promote ISC officers' attendance at SA-SWG to present their assessments ii) On-time submission of ISC documents to SC iii) Allow sufficient time for SC to review ISC's assessments and advice d) To promote harmonization of the Commission's science functions, the SC's research plan should include the ISC's work plan	6) a) While non-ISC Members support this amendment, most ISC Members wanted to discuss this at WCPFC6. b) i) Not addressed at SC5 ii) Not addressed at SC5 iii) Not addressed at SC5 c) i) SC noted it's feasible but cost implications here. ii) Recommend to ISC to post ISC's working papers on the ISC website. SC noted that ISC working papers require authorization by authors. iii) SC thought it feasible but need to adjust meeting time table with a suitable time gap between meetings. d) SC recommends that the SC work plan and the ISC work plan reference each other.
7) Restructuring the SC process a) To clarify the role of SC and ISC in advising NC, the SC, as the statutory WCPFC body, should take the lead in endorsing the scientific work done by the Commission's Science Services Provider and SWGs, and providing advice to the NC and Commission, even if this advice is a simple endorsement of the advice of other bodies such as the ISC i) The SC Chair introduces the SC report to NC ii) The ISC Chair presents and provides technical explanation to NC in a non-confrontational way between SC and ISC b) Specialist Working Groups and related processes. i) Strengthening Stock Assessment	7) a) The Commission to decide. i) SC supported. ii) SC supported. b) i) Generally support PWSA, strongly support to remain as an informal meeting, including relevant biological and methodological papers. SPC will facilitate the

Preparatory Workshop (SAPW) by the WCPFC taking ownership of that activity with appropriate funding support ii) Incorporate the BI-SWG and ME-SWG into SAPW iii) Revise the Terms of Reference of the SAPW to include provision for agreement on data inputs, model runs and the setting of an appropriate timetable iv) Identify risks and seek solutions to address such risks when SAPW is expanded v) Promote the participation of ISC and IATTC in the SWGs to promote coordination of ocean-wide assessments and include northern stocks in the agenda of the SAPW c) Consider other workshops on species not included in the main SPC-OFP work programme d) Allocate significantly more time to SA-SWG to thoroughly review all assessment-related outputs from SPC-OFP, ISC and CCMs e) Restructuring of the SWGs i) Have an annual meeting for EB-SWG and SA-SWG only ii) Have biennial or occasional meetings for the FT-SWG and ST-SWG iii) BI-SWG and ME-SWG to be absorbed into SAPW (or SA-SWG) or have occasional meetings iv) Less formal process of the SWG meetings, including no national representation and more intensive involvement of experts f) Establish an Ad-hoc Group on Socio-economic Issues which identifies: i) socio-economic issues and how they might be addressed ii) types of information and analyses required to generate appropriate management advice iii) availability of expertise within the CCMs and/or potential service providers to undertake the necessary work	workshop. ii) Incorporate relevant biology and methods papers into SAPW iii) Revisit at SC6 iv) Inclusion of presentations within the SC of significant issues as identified in the SAPW. v) Funding considerations. c) Generally support, perhaps as a special session within SC or as standalone workshops. Other bycatch species could be included as a special session into SC. d) Considered adequate for present schedule, re-consider with regard to work schedule. e) Alternative idea not reflected in consultancy report was adopted. Have one continuous SC session structured thematically, chaired by individual conveners. Secretariat, Chair, Vice-Chair and Conveners to plan details of new thematic structure intersessionally and post agreed plan on Commission's website. f) Consider items as special sessions of i)-iii) as interest arises.
III. IMPLEMENTATION	
8) Implementation of the recommendations a) Develop a work plan for the implementation of these recommendations.	8) a)